Diversity and Standardization:
The greening of European ports (1993-2010).

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By Chrysanthi Kourmpeti

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by
Chrysanthi Kourmpeti
Thessaloniki, Greece

Erasmus University Rotterdam

Doctoral Committee

Promoters:	Prof.dr. F. Boons Prof.dr. W.A. Hafkamp
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“As you set out for Ithaka
hope the voyage is a long one,
full of adventure, full of discovery.” ….

Ithaka, C.P. Cavafy

Years ago, setting out for my PHD research, I had never imagined how much I would grasp the connotation of the verses, which, through Homer’s eyes, perceives while wandering in the quest for experience and wisdom.
Alike *Odysses*, at an equally long journey in four countries and for many years, it would have been hard to reach Ithaka without the guidance of Prof. Frank Boons as well as the constant and discreet presence of my beloved tutor Prof. Wim Hafkamp who –like celestial Athena- was always there to solve the problems.
Companions on-board, sometimes on deck and other times at the oars, my husband, my friend Alexandra Ekonomou and above all my little daughter who after so long time had almost lost hope that we would manage it.
I thank them, along with all those at the ports of Thessaloniki, Rotterdam, Dover and Valencia who have helped me, and I dedicate to them the last verses of the poem:

“Wise as you will have become, so full of experience,
you will have understood by then what these Ithakas mean.”

Chrysanthi Kourmpeti

Thessaloniki, Greece
September 2018

SUMMARY

Port greening is rapidly increasing globally. In recent years, more and more ports in Europe cannot disregard the need to identify the main sources of pressure from their activities and determine possible policy actions to mitigate potential environmental impact. This PhD thesis analyses the longitudinal process from 1993 to 2010 through which environmental management became institutionalised in the European port community.

Ports do not necessarily have to be only seaports; notwithstanding, this thesis research will specifically focus on seaports and more explicitly on how seaports in Europe have moved towards the idea of the “green port”. Research on seaports is an emerging field mostly caused by recent advances in the port industry, port policy and regulation, port competition and competitiveness, or port planning and development. For me, apart from the evident economic value of a seaport, it is the environmental protection of its particular area that constitutes an issue of great importance both for Sustainable Development (SD) and for the overall enhancement of the environment. What I found interesting was that adopting the green port idea in different seaport organizations of diverse European national environments could present an opportunity to delve into green seaport policies realization considering how they were influenced as well as their impact on all the involved parties.

Yet, whilst Port Authorities (PAs) attempt to respond to this significant issue by adopting a variety of green initiatives, port research is way behind in its focusing and understanding why it is important for them to become green ports and even more how European ports developed greening from the mid-1990s onwards. Adding to a limited type of research across port management disciplines interested in the context and the factors that have shaped green port organizational performance, this thesis analysis combines resource-based view (RBV) and organizational institutionalism, applying it to an organization type which is slightly different from ‘normal’ firms. Regarding their greening efforts, PAs are extremely peculiar and paradoxical business organizations mainly because their own operation and activities are not the only ones causing environmental impact on the port area and beyond. They have a wider range of stakeholders but they are also usually more directly connected to public planning processes as well as to regional and national economic policy initiatives.

The continental trend of effective environmental management in industrial operations had a resonance also in the case of European ports and thus, it has been progressively applied to port areas since the mid-1990s. The port industry is particularly familiar with standards, partly because global standards are the norms in the governance of shipping worldwide. Environmental Management System (EMS) standards implementation has been considered -by actors in the European port sector- as an adequate and valid response to the quest for port greening. On the other hand, it is primarily the standards’ nature that provided an area into which neo-institutional research has had a significant input regarding green organizational studies. Hence, one might pose the question: What could the proper vehicle be in order to explore the initial phase of the novel institutional life which emerged for those European port organizations that aimed to be green (through EMS standard implementation)?

The stimulus for this PhD research was to explore the European ‘green port’ concept by shedding light to the extent of why and how it was born due to institutional demands. The utmost goal of the research is to explore in which way European port organizations organized their approach so as to minimize their environmental impact and, foremost, to provide a thorough insight of the individual ports’ response to the emergence of environmental management in Europe from 1993 to 2010. The study’s overarching research question is how the European port organizations organized their approach in order to minimize their environmental impact.

The research focus is justified by the nature of the port today, the idiosyncrasy of the port pollution, as much as, the emergence of port environmental management (PEM) in Europe through a port specific EMS standard advanced by the European SeaPort Association (ESPO) and the EcoPorts network. This collectively developed standard was valuable enough to ports, as a potential evolved

green-port institutionalized construct, emphasizing the importance of the various port actors' joint perception where particular green policies are appropriate and legitimate. Reflecting its initial interest in the dynamic institutional requirements able to produce a particular structure of organizational change and to consequently, give some EU ports the impetus to understand the problem and decide for change, the study maps the rise of the sector's 'green port' organizational field and explores its realm by investigating the standard's emergence and shaping within a timeframe of more than fifteen years. Due to the topic's relatively unexplored nature, the main goal was to better apprehend this recently evolved phenomenon, regarding interactions and connections of the green port organizational change within the context of its organizational field as well as the related actions and outcomes.

The existing port research is far from conclusive, in terms of providing a comprehensive way to look into a port's organization environmental strategy. In contrast, this PhD research proposes, as its methodological approach, an interactive conceptual framework which aims to foster the understanding of the green port strategic responses, pertaining to divergence and convergence, but also to identify the way that the collective and individual factors are combined in order to produce the EMS institutionalization in the European port community. In this respect, the research further assumes that exploring the way port EMS standards are created and adopted can help us investigate the evolved "green port" strategies of the European ports. Therefore, the study approached the European green port concept in terms of EMS standards implementation -at both the field and the organizational level- and proceeded to apply an integrative conceptual framework that structures and supports the research's analysis by proposing three distinctive levels of analysis: the field level, the (port) organizational level and the (port) capabilities.

Considering that ports in Europe differ in several aspects -such as ownership, financial structure, activities, environmental responsibilities-, a comparative case study method was chosen as the way to explore how port organizations organized their actions in order to understand their environmental problems and decide for change based on experiences and influential information and/or knowledge towards their way to become green ports. The emergence of particular mechanisms, as well as the way they evolve at field and organizational level, is vital for identifying the rationales of a port's response and how (their) diversity affects the way in which they implemented EM. Initially the first level of the research embraces the core neo-institutional perspective and assesses the occurrence of the European green port organizational field by observing the European ports' collective response to greening, but it also identifies the mechanisms involved. The study reveals that the almost anticipated mechanisms of peer organizations' imitation and indirect transmission through standards' adoption divulged the influence of field level mechanisms in the adoption of a particular EMS standard. However, the disclosed mechanisms of problem-solving and learning, that explained how individual EMS implementation characteristics emerged and changed over time, gave a different perspective to the research.

The second level of the research focused on the firm level of analysis, the port organization itself. The study's appraisal of port organizations as dynamic entities which can respond to external pressures in a variety of ways reflects its predilection to consider Oliver's (1991) suggestions that different variables represent environmental strategic response. This is the starting point that the research employs resource dependence perspective to plumb the depths of change at the organizational level. The different ways in which ports perceived and chose to strategically implement their 'greening' process by implementing EMS standards is comparatively explored by the four (4) selected port case studies, which make it possible to understand how European ports have been altered by different pressures in order to implement EMS standards.

The third level proceeds by identifying capabilities as internal 'determinants' of the individual port strategic response. Ports that are strategically proactive develop capabilities which correspond to their individual path towards greening. An inquiry based on resource dependence view is employed for a supplementary analysis which explores how individual port internal resources and capabilities coalesce to external field dynamics in developing and shaping the organizations' strategic response.

This last part of the analysis advocates that the EMS standard diffusion impact is contingent to port organizational resources and offers a more synthetic perspective of what matters to the adoption of environmental practices, providing insights into the role of specific organizational capabilities in the implementation of port EMS standards. The distinctive firm specific capabilities are once more comparatively weighing the possibility to produce organizational competitive advantage.

Four annexes supplement the main corpus of the research. They provide complementary empirical research on the selected four case-studies, yet a vital research since they especially render in-depth comprehension of how individual ports have implemented environmental management practices in order to reduce their environmental impact and thus, how individual ports strategically responded to institutional pressures and what exactly underpinned their pro-activeness. The annexes' case study inquiry introduces for each individual port case study: the green national context and the national port policy within which the port has been embedded, each port's unique profile, as much as the latest port's reaction to the overall changes in the port sector. In addition, every case study gives descriptive information about: the port's environmental aspects; the port's efforts in terms of green operational plans and procedures; as well as EMS implementation. In a way, each case study provides a comprehensive port description following green issues and types of indicators (operational and managerial) with the utmost aim to introduce each port's EMS implementation in an integrated way. The four port case studies share a certain and critical similarity. They were all part of the organizational field that affected their strategic behavior towards EMS implementation. Yet, they differ in their response to EMS implementation.

The analysis' results are focused on the EU green port field within the timeframe from 1993 to 2010 and reflect the correlation between the theoretical perspective and its application to the port industry practices, adding value by representing four different European port cases from two different key geographical regions. The study contributes to the growing empirical literature on port sustainability and more particularly on the emerging field of port EMS standards implementation threefold, by explicitly introducing: the mechanisms that provoked EMS standards implementation; the institutional factors that shaped individual green port strategic response; and the role of distinct organizational capabilities in building up the individual 'green port'.

At an initial level, the analysis of how ports in Europe have engaged in "greening" via EM implementation, looks into the way EU ports have implemented EM; assesses whether diversity among ports in developing EM exists; and to what extent ports have learned from each other's experience. Factors that led to a differential timing of taking up the challenge of developing EM, as well as the variety in the form that EM took in different ports, drive the comparative analysis, which finally points out the operative mechanisms in the individual ports EM development.

Asking how exactly port organizations deal with isomorphistic pressures, the analysis addresses its secondary level. It confronts the strategic response to greening at the port organizational level and uses the Oliver (1991) typology so as to detect the different port leaders-laggards EM strategies within the European green port organizational field. The empirical analysis explores the willingness and ability of the four investigated port organizations to conform or resist based on the dual predictive dimensions of organizational strategic response related to five institutional factors according to the Oliver (1991) framework. The empirical testing enables a loop in the analysis and makes it feasible to draw concluding remarks on how different engagements in environmental strategy have affected port greening in Europe over the last decade, as well as on the dynamic of the interaction between the individual ports and their institutional environment.

Hereupon at a third level, the analysis further proceeds by asking if it is possible that certain strategies and tactics are driven from the existing situation within the organizational field, while some are raised through specific organizational capabilities, aiming to explore the way in which each port developed core port capabilities towards greening, and to what extent the resource requirements are significant for the adoption of a successful green port strategy through EMS implementation. The empirical analysis investigates how environmental pro-activeness of port organizations is advanced through four diverse constructs proposed by theory: pollution prevention, stakeholder integration, higher order learning, and continuous innovation, focusing on how individual organizational characteristics influence strategic responses, and therefore, the interest is different from the Oliver's approach whose centre of attention is on relational characteristics. Port capabilities are considered as drivers able to shape the degree of a port's pro-activeness and responsiveness to greening and thus, the analysis concentrates on their role of enhancing EMS implementation by providing a competitive advantage.

The overall picture of the case studies indicates that between mid1990s and 2010 the green port field in Europe was at a dynamic developing stage. The findings affirm that, institutional research has both a leading and supportive role in providing knowledge about the EMS standards adoption which facilitated port greening in Europe. The research answers why European ports are interested in green legitimacy and how exactly the legitimated response to institutional demands is created. Understanding the mechanisms and factors by which institutional demands invoked change both at field and organizational level allows this research to interpret the narrative of the European green port at its very early stage. By combining both institutional and RBV theoretical perspectives, the study could better explicate the dynamics of both convergence and divergence in EMS standards' adoption among the European ports and contribute to the better understanding of the peculiarities of port greening. By providing insights into the role of environmentally related organizational resources and capabilities in the implementation of port EMS standards, the research findings reveal that the gradual development of proactive ports' competences, which address sustainability issues and enhance the individual port's green behavior, are complex and path dependent. Comprehension of the emerging organizational capabilities which contribute to the port strategic responses towards EMS application, has managerial implications that allow to further evaluate the pros and cons of implementing environmental management by using EMS standards, as well as, fields of action for further improvement. Therefore, the results assist any future research to recast the debate over port environmental performance beyond EMS standard implementation and to begin focusing on individual environmental capacity by reflecting the individual port's characteristics.

SAMENVATTING

Havens zijn snel aan het vergroenen, wereldwijd. Europese havens moeten op zoek naar de bronnen van hun milieubelasting, en beleid ontwikkelen om de milieudruk te verminderen. Dit proefschrift analyseert het proces waarin milieumanagement in havens geïnstitutionaliseerd werd in Europese havens tussen 1993 en 2010. Het onderzoek richtte zich op zeehavens, en meer specifiek op de manier waarop zij het idee van 'de groene haven' vorm gaven. Het onderzoek naar zeehavens is relatief nieuw, en ontstaan door recente ontwikkelingen in de havenwereld, havenbeleid en regelgeving, de concurrentie tussen havens en meer in het algemeen de planning en ontwikkeling van havens. In dit onderzoek was in het bijzonder het aspect milieubescherming van belang, naast het evidente economische belang. Daarin ligt immers de potentie van duurzame ontwikkeling en versterking van het milieu. Het interessante was het idee van 'de groene haven' in verschillende havenbedrijven in verschillende nationale milieus in Europa kansen zou bieden om havenbeleid te onderzoeken; havenbeleid dat beïnvloed wordt door uiteenlopende partijen, maar dat ook invloed op hen heeft.

Het havenonderzoek loopt echter fors achter bij de initiatieven die havenbedrijven op dit gebied nemen. Het levert onvoldoende op de vraag waarom havens moeten vergroenen, en hoe ze die vergroening vanaf midden jaren 90 aangepakt hebben. Dit onderzoek combineert de resource based view van bedrijven met organizational institutionalism, toegepast op havenbedrijven (die nogal verschillen van gewone bedrijven. Daarmee voegt het toe aan het bestaande onderzoek dat zich vanuit een beperkt aantal disciplines richtte op de milieuprestaties van havenbedrijven. Dat zijn bijzondere bedrijven, omdat zij bepaald niet de enige zijn die de milieuimpact hebben in het havengebied hebben. Ze zijn gewoonlijk veel directer verbonden met publieke planningsprocessen en met regionale en nationale economische beleidsintiatieven.

De trend op het gebied van milieumanagement in het bedrijfsleven resoneerde bij Europese havenbedrijven, en leidde daar tot een verdergaande ontwikkeling van milieumanagement. Havenbedrijven zijn vertrouwd met richtlijnen, omdat mondiale richtlijnen de norm zijn scheepvaart. Daarom werd de toepassing van standaarden voor milieuzorgsystemen in Europese havens gezien als legitieme en adequate respons op de vraag naar vergroening van havens. Juist neo-institutioneel onderzoek naar de vergroening van organisaties heeft veel te bieden als het gaat om de adoptie van standaarden. Daaruit komt de vraag voort: hoe kan de aanvangsfase onderzocht worden van het nieuwe institutionele leven dat tot ontwikkeling kwam door Europese havenbedrijven die wilden vergroenen?

De stimulus voor dit onderzoek was de verkenning van het Europese concept van de vergroening van havens door na te gaan waarom en hoe het tot ontwikkeling kwam, onder invloed van weke institutionele eisen. Het uiteindelijke doel is om te verkennen hoe Europese havenbedrijven hun aanpak zo gekozen hebben dat hun milieuimpact geminimaliseerd werd, en vooral om goed inzicht te krijgen in de respons van havenbedrijven op de opkomst van milieumanagement in Europa tussen 1993 en 2010. De onderzoeksvraag is dan ook hoe Europese havenbedrijven hun aanpak georganiseerd hebben om hun milieuimpact te minimaliseren.

De focus van dit onderzoek past bij de huidige aard van havenbedrijven, de bijzondere aard van vervuiling in havengebieden, maar evenzeer de opkomst van specifieke milieuzorgsystemen voor havens zoals bevorderd door de Europese Associatie van Zeehavens (ESPO) en het EcoPorts netwerk. Deze gezamenlijk ontwikkelde standaard was waardevol voor havenbedrijven omdat hij past bij hun type organisatie; En ook omdat het belang van de betrokken havenactoren onderkende bij de ontwikkeling van milieubeleid. Deze studie brengt het organizational field in kaart en onderzoekt hoe de standaard tot ontwikkeling kwam en zich verspreidde over een periode van meer dan 15 jaar. De studie bouwt op de aanvankelijke interesse van de onderzoeker in de dynamische institutionele vereisten van organisatieverandering. Ook laat de studie zien hoe sommige Europese havens het probleem begrijpen en beslissingen nemen om te veranderen. Dat is nog nauwelijks onderzocht. Het voornaamste doel was dan ook om de opkomst van milieuzorgsystemen in havenbedrijven beter te begrijpen in de contekst van het organizational field, met al zijn activiteiten en resultaten.

Het bestaande havenonderzoek is niet eenduidig over de vraag hoe de milieustrategie van een havenbedrijf op een alomvattende manier beschouwd moet worden. Dit onderzoek kiest in methodologisch opzicht voor een interactief, conceptueel raamwerk dat (i) bijdraagt tot het begrijpen van divergentie en convergentie in de vergroeningsstrategieën van havens, en (ii) duidelijk maakt hoe collectieve en individuele factoren de institutionalisering van milieuzorgsystemen in Europese havens beïnvloeden. Een aanname in dit onderzoek is dat onderzoek naar de manier waarop milieuzorgsystemen voor havens tot stand komen ons kunnen helpen om te onderzoeken hoe 'green port' strategieën van havens tot stand komen. Daarom benadert het onderzoek het concept van groene havens in termen van de implementatie van standaarden voor milieuzorgsystemen – zowel in organisaties als in het grotere veld. Het past daarbij een integratief conceptueel raamwerk toe dat de analyse structureert met drie niveaus van analyse: het ruimere veld, de havenorganisatie en de haven capabilities.

Omdat havens in Europa sterk verschillen, bijvoorbeeld qua eigendomsstructuur, financiële structuur en milieuverantwoordelijkheid is gekozen voor een case study methode. Daarmee kon verkend worden hoe havenbedrijven hun acties organiseren om hun milieuproblematiek te begrijpen en te beslissen welke veranderingen nodig zijn om een groene haven te worden. Het ontstaan van specifieke mechanismes is essentieel voor het identificeren van de rationales achter de response van een havenbedrijf op de nieuwe uitdagingen; hetzelfde geldt voor het begrijpen van de verschillende manieren waarop zij milieuzorg invoeren. Op het eerste niveau gebruikt dit onderzoek het neo-institutionele perspectief om het organisationele veld in kaart te brengen, de collectieve respons op milieugebied te zien, en de mechanismen te bestuderen waarmee dit gebeurt. Het onderzoek laat zien dat de verwachte mechanismen van imitatie en indirecte overdracht door standaarden een rol speelden. Er bleken echter ook mechanismen van leren en probleemoplossing te zijn die verklaarden hoe de implementatie van milieuzorgsystemen op gang kwam en in de loop van de tijd veranderde.

Op het tweede niveau lag de focus op het bedrijfsniveau, het havenbedrijf zelf. Het onderzoek liet zien met welke dynamiek havenbedrijven kunnen reageren op druk van buiten. Dat strookt met het werk van Oliver (1991), die suggereert dat de verschillende variabelen daarin een strategische milieuresponse voorstellen. Dit is het startpunt voor het onderzoek dat het perspectief van resource dependency gebruikt om diepte van veranderingsprocessen op het organisatieniveau in te duiken. De verschillende manieren waarop havenbedrijven een strategische implementatie kozen van hun vergroeningsproces wordt op een vergelijkende manier verkend voor vier havensteden. Dat maakt het mogelijk om te begrijpen hoe Europese havens veranderd zijn door de verschillende vormen van druk van buiten om milieuzorgsystemen in te voeren.

Op het derde niveau gaat het onderzoek verder door vaardigheden te vinden die beschouwd kunnen worden als interne determinanten van de strategische response van individuele havenbedrijven. Havens die strategisch proactief zijn ontwikkelen vaardigheden die passen bij hun individuele 'vergroeningspad'. In een aanvullende analyse is nagegaan hoe individuele havenbedrijven hun interne middelen/hulpbronnen en vaardigheden inzetten in antwoord op dynamiek in het externe veld; en hoe daarin de strategische response van de organisatie vorm krijgt. Het laatste deel van de analyse bepleit dat de verspreiding van de standaard voor milieuzorgsystemen in zijn impact afhangt van de middelen van de organisatie. Dit geeft een meer samengesteld perspectief van wat er toe doet bij het opzetten van milieubeheer, en daarmee meer inzicht in het belang van verschillende organisationele vaardigheden bij het tot stand komen van standaarden voor milieuzorgsystemen bij havenbedrijven. De onderscheidende, specifieke vaardigheden van een havenbedrijf laten nog eens goed zien waar de mogelijkheden liggen om organisationeel concurrentievermogen te verwerven.

Vier bijlagen bij dit proefschrift vormen een aanvulling op het hoofdonderzoek. Ze geven complementair empirisch onderzoek bij de vier geselecteerde case studies. Ze zijn echter van vitaal belang omdat ze zo'n diepgravend inzicht geven in de manier waarop havens milieumanagement praktijken hebben ontwikked, en daarmee hoe individuele havens tot een strategische response kwamen op institutionele druk; en ook waar hun proactieve opstelling uit voortkwam. De bijlagen bespreken voor elk van de vier havensteden de nationale milieu- en havenbeleidscontekst, het unieke profiel, inclusief de meest recente reactie van het havenbedrijf op veranderingen in de havensector. Daarnaast geelft elke case study beschrijvende informatie over de milieu-aspecten van de haven, de inspanningen van het havenbedrijf op het gebied van milieuplannen en -procedures en de impelementatie van milieuzorgsystemen. De vier case studies waren elk deel van het organisationele veld dat hun strategische keuzes beïnvloedde bij het de adoptie van milieuzorgsystemen. Ze verschillen echter waar het gaat om hun response.

De resultaten van de case study analyses richten zich op het terrein van groene havens in Europa in de periode 1993-2010. Ze laten de samenhang zien tussen het theoretische perspectief en de toepassing daarvan op de praktijken in de havenbedrijvigheid. De toegevoegde waarde ligt in de keuze voor vier verschillende havens in twee geografische regio's. Het onderzoek draagt bij aan de toenemende empirische literatuur over duurzame havens en meer in het bijzonder de literatuur over standaarden voor milieuzorgsystemen bij havenbedrijven. Dat wordt gedaan op drie manieren, door de mechanismen die leidden tot de implementatie van een milieuzorgsysteem, de institutionele factoren die de strategische response van havenbedrijven bepaalden, en de betekenis van specifieke organisationele vaardigheden in het opbouwen van de eigen 'groene haven'.
Op een eerste niveau is er de analyse van de manier waarop Europese havens zijn gaan vergroenen door milieuzorgsystemen. Deze analyse betreft ook de verschillen tussen de vier havens bij het invoeren van hun milieuzorgsysteem, en de mate waarin de havens van elkaars ervaring geleerd hebben. De vergelijkende analyse wordt vooral gestuurd door verschillende factoren die de timing bepaalden waarmee havens milieuzorgsystemen invoerden, en de verschillen tussen de milieuzorgsystemen; Zo konden de mechanismen blootgelegd worden die de verschillen in ontwikkeling van milieuzorg bij de vier havens verklaren.
Op het tweede niveau richtte de analyse zich op de precieze manier waarop havenbedrijven omgaan met isomorfistische druk. Deze analyse plaatst de strategische response vergroeningsrespons van havenbedrijven in de typologie van Oliver (1991) en laat zien wie de voorlopers en achterblijvers zijn. Ook blijkt uit deze analyse hoe de verschillende milieustrategieën hebben bijgedragen tot de vergroening van havenbedrijven in Europa in de laatste 10 jaar, en wat daarbij de interactie was tussen afzonderlijke havenbedrijven en hun institutionele omgeving.
Dan is er een derde niveau van analyse waarin geprobeerd wordt of bepaalde strategieën tot stand komen vanuit de bestaande situatie in het organisationele veld terwijl andere vooral voortkomen uit organisationele vaardigheden. Zo kan duidelijk worden hoe elk havenbedrijf zijn vaardigheden ontwikkelde en in wat de invloed is van de beschikbare hulpbronnen op een succesvolle vergroeningsstrategie door invoering van een milieuzorgsysteem. De empirische analyse onderzoekt hoe een proactieve houding op milieugebied bevorderd wordt door vier factoren (constructs) uit de theorie: preventie, stakeholder integratie, hogere orde leren en continuë innovatie. De analyse draait om de manier waarop de vaardigheden van havenbedrijven (om te vergroenen) een proactieve houding responsiviteit bevorderen, en daarmee een sterkere implementatie van mileuzorg en concurrentievoordeel.
De case studies laten zien dat tussen het midden van de jaren 90 en 2010 het bredere veld van groene havens een sterke ontwikkeling doormaakte. De resultaten van het onderzoek bevestigen dat onderzoek zowel een leidende als een sturende rol heeft gehad in het verwerven van kennis over het tot stand komen van standaarden voor milieuzorgsystemen voor havens in Europa. Dit onderzoek laat zien waarom havenbedrijven vergroening belangrijk vonden, en hoe ze tot een legitieme reponse op institutionele druk gekomen zijn. Door de theoretische perspectieven van institutionele theorie en de theorie van de resource based view (of the firm) te combineren was het mogelijk om de dynamiek van convergentie en divergentie in adoptie van standaarden voor milieuzorgsystemen te begrijpen. Met nieuw nzicht in de betekenis van milieurelevante organisaztionele vaardigheden en hulpbronnen laat het onderzoek zien hoe havenbedrijven hun competenties ontwikkelen om duurzaamheidsissues te adresseren en hun milieugedrag te verbeteren. Daarom helpen de resultaten van dit onderzoek elk toekomstig onderzoek naar milieuprestaties van havenbedrijven dat verder gaat dan de implementatie van standaarden voor milieuzorgsystemen. Dat onderzoek kan zich dan met name richten op de relatie tussen enerzijds de individuele kenmerken van havens en havvenbedrijven en anderzijds hun milieuprestaties.

List of Acronyms and Abbreviations

AAPA	American Association of Port Authorities
BPA	British Port Association
CEDA	Central Dredging Association
CMI	Comité Maritime International
CSR	Corporate Social Resposibility
DHB	Dover Harbour Board
EC	European Community
ECEPA	Environmental Challenges for European Port Authorities
EM	Environmental Management
EMAS	Eco-Management and Audit Scheme
EMIS	Environmental Management and Information System
EMS	Environmental Management System
EPF	ECOPORTS Foundation
EPIs	Environmental Performance Indicators
ESPO	European Sea Ports Organization
FEPORT	Federation of European Private Port Operators
EU	European Union
IACP	International Association of Cities and Ports
IAPH	International Association of Ports and Harbors
ICZM	Integrated Coastal Zone Management
ILO	International Labour Office
IMO	International Maritime Organization
IPPC	Integrated Pollution Prevention and Control
ISO	International Standards Organization
MARPOL	International Convention for the Prevention of Pollution from Ships
LNG	Liquefied natural gas
NGO	Non-governmental Organization
NRBV	Natural Resource Based View
OECD	Organization for Economic Co-operation and Development
OHSAS	Occupational Health and Safety Assessment Series
PA	Port Authority
PERS	Port Environmental Review System
PEM	Port Environmental Management
PES	Proactive Environmental Strategy
PIANC	World Association for Waterborne Transport Infrastructure
PoR	Port of Rotterdam
RBV	Resource Based View
RDT	Resource Dependence Theory
R&D	Research and Development
RMPA	Rotterdam Municipal Port Authority
SCAs-SPAs	Special Areas of Conservation- Special Protected Areas
SD	Sustainable Development
SDM	Self-Diagnosis Methodology
SOLAS	International Convention in the Safety of Life at Sea
TEN-T	Trans-European Transport Network
ThPA	Thessaloniki Port Authority
TQM	Total Quality Management
UNCLOS	UN Convention on the Law of the Sea
UNCTAD	United Nations Conference on Trade And Development
VPA	Valencia Port Authority

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Prologue

‘Beware of Greeks bearing gifts’.
Does this sound almost archetypal to you? Hear the rest….
“the port of Thessaloniki is among the early adopters and a certified port according to the PERS standard for its environmental management system”
(EcoPorts, 2003).

Dear reader,
In case you do not miss much of these words and I hope that you do know where Thessaloniki is and that it certainly has a port,
YES!............. you understood it clearly,
the port has implemented an EMS and was awarded a standard certification!
Are you still interested there?
The rest is a European history….. and about ‘Greeks that once again walked into Troy’!!!
Enjoy!

CHAPTER 1: INTRODUCTION

The 'green port' concept in Europe was born due to institutional demands. Institutional requirements are dynamics capable of producing a particular structure of organizational change, *thus* giving the European Port Authorities (PA) an impetus to understand and decide for a change based on experiences and influential information towards their way of becoming green ports.

The green port of Piraeus is an illustrative case. Piraeus is Greece's leader port and part of Athens' greater metropolitan area (with a population of approximately 5 million inhabitants). It is the largest passenger port in Europe and one of the largest in the world. The port has significant ferry activities with more than 24.000 passenger ships going through the port each year, serving annually more than 10 million passengers (Pantouvakis, 2006), while it is one of the largest Mediterranean ports in terms of cruise shipping (Lekakou, et.al, 2010). In addition to passenger traffic, the port was established as a Med hub port in 1997 doubling its container traffic in just 4 years (1996 to 2000) (Psaraftis, 2007), and it is handling conventional cargo (Ro-Ro, bulk, general and fish products), a car terminal with the biggest capacity in Eastern Mediterranean, as well as a ship repairing zone.

Indeed, the aforementioned facts are remarkable business efforts but shipping and cargoes have for many years constituted sources of **environmental pollution** in the port area. Air-pollution from shipping -increased by the seasonal traffic of cruise and coastal passenger shipping- was (and *still is*) a dominant environmental issue for the port, as the impact of ship exhaust pollutants has a direct effect on the inhabitants of the surrounding areas (Tzannatos, 2010). By the end of the 1990's these problems were finally regulated owing to obligatory enforcement -mainly due to the national and EU Directives. Since EC 'Green Paper on Ports and Maritime Infrastructure' was put into action back in 1997, the Piraeus Port Authority (PPA) has actively participated in the **European Sea Port Association** (**ESPO**) discussing issues. At that time, the PPA's main challenge -regarding environmental targets performance- was the availability of practical tools and methodologies for **Environmental Management** (**EM**) implementation.

In 2004 PPA, aiming at a prior legal compliance, initiated an Environmental Policy and advanced EM by means of the following actions: 1) Environmental Quality monitoring programs on air, soil and water quality, 2) Ship-generated Waste Management Plan, 3) Marine Pollution Preparedness and Response Contingency Plan, 4) Resources conservation, and 5) Environmental Management Standard PERS certification, (Kontogiorgi-PPA Environmental Officer, 2005). The port has been encouraged by collaborative research initiatives in cooperation with the Universities of Piraeus, Thessaloniki and Cardiff (UK), and has commissioned projects on seawater and air quality monitoring, noise map production, development of electronic data base for port environmental management (Naniopoulos, et.al., 2006).

Consequently, the port has achieved an "EcoPorts port'' status and has joined the **Ecoports network**. The Ecoports network consists of European ports that have self-assessed their environmental performance, according to the Code of Environmental Practice which was launched by their association: the European Seaport organization (ESPO). Since 2004, PPA has been certified according to the European Environmental Management System **PERS** (Port Environmental Review System) supported by the ESPO/Ecoports synergy. In 2011, PPA was recertified (for the third time since 2004) for its Environmental Management System (EMS) implementation based on the requirements of the revised edition of PERS (version4). The port of Piraeus is currently in the process of obtaining ISO 9001 and ISO 14001 Certificates for its Cruise Terminals.

Piraeus received attention for its best practices' environmental efforts among its fellow Ecoports, but it was not the first port to behave as a "green port" in Southern Europe; it was the port of Thessaloniki, the first Greek port to be accredited by the Ecoports/PERS standard in 2003, and it was ahead in introducing the value of the ESPO/Ecoports tools on port EMS implementation in Greece. For anyone interested in port environmental problems, but also curious enough about the Port Environmental Management (PEM) status in Europe, like *I* was in the beginning of this research, the first question that arises is: *WHY*? Moreover, following the King and Toffel (2009) suggestion that *self-regulation should be taken seriously into consideration,* the next question to be answered is: *HOW*?

Seaports are the gateways of an enormously increased maritime trade. All ports have an environmental impact of some kind (EcoPorts, 2003), as their activities- like any human activity-, entail the creation of pressures on the surrounding environment. But ports today 'harbor' more than just ships, they are complex nodes in transport networks because they are transit points but also, in many cases, places of processing. Sources of port pollution generate concern for potential environmental impact at a local (port area) or regional level (port-city). With the increasing emphasis on environmental sustainability, many ports worldwide have responded and committed themselves to working towards an improved environmental performance.

In recent years, increasingly more ports in Europe cannot disregard the need to identify the main sources of pressure from their activities and determine possible policy actions to mitigate potential environmental impact.

- This PhD research analyzes the realm of the "green port" in Europe, investigating the emergence and shaping of a collectively developed port-specific Environmental Management System (EMS) standard from 1993-2010.

1.0 Port today – short introduction to the sector's complexity and dynamics.

1.1 Maritime transport has increased enormously

In the past decades, **maritime transport** has seen spectacular progress. It is now widely recognised that an efficient transport system -one that allows the economical movement of goods, resources and people- is vital for economic growth and globalisation (Owen, 1987). Likewise, ports around the world are facing increased pressure to develop newer, larger, and more efficient facilities to accommodate the increased waterborne trade carried by increasingly larger vessels. The vital importance of the **port sector** within the transport chain is demonstrated by statistics: Ports today are perceived as the remaining controllable component in improving the efficiency of ocean transport logistics, and this has generated *integrated port services with other components of the global distribution network* (World Bank, 2003). Deep draft ports accommodate more than 95% of weight, and 75% of value, of all overseas trade. It is forecasted that the international waterborne freight volume will have tripled by the year 2020 (AAPA, 2009). In addition, cruise ships and other waterborne passenger services are increasingly using commercial port facilities.
In Europe, the maritime sector is responsible for approximately 90% of the European Union's trade with third countries, as well as some 40% of intra-Community trade (EMSA, 2010). This involves the handling of 3.5 billion tons of goods and the transportation of 350 million passengers in millions of journeys by ship each year (EMSA, 2010).

Ports do not necessarily need to be only seaports, but this thesis research will specifically focus on *seaports* and particularly on *how* seaports in Europe have moved towards the idea of a "green port".
Research on seaports is an emerging field mostly caused by: 1) recent developments in port industry (increased world trade, technological innovation, seaports regionalization and embedment in supply chains of wider transport networks, privatisation and liberalisation of port governance); 2) port policy and regulation (e.g. the efforts of the EU to develop supranational port policies including policy swiftness towards sustainability); 3) port competition and competitiveness; or 4) port planning and development (Pallis et al. 2010; Pallis et al. 2011).

For *me*, apart from the evident economic value of a seaport, it is the environmental protection of its particular area -often spacing within a city- that is an issue of great importance both towards Sustainable Development (SD) as well as for the overall enhancement of the environment.
It seemed that conceptualizing about *adopting and applying* the green port idea in different seaport organizations of diverse European national environments could present an opportunity to dig on green seaport policies realization and their influence on all the involved parties.

1.2 Seaports are complex nodes in transport networks

A **seaport** is defined as an area of land and water where vessels can be loaded and unloaded, cargo can be stored and hinterland connections can collect and deliver cargo, (ESPO, Statistics Committee, 2006). Today, this "*area, where traffic changes between land and sea modes of transport",* (English Nature, 1999:40) may be defined differently and in various ways due to both the complexity and the dynamics of the sector. Seaports have gradually developed into genuine "global villages" (ESPO, 1994), and into main gateways for Europe, "*demonstrating the indispensable role that ports play in the logistic chain"*, (Goulielmos, 2000); or they are a mixture of industry and services that serve production and distribution processes, *(*Stavrakouli & Wooldridge, 2004).
The complex nature of port's activities and services is further framed from the *"diversity of ports in terms of size, geographical position, administration, activities and labour conditions"*, (Chlomudis, et.al., 2002). In addition, it is important to note that market-driven processes have gradually replaced the single corporate hierarchies of Port Authorities (PAs) with networks of organizations based on relations between providers and users (Chlomoudis et.al., 2003). Ports today are also increasingly considered as clusters consisting of heterogeneous organizations with differentiated core business, including port authorities, shipping companies, shippers, forwarders, services in logistics, warehousing, railway and road transportation, seeking to remain competitive through a *"new matching framework of interactions"* (Van der Horst & De Langen, 2008).
Fundamental changes in the global production and cargo distribution are introduced with the development of industrial networks, containerisation and logistics. Today, ports are viewed not in isolation but as *"key interfaces in global and domestic logistics chains"*, with logistics reducing the advantages created by a port's geographical location (Helling & Poister, 2000) and even producing *"port regionalisation"* (Notteboom & Rodrigue, 2005). They are considered as *"nodes of complex functionally and geographically integrated systems of locations and flows with the purpose of generating value"* (Pallis & Verhoeven, 2007). However, the implementation of inter-modalism is both complex (especially with fragmented government and private ownership of transport infrastructure and equipment) and highly priced, with the benefits extensively distributed across a large number of users.

Port activities

A sea port *"is not just one company or organization but a network of different companies acting together"* (WORKPORT, 2000:18). Activities carried out in port areas, apart from ship services, have a wide scope, ranging *from* those related to goods' traffic (loading, offloading, storage, etc.) *to* those directly connected with the industrial activity performed by certain manufacturing industries located within the port area, as well as the added value facilities. Table 1.1 lists some of the most common port and harbour development and operational activities. The initial focus of this research was on the connection of these activities with the environment and more specifically the port's management effort to tackle them via EM implementation.

Table 1.1: List of the most common port development and operational activities.

Examples of Typical Port Development activities

i) Land-water interface
- Land reclamation and associated land filling works
- Quay construction, extension and restoration
- Raising of quay/berth/pavement level

ii) On-land
- Demolition of old buildings and structures
- Construction of new buildings and structures
- Placement/restoration of aboveground and underground storage tanks

ii) In water
- Channel deepening
- Piling works
- Pontoon placement

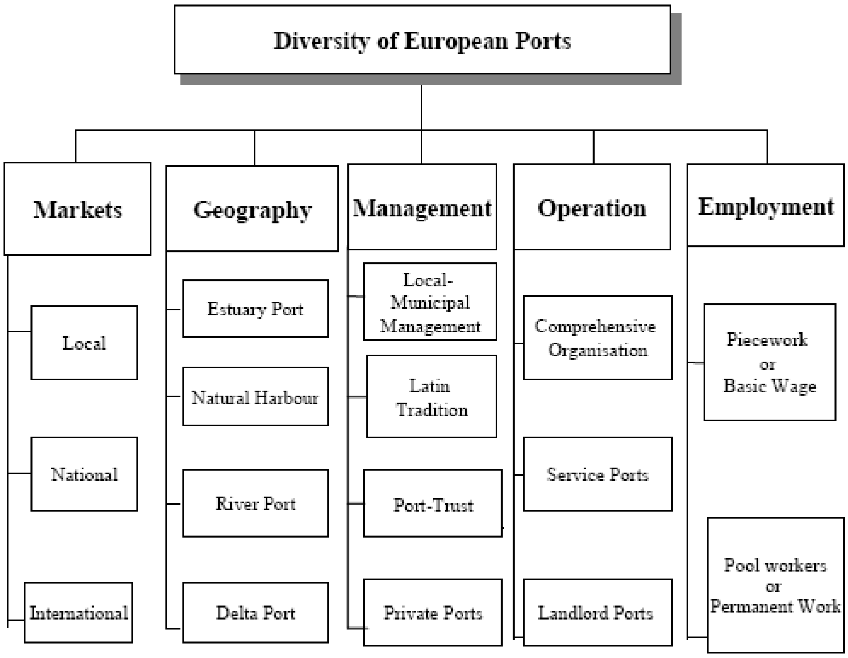
Examples of Typical Port Operational activities

- Commercial shipping & recreational boating
- Building/vessel repair & maintenance
- Vehicle and equipment maintenance
- Site cleaning and clearance
- Cargo handling
- Cargo storage
  Bunkering
- Grounds maintenance
- Port traffic

Source: Paipai, 1999.

Seaports are diverse. The quote *"when you have seen one port, you have seen one port"* (ESPO Green Guide, 2012) emphasizes the extent diversity that exists between European ports. Within the EU over 600 ports are situated near industrial centres, the largest concentration of ports in the world. Ports in Europe are quite diverse in many dimensions (Pallis, 1997)- as it is illustrated in Fig.1.1- in terms of size, geographical location, management practices, port operations and different employment patterns.

Fig.1.1: The diversity of the European Ports



Source: Pallis (1997).

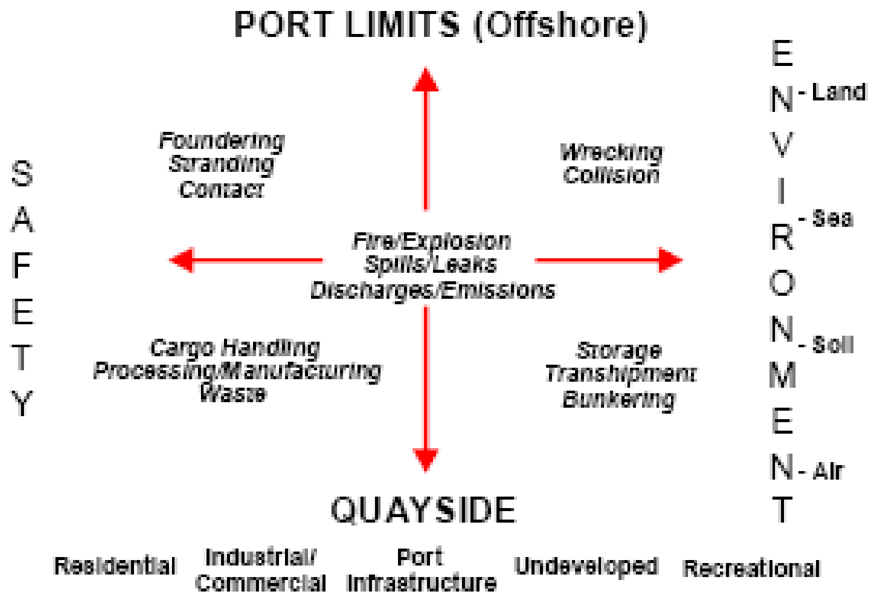
The different management practices consist of the tradition of *local*-usually municipal- management typical in North Western Europe; the *Latin* tradition, typical in the Mediterranean countries *"which incorporates a certain but varying influence of central government"* (Pallis, 1997); and the tradition of the *trust-port* as much as private ports existing only in the UK ports. Although the distinction between traditions is gradually fading due to several influences, while corporatisation and commercialisation processes have increased the autonomy of PAs, what remains dominant in the continental EU PAs is the public ownership and influence (Verhoeven, 2006).

Complexity of seaport: Modern seaports -especially those of the third generation- have emerged as parts of the logistics chain, (Goulielmos, 1998), while *logistics chains* are the pertinent emphasis in the European port competition. EU ports today are increasingly competing within supply chains; and as a consequence, seaports are the central nodes driving the dynamics in large logistics pools, developed by the interaction between seaports and inland locations and consisting of several logistics zones (Healey & Baker 2003; Heaver, et.al., 2001). *Containerization*, *"a result of the interplay of macroeconomic, microeconomic and policy-oriented factors"* (Notteboom 2004), seems to have turned into a 'must' for ports, since container facilities is considered to be one of the fundamentals for success in the newly logistics-restructured environment.
In addition, many ports have become the location of industrial clusters which specialize not only in distribution but also in production as well, mostly developed due to targeted development policies or unplanned growth of interrelated industries, (World Bank, 2007). Thus, the complexity of seaports is not due to them being transit points. Nowadays, seaports' complexity is enhanced by the range of operations involving production, trade and service industries, something that makes it extremely difficult to combine port roles and functions under the same operational, business or market category (Bichou & Grey, 2006:80). For ports, this situation is depicted in the longevity needed to conceive, plan, obtain approval, and build major new port facilities. Since the 1990's, large scale port expansions -which often exacerbate critical environmental issues- have already existed in various European port areas.

1.3 The idiosyncrasy of port pollution

Maritime transport is perhaps the most "*international"* of all the world's great industries and one of the most *dangerous*. Over the years, it has undergone many technological innovations and changes, which have presented challenges as much as opportunities (Couper, 2004). It has always been recognized that the best way of improving safety at sea is by developing international regulations that are followed by all shipping nations. But the attention of international community has been also concentrated on ports, because of the well-known marine accidents.
Conventionally, *shipping* and *port organizations* appear to have trailed discrete agendas related to safety and environmental issues. *"Strategically, the close interrelationships between their respective interests were acknowledged, but in practice, the organization and implementation of policies was very much split across the land-sea divide"* (Wooldridge & Couper, 2006). The shipping industry's reaction to its environmental responsibilities has been largely driven by statutory regulations.
Matters of shipping safety became a major concern towards the end of the 70's. With the Amoco Cadiz catastrophe fresh in people's minds (Amoco Cadiz ran aground off the coast of Brittany France on March 16th 1978, spilling 687 million gallons of oil), international conventions on shipping safety were recommended, urging: a) the EU Member States to take all necessary steps to ensure that tankers carrying oil, gas and chemicals and docking in the Community's seaports are obliged to respect certain conditions; b) the ships using EU ports and sailing in the waters under the jurisdiction of the Member States to respect the international standards for ship safety, pollution prevention; (clear and efficient safety procedures are also applied to ro/ro (transfer) passenger vessels).
Already in the last half of the 20th century, it was recognised that ports have significant environmental costs for the global ecosystems (Krech, et.al, 2004). Ports have been the target sector for environmental concern as early as 1970's in Europe, but they received the appropriate attention only after 1989 (CE, 1990). The inert role of ports against whatever was coming from sea towards the mainland *and* from the mainland towards the sea has changed (Gulielmos,2000).

Fig. 1.2: Environmental risks in shipping and port operations



Source: Wooldridge & Couper, 2006

Their strategic setting between sea and land makes them the preeminent onlookers of pollution coming from land, ships and from the ports themselves,) resulting in a close interrelationship between the environmental risks, aspects and impacts of shipping and port operations (Wooldridge & Couper, 2006) (see Fig.1.2). Thus, a complete view of safety, health and environmental issues assimilating the interests of shipping and port operations and activities, has been ever more applicable for ports (Wooldridge & Couper, 2006). Sea-ports and land-sea interfaces are difficult to balance -in environmental terms- since the coastal ecosystems -where they are located- are very sensitive to human actions. Ports, due to their nature, -being in close proximity to highly sensitive resources-, are under increasing *scrutiny by the environmental community* — both by the regulators and public/private interest groups. On the other hand, ports have often *turned into full-scale industrial centres* where, alongside traditional ship loading and offloading, operations take place. There are also various installations performing different jobs -from cargo storage to goods processing or industrial transformation operations. Their importance in production and consumer chain is rising and the prevention of risks in their facilities and processes is increasingly more decisive for the shipping lines and the terminal operators which are *"well aware of the fact that the transport chain is viewed as a totally integrated system"*, (Notteboom, 2004).

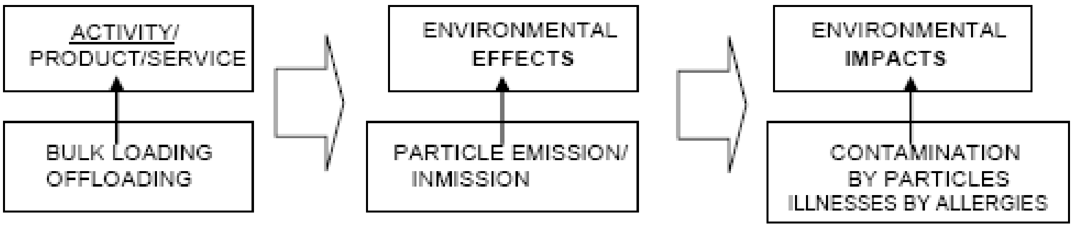
The creation and expansion of transport infrastructures -like ports- has the potential to cause serious environmental impacts, insofar as the increased scale of port activity during the last half of the 20th century has substantially increased pressure on the environment (UNCTAD, 2003). In addition, the development of port areas to satisfy the ongoing traffic needs often *clashes with adjacent metropolitan areas thus*, causing port activities to have a greater social impact, (IACP, 2006). A large part of the community takes the port industry for granted and is ignorant of how the industry is organized and operated. To an extent more attention is given to the fact that these industries generate negative effects such as, road congestion in and around ports, the use of scarce land, pollution (mostly oil spills) and unsafety. Thus, while global competition puts pressure on the European ports to offer adequate infrastructure and facilities to accommodate the wishes of their customers, port development in Europe is constrained by scarcity of land, urban development and ecological considerations, (ESPO, Genoa Conference results, 2002).

Identification of port environmental impacts

All seaports, regardless of their size, contribute to the environmental impact on the coast, land, the marine and atmospheric environment, (Perman et al., 1996; Gibb, 1997; Trozzi & Vacaro, 2000; Zanetto, et.al., 2002; Gupta, et. al, 2004; Dabra, et.al., 2004). The environmental impact mainly depends on the port's physical characteristics and commercial activities, (Wooldridge et al., 1999), while many port areas now exhibit environmental issues typical of other large industrial and manufacturing operations (Dalley & Deeming, 1994).

The European Seaport Organisation (ESPO) defines port **environmental impact** as the quantification of **environmental effects** identified as possible interactions of port activity- often similar to industrial processes- with the environment (ESPO, 1999). Fig.1.3 illustrates bulk cargo loading and offloading as an example of this possible interaction.

Fig. 1.3: Bulk cargo loading-offloading possible environmental impact



Source: ESPO definitions (ESPO survey, 1999)

Environmental impacts are likely to result from the two major groups of port activities, mentioned above (Table 1.1). The impacts from the *development activities* are crucial in the cases that the alterations to environmental resources are permanent. The impacts from the operation activities last at least as long as the operations do, unless the effect has resulted in irreversible change or loss of the environmental resource. The port environment is mostly threatened by: "the port's hinterland, ships' activity, port activity and port operation, whereas pollution may result from ship accidents, accidents in ports, land activities, ship bunkering, noises, garbage, dust, dredging, port maintenance, ship air pollution, traffic congestion, sewage" (Goulielmos and Pardali, 1998). The primary environmental resources which could be at risk from port activities are listed (in no order of significance) in Table 1.2.

Table 1.2: Environmental resources at risk from port and harbour activities

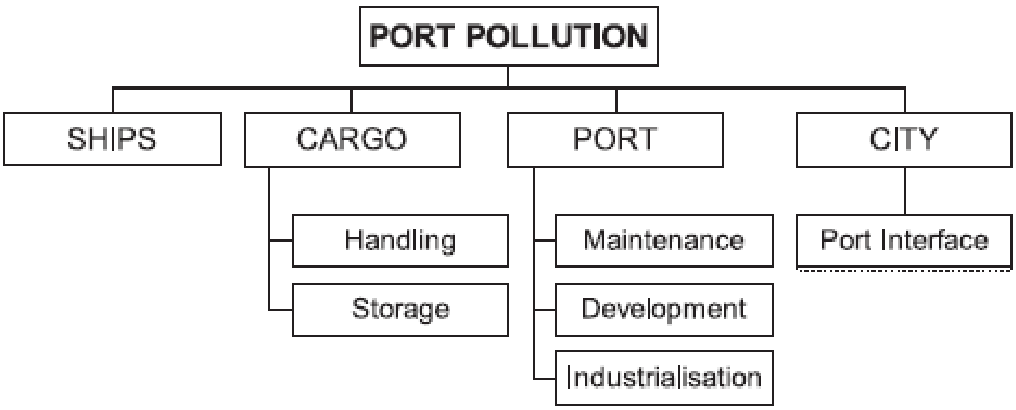
• **surface and groundwater quality** • **harbour sediment quality** • **air quality** • **soil quality** • **noise levels** • **status of natural habitats and individual species** • **human health and welfare** • **local community interests / cultural heritage**

Source: World Bank (1990) "Transport and the Environment Series", Technical Paper No 126.

From a particular scientific point of view, *"port environments represent special ecosystems whose communities are capable of alternating in various ways the chemical-physical parameters of waters"* (Cognetti & Maltagliati, 2004). As far as their ecological profile is concerned, these are especially crucial environments due to the nature of activities performed in ports and their environs, whereas they are liable to the danger of additional pollution from unintentional reasons.

Moreover, a port may result in a serious pollution problem over an extended region because of the miscellaneous activities. The upsurge of pollutants' emissions can have an effect on both local and regional quality (Galloway,1989: Gupta et al., 2002; Rodhe, 1989; Streets et al., 2000). The environmental resources can be affected either for a short or a long period of time and they can be either reversible or irreversible; moreover, the impacts may be local or regional and direct or indirect. Pardali, (1997), has detected that the main sources of pollution in port areas are identified within (3) different activities: a) ship service activities during navigation, mooring, repairing, maintenance and bunkering procedures; b) activities for cargo handling (bulk, liquid, and general cargo); and c) maintenance and port development activities (construction works for port development and maintenance of port infrastructure, dredging and disposal of dredged). UNCTAD has identified (4) areas of port generated pollution: a) ships, b) cargo, c) port, and d) city, (UNCTAD, 1993), putting in this puzzling frame the importance of adding the critical port-city interface as an area of potential pollution. The following Fig.1.4 presents the extend of port generated pollution.

Fig. 1.4: Port Pollution and its causes.



Source: UNCTAD, (1993)

Ports and shipping operations over the years are under increased environmental scrutiny in Europe, particularly given the fact that so many EU ports are located in -or near- major environmentally sensitive areas. The environmental risks involved have been highlighted by a developing environmental consciousness, while research (Tselentis,1998; Wooldridge, et. al, 2000; Wooldridge, 2004; Stavrakouli, & Wooldridge, 2004; Dabra, et.al., 2004; Naniopoulos et.al., 2006, Journee, et.al., 2006) has reported on the increased priority of certain environmental issues by European ports.

Seaports are located either in marine or estuarine zones, but general guidelines are applicable to both. The emission of natural and anthropogenic contaminants to the environment can be the outcome of miscellaneous port activities (extending from dredging procedures, but also discarding of materials, the shore zone growth, augmented maritime traffic as well as vehicular traffic in the port).

The pollution problems typically produced by port activities can be categorized as follows in Table 1.3.

Table 1.3: The pollution problems caused by port activities

- Coastal habitats may be destroyed due to construction and land reclamation.
- Deterioration of surface water quality may occur during both the construction and operation phases.
- Port activities may produce sewage, bilge wastes, solid waste and leakage of harmful materials both from shore and ships.
- Human health may be affected by soil contamination and contamination of coastal water.
- Oil pollution is a severe environmental hazard resulting from both port and shipping operations. The related critical environmental effect comprises bilge oil released from both oil tankers and commercial ships handling non-oil cargo.
- Human health may be affected by unallowable noise levels.
- Air pollutant emissions due to ship emissions, loading and unloading activities, construction

Source : Gupta et. al., 2004 ; Goulielmos, 2000; Van de Voorde, et.al., 1998; UK Royal Commision,1994

Their strategic location between sea and land increases the complexity of their environmental protection and makes them vulnerable to different kinds of pressures (Goulielmos, 2000). There are enormous environmental challenges related to shipping and ports:

- Policy makers have acknowledged that the mode could contribute to sustainable transport as it can achieve low air and noise emissions per ton of freight transported. But ships and the development of the required inland and port waterways may have major environmental impacts on water quality, biodiversity, landscape and recreational value of natural resources.
- Traffic congestion at seaports causes an augmented energy consumption, operational pollution as well as loss of time and comfort. Transport requisition for goods has been altered, and the emphasis has been shifted from the bulk of shipped goods to the frequency and swiftness, consistency and suppleness, besides the decreased typical shipment sizes. Thus, port operations become faster and berths are shorter (Couper, 1992). Seaports are now parts of the transport network. Transportation, along with energy-generation plant and industry are thought to be the most important sources of carbon dioxide emissions. Short-sea shipping, albeit short in length (compared to road traffic), implies traffic growth as well as probable bottleneck at ports. The Kyoto Protocol (articles 2.2 and 3.2) concludes that the creation of an integrated logistics management system with full use of telematics would allow a CO2 reduction of about 4 %. This last fact also requires change in the port's infrastructure layout (UNCTAD, 1993).
- *The recently evolved issue of port Air Pollutants*. In relation to environmental performance, the maritime sector is lingering as far as land-based transport industries are concerned thus ships have turned out to be the only major source of Sulphur dioxide (SO2) in the EU. At present, marine fuel has a maximum Sulphur content of 0.5 or 500,000 parts per million (ppm) in comparison with petrol for cars which by 2007 in the EU will only have 10ppm. Noteworthy SO2 emissions together with precise transport corridors may well vitally enhance the occurrence of asthma, bronchitis and heart failure. Likewise, they contribute to acidification which is still a severe problem for lakes and forests. Consequently, the decrease of NOx emissions and sulphur content in fuel are significant maritime policy objectives which, assuming the international nature of such transportation, can solely be efficiently confronted at the international level, possibly within the United Nations Convention for the Prevention of Air Pollution from Ships (MARPOL Annex VI, 1997). Particulate matter pollution (PM), at ports, construction and daily operations often create coarse PM, but it is the tiniest PM that causes the greatest health hazards coming from diesel engine exhaust. Volatile organic compounds (VOCs) are often toxic, and when they evaporate into the air they can react with other pollutants to form ground-level ozone, commonly referred to as smog. Common VOCs produced by diesel engines include benzene. Nitrogen oxides (NOx) are a family of chemicals, including nitrogen dioxide, nitric acid, nitrous oxide, nitrates, and other related compounds. They can cause a wide variety of health problems, and react with VOCs in the atmosphere to create ozone. Ozone, also known as smog, is a reactive gas produced when VOCs and NOx interact in the sunlight and split apart oxygen molecules in the air. Burning fuels that contain sulfur, such as

diesel and especially marine diesel fuels that have a high sulfur content, produce sulfur oxides (SOx). Sulfur oxides include sulfur dioxide, PM, and a range of related chemical air pollutants. In addition to the aforementioned, there are other air pollutants that *“threaten public health including carbon monoxide (CO), formaldehyde, heavy metals, dioxins, and pesticides used to fumigate produce”* (Mitchell, 2001). Considering that the majority of ports are close to urban environments, it is easy to comprehend why the air of any port-city beyond the city’s activities itself becomes deteriorated.

- *Another important issue is <u>port development</u>,* -and *thus,* the critical relationship between port development and environment (Finney and Young, 1995; Vandermeulen, 1996; Guhnemann and Rothengatter, 1998)- that is crucially related to the constant societal pressure created from the port-city interface (Daamen, 2007). As traffic (demand) expands and the role of ports change from a simple hinterland terminal to a complex nodal point in the logistics chain, changes in the port's infrastructure layout might be also required (UNCTAD, 1993). Apart from the investment cost for dredging facilities, the infrastructure ought to take into account the environmental impact and environment restoration according to ecological standards. As long as, the economic value of a port development project is likely to be taken as given, the arguments focus on the environmental criteria (for example, dredging and dredge disposal, loss of wetlands, emissions into the air, water pollution, congestion, loss of open space, light and noise externalities, potential conflicts with commercial fishing and recreational uses of area waters, etc.). Port development typically generates local environmental problems; however, when effects are caused to sensitive estuaries or inland or freshwater rivers the problems affect the environment in a regional scale. The impacts may vary from place to place depending upon the differences of geography, hydrology, geology, ecology, types of shipping, industrialization and urbanization. Therefore, systematic monitoring and valuation are essential during both the construction and operation phase for any port, to detect pollution levels and sources, control the disposal of waste from various point and non-point sources, as well as, to predict pollution levels in the future. Environmental requirements are now part of the investment cost and this may be relatively high for a port, even for those owned by the public sector (Gibb, 1997). Environmental policies are now drastically entering the decision of new ports’ sites (e.g. away from river mouths), while they are obliged to consider radical and, in many cases, innovative compensation measures to avoid denial of port expansion on environmental reasons which may favour other competing ports.
- Port environmental effects also depend on the ports with close proximity to highly sensitive environmental resources. This condition, together with the ever-increasing pressure from regulators and environmentally aware groups on ports to conduct their business in the most environmentally responsible way, has left ports with the most challenging task. Ports today are challenged to satisfy their customers by responding to their needs for newer, larger, and more efficient facilities as well as to satisfy environmental obligations by complying with laws and stringent environmental quality standards. Thus, ports in Europe have to ensure that environmental considerations are better integrated into both their planning cycle and their daily operational management.
- Ports and port companies must exhibit a high level of environmental performance in order to safeguard community support, while environmental aspects also play an cumulative role in attracting trading partners and potential investors. A port with a strong environmental record and a high level of community support is likely to be favoured. Differences in terms of green obligations among competing ports -embedded in diverse national contexts- are generated due to the lack of a common port environmental policy at an EU level. Consequently, since the mid 1990’s port environmental criteria, harmonized among- *at least*- the members-states of the EU, have been requested (Goulielmos, 2000).

However, although all seaports, have the potential to pollute extensively, depending on their physical characteristics and commercial activities, until the 1990’s the management of environmental issues was hardly taken up by port management organizations, and environmental policy statements were not available (Paipai, 1999).

1.4 Port Management (PEM) in Europe

Since the 1990's mandatory and stakeholder demands have reinforced the reduction of negative externalities and have increasingly provided powerful incentives to organizations to pay more attention to green strategic choices and actions (Hart, 1995; Porter & Van der Linde, 1995). For ports, meeting these requirements was typically perceived as added costs, although over the past decade environmental issues have begun to dominate the agenda of the European port industry. Ports are indeed generators of economic growth as much as magnets for the related industries and thus, they face the potential for considerable impact on the environment. The latter over the years has been considered as of critical importance, given the significant environmental impact, sometimes for an entire region (Button, 1993).

During the last two decades, the Port Authorities (PAs) have been functioning in a strong growth environment which calls for continuous investment in port facilities and connections. Being unable to consider the potential environmental impact, strategic port decisions and actions could negatively affect the business ability of a port, since the environmental legislation and ecological pressures are rapidly evolved. In this case, port activities and new investment projects in the port area are aimed to be managed and assessed, not merely in terms of economic potential as measured by the impact on market share and growth rate, but also in terms of the environmental impact (Verbeke, 1998). Therefore, the ports in Europe (as much as around the world), having a wide range of reasons to respond to the new demands as shown in the following box 1.1, began pursuing greening of the port management, in view of safeguarding their *"license to operate"* but also of increasing their economic and environmental competitiveness.

Box 1.1: Why is port environmental management requested?

▪ Compliance	▪ Investor and shareholder
▪ Port development	▪ Director's liability
▪ Risk management	▪ Cost and cost saving
▪ Customers	▪ Market opportunity
▪ Community	▪ Positive image
▪ Insurance and banks	▪ Influence policy

Source: Theofanis, et.al., 2005

Consequently, since the mid-1990's the European port industry has recognised that it is essential to incorporate environmental considerations into the port management structure. Ports recognized that they had to operate in a sustainable way defined from an economic, social and environmental point of view and that this sustainable operation must be based, as in other industrial sectors, on the provision of high quality services with respect to the protection of environment (Naniopoulos, Tselentis, Wooldridge, 2006), following the sector's recommendations:

"Services provided in seaports should be equally competitive, market oriented, efficient, safe, secure and environmentally sustainable",

ESPO, "Seaport Policy – A practical guide for EU policy makers", 2004

It was further realised that environmental issues were global and complicated in nature and that any potential 'green port' guidelines had to be applicable to different European member states, not to mention that they had to take into account the range of wealth, resources, legislative and organisational structures of individual ports. The European port sector through its authorised representative, the European SeaPort Organization (**ESPO),** deemed that *"such considerations require a structured approach managing the environment"* (Whitehead, 2000) and it was challenged to *"produce a unified response to the demands of environmental protection"*, (Wooldridge et al., 1999). Since 1994, by publishing its first Environmental Code of Practice, ESPO has proved its commitment to environmental improvement by promoting the sector's self-regulation towards greening. The *"ports for ports"* ESPO encouragement evolved into a network initiative of ports working together in collaborative EU funded projects, addressing common environmental issues, with the scope of exchange cost and environmentally friendly solutions. The **ECOPORTS network** from its beginning tried to eliminate the environment as a competitive factor among ports in Europe *and* to create a *"level playing field"* in port environmental management.

- The outcome was a harmonized PEM approach available for all port administrations in Europe, willing to plan a green port policy. It has been considered *"an important new development for ports in Europe, as it demonstrates attainment of a benchmark standard"*, (Journee, 2006).

1.5 Research interest and scope – Research Questions

European ports in the 1990's, were increasingly under societal pressure derived from negative social impacts of ports (often health-related) and primarily generated by pollution (OECD, 2010). Tensions between city and port development, limits to port area space despite the growing demands, new strict rules for clean air, soil, water, all shape the ongoing puzzle of how the port's license to operate is preserved, (Journee, 2008) and force all European ports to face a *common challenge*: "*to confront with the significant environmental aspects of their activities*", (Wooldridge & Couper, 2006).
They were compelled to provide some sort of indication that confirms compliance with environmental legislation and report on environmental quality. In addition, while most Port Authorities (PAs) adopted stringent environmental guidelines, they remained concerned about the full impact of the proposed environmental regulations on their competitive position in the port market, embedded even more in *competitive complete logistics chains* (Meersman, et.al., 2002) and shaping the competition between them. Thus, since the mid-1990s ports in Europe have faced -both collaboratively and individually- the challenge of confronting -in a reliable manner- their port environmental protection through EMS standard implementation yet still remaining equally competitive. The *aim of this thesis* research was to analyse the way in which ports addressed this challenge as well as to explore individual ports' and the sector's strategic responses to the emergence of environmental management in Europe from 1993 to 2010. *The end year of this particular time period –namely 2010- is the year when the EPF, the formal representative of the EcoPorts network dissolved and merged into ESPO organizational structure, signifying the end of an era with a unique characteristic that of European ports getting together to take action in a common cause.*
Given that the greening of European ports takes place in the wider field of competing PAs, the *research focus* developed to include three (3) different levels of analysis:

- the development and diffusion of EMS standard within an institutionalized 'environment';
- the diversity of individual port organizational strategic reactions to institutional pressures;
- the organizational environmentally-related resources and capabilities as the means to enhance a port's green behavior and provide potential competitive advantage.

The study, with respect to the introduction of a specific Port Environmental Management (PEM) standard among European seaports, maps the rise of the sector's 'green port' organizational field from 1993 to 2010. A certified EMS implementation has been considered by actors in the European port sector since the mid-1990's as a preferable and legitimated answer to the quest for port green policies. It aimed to maintain a balance between the need for continued economic viability and competitiveness of ports, and the community's desire to protect the environment. Within that evolving institutional context, the second part of this study explores the different ways in which ports perceived and chose to strategically implement their 'greening' process. Considering that ports in Europe differ in several aspects, ownership, financial structure, activities, environmental responsibilities, this part of the study analyses how their diversity affects the way in which they implemented EM. In the third part, the research investigates environmental pro-activity related to organizational capabilities and explores the organizational capabilities that trigger and further enhance a PA's ability to generate competitive advantage from proactive PEM implementation. Each of these levels of analysis is introduced more thoroughly in the next chapter.

RESEARCH QUESTIONS
The goal of this research was captured in the following overarching research question:

- ***How have European port organizations organized their approach to minimize their environmental impact?***

The answer to this question required that the following sub-questions were answered:

- *How have the EU port organizations organized their approach to minimize their environmental impact?*
- *How have individual ports implemented environmental management practices to reduce their environmental impact?*
- *How did field dynamics shape the individual process?*
- *How have individual port characteristics contributed to those dynamics?*

- Clarifying the notion of ‘greening’, ‘collaboration’ and ‘diversity’ in this research

While the word ‘*greening’* is an accepted language in organizational studies it reflects also the need its concept to be explicit within a research framework. This study is targeting a specific area and concept of greening -with a rather technical orientation- *the EMS implementation type of (port) organizational greening*. Luke (2001) points out nowadays environmental protection forces organizations to accept the need to confront a novel economic growth ideology, hence, the notion of *‘port greening’* in this research is also engaged –beyond strict EMS implementation- in forward-thinking policies for environmental concerns that a particular type of port organization the Port Authority (PA) applies in practice.

Collaborative and diverse ability of ports to facilitate EM in order to become *green ports* has been the trigger of this research.
‘Collaboration’ is understood here as the process of creating and changing relations among actors within a specific organizational field. The research looks at how collaboration within a port network unfolds, guided by the main research question.
‘Diversity’, as it is understood in this study, refers to the diversity of green strategic decisions and thus it addresses the question: can a port implement its green strategy in different ways, different from those imposed by institutional pressures? To put it differently: *how* did standards of port EM emerge and *how* are they managed through individual strategies?
The intention is not to identify difficulties in standard implementation and present them as challenges or problems to be solved. Instead, the focus is on the tensions of inherent features of the complex processes of collaborative relations among diverse actors promoting standard diffusion. Answering these research questions should not only produce interesting information from a field which has been hardly researched, but it should also help the port management understand the complexity of the phenomenon.

1.6 Layout of the research

The thesis is organized in seven chapters along with four annexes.

The above *chapter 1* has already given a brief introduction of the business’ nature of the port today as much as the idiosyncrasy of the port pollution. The quest for green port policies through EM implementation and *thus* the central topic of this study has been also discussed in short, while the research focus has been justified. The present section also introduces the research’s layout illustrated in the following Fig. 1.5

Chapter 2 clarifies the research theoretical framework and method. Port existing research is far from conclusive in terms of providing a comprehensive way to look into a port’s organization environmental strategy. The employed methodological approach proposes an interactive conceptual framework that aims to foster the understanding of the green port strategic responses in terms of divergence and convergence and contribute to the evaluation of the role of correlation between the collective and individual dynamics within the European green port field. In respect to the above, this research assumes that the exploration of how port EMS standards are created and adopted can help us investigate the evolved “green port” strategies of European ports. The method for data selection is also comprehensively elucidated signaling the departure point of this research.

Chapter 3 analytically introduces the emergence of PEM in Europe. This section introduces a port specific EMS standard advanced by the European SeaPort Association (ESPO) and the EcoPorts network, as the standard that was valuable enough to ports, as the green standard to be implemented in practice, and moreover as a potential evolved green-port institutionalized construct. The section emphasizes the importance of the joint perception of various port actors where particular green policies are appropriate and legitimate.

The four annexes are complementary to this background material but also vital for answering the research sub-questions, especially for gaining in-depth understanding of how individual ports have implemented environmental management practices in order to reduce their environmental impact and *thus*, how individual ports strategically responded to institutional pressures and what exactly underpinned their pro-activeness. The four annexes provide empirical research on four different case studies. The annexes' case study inquiry introduces for each individual port case study: the green national context and the national port policy within which the port has been embedded, each port's unique profile, as much as the latest port's reaction in the overall changes in the port sector. In addition, every case study gives descriptive information on: 1) the port's environmental aspects, 2) the port's efforts in terms of green operational plans and procedures, 3) EMS implementation. In a way, each case study provides a comprehensive port description following green issues and types of indicators (operational and managerial) aiming to introduce each port's EMS implementation in an integrated way.

Chapter 4 illustrates the characteristics of the evolved green port organizational field in Europe and identifies the dynamics involved in the field. Further empirical analysis looks into the way EU ports have implemented EM; assesses whether diversity among ports in developing EM exists; and to what extent ports have learned from each other's experience. Factors that led to a differential timing of taking up the challenge of developing EM, as well as the variety in the form that EM took in different ports, drive the comparative analysis, which finally points out the operative mechanisms in the individual ports EM development. Thus, this chapter addresses the *first level of analysis* of the organizational field and the identified mechanisms involved.

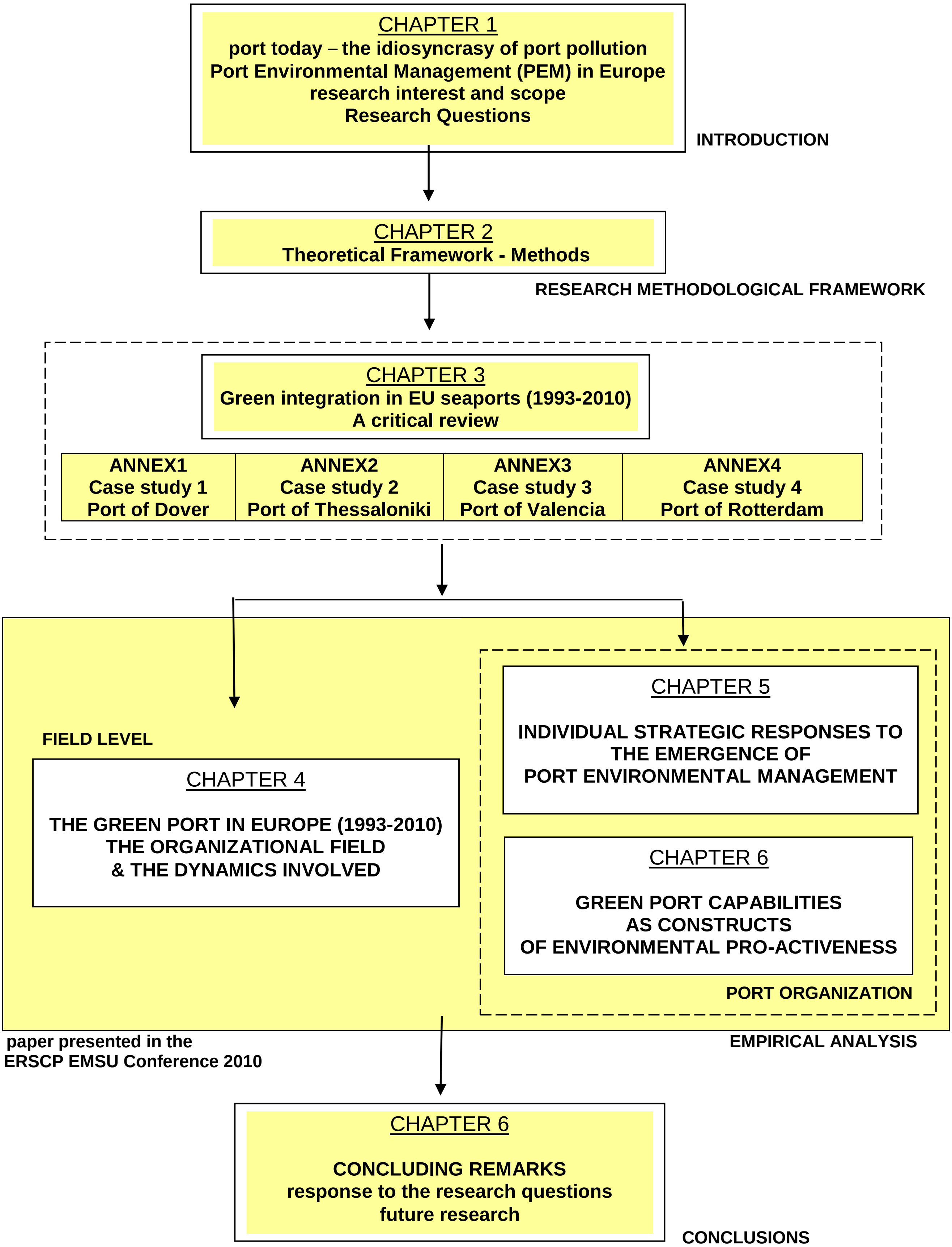
Chapter 5 confronts the *second level of analysis* of the strategic response to greening at the port organizational level and uses the Oliver (1991) typology to detect the different port leaders-laggards EM strategies within the European green port organizational field. The empirical analysis explores the willingness and ability of the four investigated port organizations to conform or resist based on the dual predictive dimensions of organizational strategic response related to five institutional factors according to the Oliver (1991) framework. This last part of the chapter's empirical testing enables a loop in the analysis and makes it feasible to draw concluding remarks on how different engagements in environmental strategy have affected port greening in Europe over the last decade, as well as on the dynamic of the interaction between the individual ports and their institutional environment.

Chapter 6 goes further by asking if it is possible that certain strategies and tactics are driven from the existing situation within the organizational field, while some are raised through specific organizational capabilities. This part of the study aims to explore the way in which each port developed core port capabilities towards greening, and to what extent the resource requirements are significant for the adoption of a successful green port strategy through EMS implementation. The chapter deals with the *third level of analysis*; the individual port capabilities and the empirical analysis investigates how environmental pro-activeness of port organizations is advanced by four diverse constructs proposed by theory: pollution prevention, stakeholder integration, higher order learning, and continuous innovation. The capabilities are considered as drivers able to shape the degree of a port's responsiveness to greening. The primary focus is on how individual organizational characteristics influence strategic responses, and therefore, the interest is different from the Oliver's approach whose centre of attention is on relational characteristics. Finally, the analysis concentrates on the role of port capabilities of enhancing EMS implementation by providing a competitive advantage.

Chapter 7 provides the research concluding remarks. It briefly discusses the reflections of the findings regarding updated developments within the institutional perspective. Finally, the author discusses the contributions of the study and raises questions about the direction that future research could take.

The following Fig. 1.5 illustrates the *layout of the research*.

Fig. 1.5: Research layout



CHAPTER 2: THEORETICAL FRAMEWORK & RESEARCH DESIGN

2.0 Introduction

Like most other transport-related industries, the maritime industry's most significant negative contribution to global challenges is probably environmental and *thus* the seaport sector in Europe has been subjected to increasing pressures from public regulators and various social groups (Goulielmos, 2000). Apart from any port development's environmental consequences (Finney & Young, 1995; Vandermeulen, 1996), as traffic demand expands and the role of the port changes to a complex nodal point in the logistics chain (UNCTAD, 2004), the societal pressure for environmental protection that derives from the port-city interface is even more critical for ports today, (Daamen, 2007).

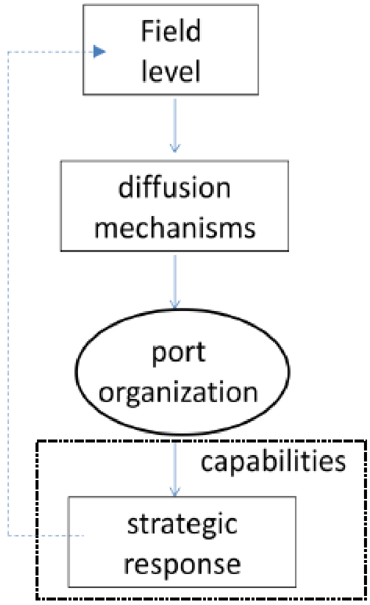
Dealing with issues of "greening" and sustainable development is a related, yet novel, area for ports and has raised a number of questions on how the industry would actually better deal with environmental issues in practice. Consequently, over the past 15 years, the concept of the "green port" has become a significant strategic issue for most European ports, causing much debate among EU policy makers, the European Seaports Association (ESPO), PA's and port-cities' authorities. This thesis research particularly takes place in the European seaport industry and focuses on individual and collective responses to the emergence of port environmental management within a specific period of time (1993-2010), aiming to add knowledge about *why* and *how* the "green port" concept evolved within this particular *time* and *space* context. Since the intended audience for this thesis is rather broad, ranging from practitioners within the port industry to researchers within different port environmental management scientific disciplines, its main objective is to broaden the spectrum of acquaintance of what the port sector in Europe really knows about its overall environmental performance.

In order to understand how ports in Europe have been finding their way to become green ports one can turn his attention to the power and pressures exerted by different groups of stakeholders, as well as to the way these actors have an effect on the use and dissemination of valuable information about how the "green port" concept would be implemented. Although institutional research has been a useful instrument for providing credible data on environmental management organizational research-*providing* means understanding the context and the factors that shape green organizational performance-, this type of research tends to be scattered across port management disciplines. To my knowledge, research in port greening is mostly focusing on best practices or multi-case study comparison research on green practices which the ports have utilized to manage their environmental aspects. Port organizational analysis of environmental management standards' application- which focuses on the role that institutions play in shaping these standards- is still absent. There are a few comparative studies focusing on port environmental policy outcomes which suggest that the institutional theory may be explored in order to examine the behavior of PAs in devising green port policy (Acciaro, 2013; Lam & Notteboom, 2014). In addition, institutional theory has successfully explained that conforming to field expectations increases legitimacy by means of standardization, while the nature of standards is an area into which neo-institutional research has made important contributions.

In this respect, based on an **institutional theory perspective,** the research primarily *assumes* that the European port organizations voluntarily adopted EMSs, in response to the perceived institutional pressure from external actors, and *identifies* the recently evolved green port organizational field which has facilitated the adoption and dissemination of port EMS standards in Europe. However, there is criticism opposite to the theory arguing that organizations are dynamic entities, that there are different variables representing environmental strategic responsiveness (Oliver, 1991) and furthermore that organizations can respond to external pressures in a variety of ways derived from the individual capabilities they possess (Oliver, 1997). As such, exploring and understanding potential mechanisms evolved at field and organizational level, as well as individual port capabilities, is vital in identifying the rationales of a port's pro-active green strategic response. Due to the relatively unexplored nature of the topic, the main goal of the research was to obtain a better understanding of this recently evolved phenomenon using different levels of analysis, seeking to better understand the dynamics of the interactions and connections of the green port organizational change within the context of its organizational field as well as the related actions and outcomes. Thus, the study approached the

European green port concept in terms of EMS standards implementation at both field and organizational level and proceeded applying an integrative conceptual framework that proposes *three distinct levels of analysis*. Fig.2.1 illustrates the three levels of the analysis.

Fig. 2.1: Research's evels of analysis



1. **Field level**. The analysis specifies the green port organizational field and explores its characteristic elements. As a stepping stone to the next level, the research following the Delmas and Sancho (2011) suggestion -that the emerging phase of standards provides a unique opportunity to analyze the web of institutional forces which shape and guide the diffusion of standards-, proceeds by identifying the potential mechanisms that shaped the individual port EM development.
2. **Port organizational level**. The Comparative case study analysis explores the individual port organizational strategic response to the emergence of environmental management. The institutional and resource dependence theory driven by Oliver's (1991) framework is employed to test the variety of green port responsiveness and to add to the detection of the different port leaders-laggards' strategies within the European green port organizational field.
3. **(Port) capabilities**. Recourse based view theory suggests that external factors, although vital to form the organization's strategy, should coalesce with firm-specific capabilities to produce competitive advantage. Based on this theoretical perspective this level's analysis explores how individual port internal resources and capabilities contribute to external field dynamics in developing and shaping the organizations strategic response.

The research integrates the above three (3) separate yet interrelated levels of analysis that can lead to a deeper understanding of the following points:

- Why PAs are *similar* to each other in the way they implemented EMS standards.
- Why PAs are *different* from each other in the way they implemented EMS standards.
- Why some PAs are early adopters and others are followers in EMS standard implementation.
- In which way EMS implementation requires them to develop new capabilities and look beyond their traditional business scopes so as to address a wider range of issues, interests and stakeholders, aiming to become green ports.

To conclude, port existing research is far from conclusive in terms of providing a comprehensive definition or measure of port environmental strategy. The proposed interactive conceptual framework aims to foster the understanding of the green port strategic responses, in terms of divergence and convergence, and contribute to the account of the role of correlation between the collective and individual dynamics within the European green port field. With respect to the above, this research assumes that exploring *how* port EMS standards are created and adopted can help us investigate the evolved "green port" strategies of the European ports.

2.1 Selecting the research's theoretical framework

2.1.1 Standardization in organizational fields (a neo-institutional theory perspective)

The *Institutional theory* focuses on the processes by which structures, -including rules, norms, and routines-, become established as authoritative guidelines for social behaviour (Scott, 2004). In the view of the theory, organizational performance is formed by the expectations arising from the institutional environment that *"penetrates the organization, creating the lenses through which actors view the world and... categories of structure action and thought"* (DiMaggio & Powell, 1991:13). The conception of the organization as an open system (Scott, 1992) emphasizes even more that the organization is influenced by the environment in which it operates. Thus, regardless of efficiency's promotion, the organizations ceremonially integrate into their formal structure institutional rules or practices, which are believed to be rational as much as the key to survival in modern societal environments (Meyer & Rowan, 1977). Various parts of institutional theory explain how these elements are created, distributed, approved, and become suitable in space and time (Scott, 2004). The theory signifies that in order to survive, organizations must conform to the rules and belief systems that predominate in their environment because institutional isomorphism, (both structural and procedural) will earn the organization *legitimacy* and secure access to essential resources and long-term survival (Meyer and Rowan, 1977; DiMaggio and Powell, 1983; Scott, 1995).

Organisations, being embedded in the institutional context, receive "templates" or archetypes of organising (DiMaggio & Powell, 1991) which serve their need to secure legitimacy. According to Meyer and Rowan (1977), typically means of legitimacy achievements is the alliance with some *"rationalized institutional myth"*, which is commonly demonstrated by the acceptance of specific structural features that are exhibited by important organizations through some isomorphic process (DiMaggio and Powell, 1983).Thus, the theory indicates that an organization's need to secure legitimacy by following specifically approved scripts and routines is reflected on stability reasons and on the similarity of organizations within an institutional field. The core element of the theory, the organizational *isomorphism,* is defined as the resemblance of a focal organization to other organizations in its environment (DiMaggio & Powell, 1983); or as a process in which organizations of the same institutional field conform to the same set of practices, (DiMaggio & Powell, 1991:66). DiMaggio and Powell (1983) discussed isomorphism as both a state and a process; their study of what makes organizations so similar presented three different *isomorphic processes*. The first process, *coercion* is a pragmatist one, as organisations are confronted with rules and power and act in accordance with these rules. The other processes, *mimetic* and *normative*, are social constructivist. Mimetic processes are about the imitation of those organisations that are perceived to be successful. Standardizing processes concern the common beliefs of professionalism that are gained through education. While adoption of an innovation may initially relay to the outlook of improved performance- as the innovation gains acceptance- others may adopt more in order to seek legitimacy (DiMaggio and Powell, 1983). This pattern of behaviour is profound during times of high uncertainty, when organisations are more likely to imitate other organisations, especially those that are considered to set the norms (DiMaggio and Powell, 1983). Zucker (1987) explained that the gains of this isomorphism are more directly related to organizational legitimacy and reputation rather than to efficiency, while Abrahamson (1991, 1996) suggests that choices about whether to adopt or not can also relate to the existence of fads and fashions among members of a social network.

Institutions reflect specific power relationships (at a particular time). Since they are established, they can acquire a life of their own, and often create power relationships by defining rights and responsibilities. Thus, they *"shape the identities of social actors in ways that are durable over long periods of time"* (Jackson, 2010). It is only when organizational practices and policies become institutionalized, that they are considered as a legitimate and rational means to attain certain organizational goals (Tolbert, 1985; Tolbert & Zucker, 1983). Established institutions provide extensive scripts for action and allow theme variations *but* on the other hand they may be quite specific and mandatory within a certain field of action. The theory adopts the assumption that institutions constrain certain types of action, but by doing *so* they also always enable other new types of action. Scott (2001) identifies three kinds of institutions: cognitive, normative and regulative, while he recognized three major factors of institutionalization in literature: (a) *cognitive elements* that comprise meaning systems and cultural fundamentals of the society, the power of which rests on an agreement

of shared notions of social reality; (b) *normative elements* that specify prospects of the suitable behavior, which are learned and adopted through socialization or education; and (c) *enforcement processes* which include scrutiny, valuation, and the implementation of sanctions by official regulatory structures (Scott 1994, 1995).
The important contribution of the neo-institutionalism was to add a *cognitive type influence*. Institutional theory has taken a "*cognitive turn*" emphasizing the need to incorporate more cognitively oriented analyses of institutions and their efforts rather than to solely focus on *normative and regulative aspects* (DiMaggio & Powell, 1991:15). This view adds that individuals act because of understanding instead of acting under rules that are based on obligation. Agreement takes place in many cases because other types of behavior are unthinkable: *"routines are followed because they are taken for granted"*, (Scott, 2001:57), as the way of doing things. Thus, organizations may abide by environmental pressures not in order to get positive outcomes but because it is unthinkable to do otherwise (Oliver, 1991). Individuals make certain choices or perform certain actions not because they fear punishment or in an attempt to conform, and not because an action is appropriate or the individual feels some sort of social obligation; instead, the cognitive element of new institutionalism suggests that individuals make certain choices because they cannot think of any other alternative. As such, the emphasis of the institutional theory is on the *institutionalized symbols, values, meanings,* and *rules* which build a *"cultural rationalization"* (Scott, 1994). Cognitive institutions accomplish their authority from collective conceptions of social reality rather than through the assure of rewards (Scott, 1994).
To sum up, neo-institutional theorists explained that legitimacy is acquired by conformism to the institutional setting which enriches their stability, and survival predictions (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Meyer & Scott, 1992; Tolbert & Zucker, 1983). DiMaggio and Powell (1983) explained that organizations not only strive for resources and clients, but also for *political power*, *social legitimacy*, and *economic fitness*. Although the theory has made significant contributions to the writings on organizations, it has been criticized for its over-socialized dimension; still it offers a well-recognized theoretical structure on how (green) organizational change processes can be explored. For researchers the theory refers to a diverse set of ideas about the way in which organizations function and change (Scott 1995; Tolbert & Zucker 1996; Boons & Strannegard 2000).

2.1.2 Organizational fields

The institutional theory recognizes that organizations exist in organizational fields. Researchers recognized the value of concentrating attention onto more delimited sets of organizations, by analyzing organizations as embedded in non-local environments but in organizational fields. Fields are vital for organizational action and organizational fields are based on inter-organizational relationships that may help researchers compose societal-level fields or explore *institutions themselves*. They constitute a set of idiosyncratic fundamentals of a system that may help endorse sustainability and on the other hand they have traits and structures which subsequently have a strong impact on the kind of (green) procedures that could be disseminated among organizations, (Jennings & Zandbergen, 1995). The term **organizational field** was proposed by DiMaggio & Powell (1983/91:64-65) and remains a key concept of institutional theory. The authors defined a field as: *"sets of organizations that, in the aggregate, constitute an area of institutional life; key suppliers, resource and product consumers, regulatory agencies, and other organizations that produce similar services or products"* (DiMaggio & Powell,1983: 148-149; 1991:64-65). The concept has perhaps become the central focus of analysis within the theory (e.g., DiMaggio 1991; Fligstein 2001; Greenwood et al. 2002), while it considers the theory's prime level of analysis.
Overall, the new institutional theory involves an interest in properties of supra-individual units of analysis (DiMaggio et al., 1991), but it seems that, within the different approaches *the issue of analysis level* has occurred. DiMaggio and Powell (1983) develop the *macro perspective* that has become the dominant emphasis on sociological work. Before them, Rowan and Meyer emphasized the macro side of institutionalization viewing institutions as complexes of cultural rules (Meyer et al., 1977a). Scott (1994) acknowledged the importance of the field level of analysis and confronted a difficult task within the theory, the field's boundaries definition. Scott's (1994) proposed the functional organizational field that is a set of *"similar and dissimilar interdependent organizations operating in a functionally specific arena together with their exchange partners, funding sources and regulators"*

(Scott, 2004, p:9). He also added (1994) the idea of patterns of interaction between organizational communities which becomes defined by *shared systems of meaning*. These *meaning systems* establish the boundaries of each community of organizations, defining its membership, the appropriate ways of behaving, and the fitting relationships between organizational communities (Lawrence, 1999). Subsequently, according to his later suggestions, the center of attention is on the *entire system* of organizations and their relationships derived from both structural and cognitive structures (Scott, 1998: 129). Following a different research path, Zucker looks more closely into the 'micro-foundation' of institutions (Zucker, 1991).
Hoffman (1999), exploring chemical industry environmentalism, defined the organizational field as a community of disparate organizations, which by including procedures, consumers and advisors that engage in common activities, are subjected to similar reputational and regulatory pressures. To this view, Hoffman (1999) adds that fields should be seen *as "contested centers of debate, where competing interests negotiate the interpretation of what they each consider as key issues".* Hoffman's work highlights processes of framing, diffusion, translation, and bricolage - all mechanisms processes which were identified also by Campbell (2005).
Since the initial definition of the organizational field (in 1983), different meanings have been presented attempting to improve the concept's operationalization. This thesis research employed the DiMaggio & Powell (1983) theoretical perspective on an organizational field, considering the field as *the totality of the relevant actors,* thus as a set of organizations, that share systems of common meanings and frequently interact among themselves, constituting a recognized area of institutional life. Therefore, the following, proposed by DiMaggio and Powell (1983:148), ***criteria** for assessing what an organizational field actually is*, were used:

- increased interaction between organizations;
- increased volume of information exchange;
- increased awareness and the mutual recognition between organizations that are involved in a common undertaking; and
- the development of patterns of dominance and coalition.

The most commonly suggested view on how an organizational field is functioning, suggests that in an organizational field, organizations continuously adapt to the pressures and values of the field, and thus consider each other as relevant. Therefore, the field can be pictured as a *large, non-static network*. The actors in the field contribute to the development of these pressures and values, act accordingly, and thus they influence the characteristics of the field. The term is meant to *"signify both common purpose and an arena of strategy and conflict",* (DiMaggio 1983:149), A key word within the theory is relations, or "*a system of relations which have evolved between the actors"* (Sahlin-Andersson 1996:74), produced by mutual concerns among the actors on similar issues. Mc-Adam and Scott (2002) explored a more dynamic appraisal and according to them the field concept *"identifies an arena –a system of actors, actions and relation– whose participants take one another into account as they carry out interrelated activities",* and develops it as the fundamental unit of (organizational change) analysis, since it *"allows us to view these actors in context"* (McAdam & Scott, 2005:10)

In sum, for Boons and Strannegard (2000) within the neo-institutional theoretical framework it is possible to develop the field of "green" organization studies. As pointed out by DiMaggio (1991) organizational fields should be treated simply as rather meaningful constructs for the actors involved (DiMaggio, 1991), with boundaries defined by the way they are perceived by them, and that the interactions among them affect not only the organizational practices but also the representation of the field itself. The concept is flexible as *"a field is always an analytical construct and how one defines it depends upon the phenomena in which one is interested*" (DiMaggio 1983:149) thus, "*the extent to interaction in the field is always an empirical question and an analytic construction and is demarcated by the eye of the observer"*, (Sahlin-Andersson 1996:73). The theory predominantly helps to examine the impact of institutions on *collective action problems* that are entrenched in the conflict between individual actors and collective rationalities. The perception of the organizational field also stresses both relational bonds within the field and a common system of meanings that the participants share.

2.1.3 (Green) organizational change and legitimacy

New institutionalism thought addresses the issue of organizational responses to environments, and adds to this dialogue returning the focus of inquiry on legitimacy and social contexts. The theory emphasizes the key relationship between stability and *legitimacy* and the power of the taken for granted; while on the other hand it confronts the rational decision-making approach in organizational theory, recognizing "the importance of the wider social and cultural environment as the ground in which organizations are rooted", (Scott & Christensen, 1995).

Zucker (1987:451) asked the question: *"Why are some organizations interpenetrated by the institutional environment, while others are not?"* She clarified that if the organizational objectives and values are not widely shared, the organization is more likely to be tested. Organizational **legitimacy is** valued as an important element in analyzing the external relationship of organizations. Organizational legitimacy is the fundamental consequence of institutional isomorphism, the acceptance of an organization by its external environment (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Meyer & Scott, 1983). Like isomorphism, legitimacy is a critical concept in institutional theory, serving as the *"anchor point of a vastly expanded theoretical apparatus"*, (Suchman, 1995).

Early contributions suggested that, in modern societies: *"formal structures are manifestations of powerful institutional rules which function as highly rationalized myths that are binding on particular organizations"* (Meyer & Rowan, 1991:44). For most institutional theorists organizational legitimacy is processed by equivalence between organizations and their cultural environment. Organizations are susceptible to their cultural environment and therefore they look for justification. Institutionalized rules (myths) are often beyond the discretion of the manager or a given organization, and they are taken for granted as legitimate. The diffusion of certain structures or operating procedures is due to the need to gain legitimacy from the environment, rather than the efficient functioning of these elements.

- *Why are organizations involved in the legitimation process?*

Legitimation refers to the process of legitimacy. According to Suchman (1995) legitimation is a widespread perception that the actions of an entity are desirable, proper, or appropriately based on common norms, values, beliefs. Through the legitimation process, the society, either accepts or endorses the organization's means and outcomes as valid, reasonable, and rational (Meyer et al., 1983). It is a means of increasing support to organizational motives for change or the necessity to reduce uncertainty, or even a way for the actor to be part of the general trend.

Organizations that neglect legitimacy are more vulnerable (Meyer et al., 1977), as it is a necessary variable for an organization to survive. In order to accomplish that, they require more than material resources and technical information; they also need social acceptability and credibility (Scott, 2001).

Meyer and Rowan argue that through legitimacy, organizations demonstrate their actions on collectively valued objectives in a *"proper and adequate manner"* (Meyer et al., 1977), providing a certain rationalization and justification, and furthermore, that compliance to institutionalized beliefs increases legitimacy, resources and survival capabilities (Meyer et.al.,1977). Organizations that accept and implement processes and structures acting in accordance with the rules and requests of the institutional environment are likely to be more successful. The origins of these rules and socially defined categories may initiate from different authorities such as the state, trade associations, or widespread belief systems that determine a legitimate organizational structure and activities.

- *How do then organizations respond to their environments in this type of institutional context?*

Legitimated organizations correspond, via their attitudes, with the mutual beliefs of social groups via a socially constructed process (Suchman, 1995). Legitimation process is a sort of continuous evaluation of the comparison between the attitude of an individual organization with the collective beliefs and values of a social system. The motives of seeking legitimacy may be of different nature also depending on the organization's own objectives and ambitions. For DiMaggio & Powell (1991 [1983]) -revisiting the "iron chains" thesis of Weber-, focusing on the structures and processes of the institutional environment itself, *institutional isomorphism* is a type homogenization of structures coming from the fact that organizations must compete with each other for *political power* and *legitimacy* (not just economics).

Scott (1991) denotes to the significance of legitimacy, as the mean for organizations to claim societal values. In dealing with their environments, organizations aren't automatically passive actors; they can be expected to *act strategically* in relationship with their environments. Scott (1991) notes that organizations may be expected to implement strategic choice in relating to their institutional environments; and moreover opposing to DiMaggio and Powell's argument, he proposes that under certain circumstances, extremely structured organizational environments may generate increased diversity.

- *Legitimacy and efficiency*

An important component of an organization's evaluation outcomes is *efficiency*. The concept of efficiency usually refers to the activity developed in an optimal way, which extracts the maximum output from the minimum input. While efficiency is connected with an organization exploration for expansion and the desire to dominate, legitimacy is connected with the demand for social binds (Richardson et al., 1997). Legitimacy and efficiency may be viewed as working in contrast or complementary, (Meyer et al.,1977; Scott, 1983).
Institutional theory addresses legitimacy and efficiency as related to two different environments, the technical and the institutional environment (Meyer et al., 1977a). A technical environment stresses the physical output like products, services, and profit, whereas the institutional environment expects the organization to become legitimate by demanding structures, ideologies, and processes (Boons, 2000). The two sectors claim diverse expectations from organizations, and organizations that need to manage both environments, are not always capable of simultaneously seeking both of them. For them claiming legitimacy (in a large spectrum of interactions among various stakeholders within this context), is a variable which makes the relationship between efficiency and legitimacy more complex. Scott and Meyer admit that it is often difficult to empirically distinguish technical from institutional rules and procedures: *"this is because those who formulate institutional rules strive to make them appear technical in nature" (*Scott and Meyer, 1991:124), believing that this will enhance their legitimacy. Those organizations, that are technically oriented, strive to protect their way of working from the external environment, while institutionalized organizations absorb technical activities from scrutiny or regulations (Scott et al., 1983). In the case that both environments, institutional and technical, are highly developed, within an organization, there is an appearance of internal contradictions. From Scott and Meyer's perspective, legitimacy and efficiency are two distinct dimensions whose connection rest on on the type of sector. Legitimacy and efficiency are frequently perceived as contradictory to each other, because they are the foundation of different logics to organizations. Legitimacy and efficiency do not necessarily conflict, as long as they are both vital for the survival of a company. Organizations are challenged to find a suitable balance, which may differ depending on the organization's sector and its characteristics. The adoption of strategies with a low and/or negative value of legitimacy is always a possibility. An important element to consider is the issue of *decoupling*, i.e. creating and maintaining separation between policy implementation and practice. Some organizations use forms of symbolic reassurance to pacify potentially influential actors (Meyer et al., 1977) and they don't present what they actually do. If legitimacy drives organizations to distinct their technological and institutional environments this may not inspire organizations to change, but rather support their current practices.

Organizations can have divergence about social norms but they preserve legitimacy. The legitimacy of another organization is always important. It even raises the issue of how an organization can be assured about the legitimacy of others within a business sector network. Consequently, *what is legitimacy in a network and how can business networks attain legitimacy to follow institutional (and even market) expectations?* According to Elsbach (1994), legitimacy can signify a way to evade or *decrease competition effects*, and governance mechanisms can assist organizations to employ legitimacy principles. A business network case also has to assemble another sort of expectations. External partners such as customers, stakeholders, governments, do have expectations which could be very heterogeneous. Aiming to be responsive to external expectations, network governance builds up its *external legitimacy*.

One of the main encouraging effects of legitimacy on organizations is reputation. For Suchman (1995), the management of legitimacy heavily relies on *organizational communication*. Setting legitimacy scope as organizational behavior rule, Oliver (1991) posits that the organizational communication constitutes a reaction to the pressures coming from its institutional environment. Organizations perceive external pressure as long as they share a common organizational field, but it is possible that the process of legitimacy appears when problems of credibility arise in organizations. Similar to the influence of legitimation, reputation supports the survival of organizations. Although connected, legitimation and reputation present differences. Rao (1994) suggests that legitimation and reputation are complementary aspects of creating an organizational identity. Rao's research (1994) on schemes used in the legitimation process, like *certification*, argues that certification is a social test that provides reliability to organizations. Gaining certifications legitimates the organizations and legalizes their reputation, because of the taken for granted axiom that being certified means that they were rational and impartially tested. (Rao, 1994).

2.1.4 Knowledge of how standards are created and adopted in organizational fields

Standards and norms constitute central objects for regulating behaviours in contemporary societies. Predominantly from a sociological perspective, Brunsson and Jacobsson (2000) argued that the new era of globalization tends to support standardization as a social form, adding to its importance, and that the nature of standards is an area into which neo-institutional research has made important contributions. Scholars consider standardization as a socio-technical process, which concurrently stimulates technical innovation and brings together collective groups around new objects. Within neo-institutional theory, standards and norms are typically allied with normative institutions (Scott, 1995), which are likely to underpin isomorphism and conformism within a specified organizational field (DiMaggio & Powell, 1983). Once defined and adopted, standards support stability, assist the diffusion of certain solutions and behaviours, and embed power relations within the field. Apart from constituting tools for changing and regulating behaviours, they frame fields and diffuse practises in professional settings (Abbott, 1988). They establish central plans through which central constituents of organizational fields and professions fight for authority over a given area of practice (Hoffman, 1999).

- *"Self-regulation" - A trend for green (port) regulation*

Organizations, by managing their environmental impact, implement changes in their business activities and they need management routines that coordinate these technical actions (Boons & Strannegard, 2000). *Self-regulation* (and partnership) is a *"popular approach"* reflecting organizational preoccupations towards social responsibility, aiming at the incorporation of green concerns into organizations' mission statements (Boons, et.al.,2000). *EM standards* can be seen as a part of broader trends that are fundamentally changing the way organizations are regulated. Efforts within this trend are to some degree undertaken without government involvement. The most evolved form of non-governmental collective action in the environmental field has been the development of the ISO 14000 series of standards for environmental management (EM). The only significant competitor to ISO 14000, is the Environmental Management and Auditing System (EMAS) developed by the European Commission. Similarly, while a long list of product environmental labels has been the outcome of industry initiatives, many others are established as a result of governmental initiatives.

- *Organizational legitimacy through EMS Standards (for green ports)*

ISO 14001 and EMAS are part of a growing trend toward creating "beyond-compliance" *supranational policy regimes* (Falk, 2000). As such, they are characteristic of a new type of environmental authority that is more dependent on both supranational rule-making and private authority in implementation. Environmental management (EM) standards support firms to voluntarily accept policies that go beyond the mandatory requirements and encourage continuous improvement in organizational environmental performance. Participating organizations establish green EMS intended to assess their environmental impacts, set goals for future improvements, and carry out regular audits of their environmental protection measures. To guarantee that each organisation's management system follows to a certain standard, they are subject to an external certification procedure that is carried out by an independent, accredited verifier. Assuming that decreasing uncertainty is a vital objective for organizations; the degree that these new trends in the regulation complement of the firm's level of uncertainty has important consequences in terms of both organizational strategy and economic efficiency. Organizations that are willing to gain legitimacy among stakeholders are more interested in adopting voluntary environmental practices that are externally visible, such as eco-labelling and international certifications (Delmas and Toffel, 2004).

The *voluntary nature* of standards indicates that they are not required by any legitimate authorities, but they are actively necessitated by (private) organizations. The voluntary character does not infer a complex way to produce a degree of organizational legitimacy (compared to the processes of political or mandatory agencies), as there is no consequence for non-compliance with the standards or for not adoption of them. Therefore, actors will deny using standards, if they are not beneficial or accepted. On the contrary, standards are generally accepted, when they provide evidence that they are *"morally right, beneficial for the users and the like"*, (Brunsson, 2005).

Standards should be 'legitimated'. Thus, they receive a significant level of legitimating power is case they include reputable leaders in their design, (Brunsson, 2005). Another critical feature of legitimacy is the participation of experts and scientific agents in the standard setting process and their involvement in the management of standards (Jacobsson, 2005). Diverse actors' involvement in the standard development processes as well as their endorsement and moral acceptance is required in order to communicate and foster standards' worth (Jacobsson, 2005). Standards should provide not only efficient procedures but they should also inspire and entice possible users to apply them and consequently, obtain endorsement by powerful organizations through the integration of organizational routines that comply with norms, values and descriptions of a widely accepted social system.
Particularly, the setting-up of the voluntarily-based green port concept that should be applied by a technical, profit-oriented and very dynamic in its nature industry- i.e. the port sector- the pursuit of legitimacy for the suggested standards had to be a notable component of these standards' activities. Considering that the green port concept pursued by EMS standards application and certification is rather 'adolescent', as the first port EMS certification (according to the PEPS standard) was in 2003, those that defined the standards had to convince ports to apply them by showing and communicating their legitimacy and their effectiveness.

- *Diffusion mechanisms of standards*

The management research offers two different perspectives to explain the diffusion of new organizational practices, as EM standards: a technical rationality approach and an institutional perspective. The latter emphasizes *institutional forces* and, in particular the neo-institutionalism perspective, stresses the diversity of institutional influences (Suchman, 1995) and focuses on how regulative, normative as well as cognitive forces shape the emergence and diffusion of practices within an OF (Scott, 2001). Suchman (1995) proposes that diffusion of new ideas will be more rapid if a single account of a problem and solution occurs. Jennings and Zandbergen (1995), elaborated distinctive institutional elements in systems for sustainability. According to them a critical point in time in the institutionalization process is just after the idea and its constituents have been elaborated by a group of actors and some guidelines or practices have been established and in this way they have gained extensive approval or *legitimacy*. Acceptance of these practices will depend on the organizational fields' type settings that promote sustainability and the *diffusion* of the concepts, rules, or practices within them (Jennings & Zandbergen, 1995). Thus, diffusion occurs only if new ideas are compellingly presented as more appropriate than the existing practices (Greenwood, et.al., 2002); while the diffusion concept correlates with the idea of organizations searching for legitimacy, (Boons & Strannegard, 2000).
Neo-institutionalism goes even further than its broad concept to differentiate among regulative, normative and cognitive dimensions of institutions and specifies three (3) *mechanisms of institutional isomorphism* that are likely to emphasize one or another of these dimensions (see Table 2.1). The proposed mechanisms spread standardized practices of institutional forms and aim at generating legitimacy (DiMaggio and Powell, 1983:150).

Table 2.1: Mechanisms of institutional isomorphism

Field mechanisms	empirical indicators
Coercive	rules, laws, sanctions
Normative	diffusion of norms standardization: certification, accreditation
Mimetic	uncertainty isomorphism

Source: DiMaggio and Powell, 1983; Scott, 1995

A certain limitation to the institutional theory remains the void of any specific framework on how to identify the relevant source of institutionalization, and how to operationalize the mechanisms of institutionalization. For example, DiMaggio and Powell (1991) call attention to that the sources of institutionalization are other firms on which specific organizations are significantly in need of, but they do not indicate which organizations these might be. Additionally, the research focuses on the pre-institutionalization and semi-institutionalization stages, which do not allow a comparative analysis over a long period of time, and thus foreshadows that there is still a deficiency of agreement on the value of the organizational innovation. Full institutionalization occurs as the density of adoption, provides ideas with cognitive legitimacy (Suchman, 1995) and the new ideas become taken-for-granted "as the natural and appropriate arrangement" (Greenwood, et.al., 2002).
However, being interested in examining the early period of the green port evolution in Europe (1993-2010), this study argues that the regulative and normative context, in which the standard is implemented, matters, at least at the earlier stages of institutionalization (Delmas,2007; Delmas & Sancho,2011). This is also reinforced by the need to comprehend what establishes the foundation of interpreting the value of a management standard when there is no indication of its technical efficiency. Therefore, the study examines potential legitimation processes and the propensity for institutionalized organizational structures and procedures to be taken for granted, unrelatedly of their efficiency effects (Hoffman and Ventresca, 2002).

What is also relevant to this study is that in the emerging phase of a European, and thus supra-national management standard, there may be differences in the interpretation of the standard across countries, an assumption that indicates an interesting consideration to be explored. The study also considers the argument that diffusion requires a normative justification in highly professionalized settings and thus the role of ESPO, the port association involved in the institutional arrangements within the green port organizational field, is explored. Abbott (1988) suggests that progress in knowledge can create a 'new' socially legitimate set of problems and hence, an opening for new professional groups. Normative arrangements, contribute to the structuring and professionalization of a field (DiMaggio, 1991) as much as establishment standards and certification challenges (Rao, 1994). They are prominent in emerging fields in which boundaries need to be set and a common identity is yet to emanate. Furthermore, Greenwood et al., (2002) suggest that field actors act more likely as institutional entrepreneurs and they mainly use existing configurations, such as existed reputable professional associations, in order to implement the institutional change, they support.

The core concept of the Ecoports network was about: *"working together in collaborative projects addressing common (port) environmental issues" (Hoenders / ESPO, 2007).* In alignment with this, the question to be posed would be whether knowledge growth in port environmental management (PEM) was sufficient enough to challenge the port professions operating to build individual green ports in Europe. The seaport industry at least at the representative association level believes so.

"The EcoPorts Foundation has developed useful methodologies (SDM, PERS) to assist ports in their environmental management. ESPO encourages the use of these tools because they can help port authorities to continue improving their environmental management and therefore to enhance the status of the environment in their port." (ESPO, 2004)

2.1.5 Conceptualizing diversity in the field

The adoption of environmental management by ports is a development where a **push for standardization** and a **pull towards diversity** have occurred concurrently. In this section, we provide a conceptual framework to assess the individual strategies of ports that lead to these simultaneous developments.

Regarding standardization, it was consequential that the development of Environmental Management within the European port sector took place within the wider context during the 1990s, at a time when organizational strategies to embrace "greening" proliferated in industry. A dominant idea, within the EU, was that enterprises should take responsibility for their environmental impact. This was complemented by a win-win philosophy, which advocated that reducing ecological impact and economic gains (profitability and competitive advantage) could go hand in hand (Boons, 2009). Stimulated by the concept of "greening", corporate environmental tools were designed by different agents, such as: environmental design, life cycle analysis, environmental management system (EMS), eco-labeling, industrial ecology, eco-efficiency, and green accounting. They intended to implement organizational changes in product and process systems to reduce environmental impacts. Additionally, a variety of EMS frameworks, such as Responsible Care, British Standard 7750, Eco-Management and Audit Scheme (EMAS), and ISO 14000, were designed.

Such standards were of interest to the port sector, which, from the beginning of the 1990s, was facing a common challenge: "to confront the significant environmental aspects of their activities", (Wooldridge & Couper, 2006). According to Wooldridge et al. (1999), demanding and substantial legislative growth pressures as well as a highly competitive port market environment, made the sector confront the challenge to produce "a unified response to the demands of sustainable development and environmental protection".

At the same time, diversity emerged in terms of the EM-practices adopted by individual ports. One important reason was that the emerging standards for firms were not immediately fitting for ports. For European ports, a major question throughout the 1990s was: Why is it important to be "green"? Are the moral and ethical dimensions of environmentalism relevant to port managers in Europe? And if there is a win-win philosophy, then a "green" movement beyond compliance is made much easier when the financial stakes are clear. Also, it is not immediately elucidated, what moving beyond compliance entails. Is compliance itself changing as a result of the upgrading European legislative framework? At the practical level: what is a "green port", what exactly initiates port environmental management, and how is a "green port" concept implemented? This was exacerbated by port diversity in terms of location, size, operations, industry, traffic volume, ownership, local geographical and hydrographic characteristics. Secondly, it is not always clear to what extent a port authority (PA) can control the environmental impact of activities taking place within the port area which is populated by a diverse set of operators, tenants, etc. Thirdly, over time it has become clear that a port environmental impact is partly determined by the logistic supply chain it is embedded in.

These factors led to a differential timing of taking up the challenge of developing EM, as well as variety in the form that EM took in different ports. As a consequence, it is expected that the following mechanisms would be operative in individual ports EM development:

1. <u>Problem solving</u>: while encountering a new situation, where the existing organizational routines are insufficient, the organization develops a new practice. When found adequate, the practice is customized (Boons 2009);
2. <u>Learning</u>: when dealing with a situation that demands attention, the organizations may develop knowledge that enables them to improve their activities' performance. This includes the adoption of new practices such as EM. Learning may be collaborative, in jointed organizational projects to develop new situations handling;
3. <u>Imitation of practices through direct contact</u>: when facing uncertainty, the organizations copy practices from organizations they are in contact with (DiMaggio and Powell 1983);
4. <u>Indirect transmission through standard adoption</u>: the organizations may decide (for various reasons) to adopt a standard set of organizational practices in order to deal with a certain topic. Often, this is associated with a form of external pressure, to which the standard adoption is a legitimate answer (DiMaggio and Powell 1983).

It is expected that to some extent a combination of mechanisms is present in all cases; for instance, even standard adoption usually requires some modification for the unique situation of an organization (Czarniawska & Sevon 1996). Nevertheless, a case study will be normally characterized by one dominant mechanism. As a result of these mechanisms' operation, it is possible to understand why there is both standardization and diversity in EM among European ports.

2.2 Organizational strategic responses towards institutionalization

Research into the relationship between organizations and their environments has produced valuable understandings of the processes that outline and clarify how an environment exerts pressures on organizations and how the organizations may respond. A criticism of institutional theory exposures the unconcern of the theory on the strategic actions employed by organizations in reaction to institutional pressures and this addresses the organizations as passive participants which respond to institutional pressures (Oliver, 1991).

In contrast, researchers suggest a strategic approach to legitimacy. This line of research points that the institutional perspective does not deal with the important issue of a *firm's strategy*, which is the diversity of strategies pursued by a firm's confronting the same isomorphistic pressures. Suchman (1995) argues that legitimacy arises from an organization's active or passive consent. The choice of *passive consent adopts legitimacy as cognitive taken for granted*. On the contrary, the active consent adopts legitimacy as evaluative approval and as a result, legitimation is cautious and often oppositional (Suchman, 1995). He describes legitimacy as an operational resource that organizations extract from their cultural environments (Suchman, 1995) and in this sense, legitimacy is directly affected and it becomes a crucial issue of organizational management. Oliver (1991) adopts a similar approach in her organization's response to institutional pressure framework.

Both approaches consider that organizations search for and need a certain level of legitimacy in order to operate and moreover maintain a long-term value. It is important to note that in many cases the approval of legitimacy has to deal with different and conflicting norms and values, reflecting the variety of social actors. Elsbach (1994) states that the variance between the two approaches is a matter of perspective, with strategic theorists embracing the standpoint of organizational managers looking 'out', whereas institutional theorists accept the standpoint of society looking "in". Perhaps, it is also directly related to the organization's decision process and in this case the extracted choice should be employed in the pursuit of the organizational goals (Suchman, 1995). For Oliver, organizations may adopt different responses entailing a certain degree of resistance and compliance (Oliver, 1991).

While green organizations are struggling to deal with their environmental effects in a more integrated and strategic way, (Boons, et.al.,2000), many scholars adopt the core assumption that the strategic and the institutional approaches are two dissimilar approaches, addressing two different levels of analysis: a) the *institutional approach* focuses on the macro level, (field level); while b) the *strategic approach* focuses on the micro level, (organizational level). Oliver (1991:195) emphasizes the theory's tension to *"limit attention to the effects of the institutional environment on structural conformity and isomorphism"* and to "overlook the role of active agency and resistance". In this line, researchers have also argued that the choice of conformity or resistance to environmental pressure is a strategic choice (DiMaggio, 1988; Oliver, 1991; Powell, 1991; Goodstein, 1994;). This reasoning proposes that organizations do not instinctively obey to environmental pressures, but they rather evaluate the degree to which conformity serves organizational benefits (Goodstein, 1994). How firms respond differently to institutional pressures has been extensively explored. Scholars have presented typologies as to how firms respond differently to the external pressures. These typologies are usually based on a spectrum ranging from passive to proactive responses. For instance, Roome (1992) introduces a typology of five strategic options: non-compliance; compliance; compliance-plus; commercial and environmental excellence; and leading edge.

2.2.1 How do organizations deal with isomorphistic pressures – The Oliver (1991) framework

In her article issued in 1991 Oliver argues that organizations adopt different strategies in response to institutional pressures to change. Conforming to institutional pressures is not an exclusive option, even if the result is to gain legitimacy, thus she argues that organizations reply to dissimilar environments by pushing them in opposing directions due to varied norms and anticipations. The possibility of achieving advantages through opposition is also argued to exist.
Oliver's framework examines how organizations interact with their external environments in the light of the premises of institutional theory and Resource Dependence Theory (RDT). She applied RDT, mainly interested in the management of the interdependencies that organizations have with their surroundings, so as to explore this era of strategic management. The RDT perspective views a (field) environment as a *"bundle of resources which an organization seeks to mobilize to reach its goals"*, and by doing so, it *"exercises active choice of behavior"* (Oliver 1991:147). She states that the two theories have ascribed diverse degrees of resistance, responsiveness, and self-interested awareness to the actions of organizations responding to external constraints and demands (Oliver, 1991:146). Based on this argument, organizations make choices, and strategically respond to environmental pressures. She proposes that an organization makes an active response to institutional pressures with the extreme option being to either conform or resist. Resistance may include changing the environment itself, as well.

- *Institutional factors for strategic response*

The Oliver framework provides a *typology of strategic responses* to institutional pressures varying from passive compliance with institutional norms to direct and active defiance of an institutional environment. Strategies range from conformity (by adopting norms and values) to manipulation (trying to change them) and vary within a continuum of strategic responses with five different types *acquiescence, compromise, avoidance, defiance*, and *manipulation* and their related tactics (Oliver 1991:152).

Table 2.2: Oliver's Predictive Factors to Strategic Responses

Predictive Factor	Strategic Responses				
	Acquiesce	**Compromise**	**Avoid**	**Defy**	**Manipulate**
Cause					
Legitimacy	**High**	**Low**	**Low**	**Low**	**Low**
Efficiency	**High**	**Low**	**Low**	**Low**	**Low**
Constituents					
Multiplicity	**Low**	**High**	**High**	**High**	**High**
Dependence	**High**	**High**	**Moderate**	**Low**	**Low**
Content					
Consistency	**High**	**Moderate**	**Moderate**	**Low**	**Low**
Constraint	**Low**	**Moderate**	**High**	**High**	**High**
Control					
Coercion	**High**	**Moderate**	**Moderate**	**Low**	**Low**
Diffusion	**High**	**High**	**Moderate**	**Low**	**Low**
Context					
Uncertainty	**High**	**High**	**High**	**Low**	**Low**
Interconnectedness	**High**	**High**	**Moderate**	**Low**	**Low**

Source: Oliver, 1991:160

The framework works towards two related objectives: 1) to acquire control over critical resources in order to minimize the organizational dependence on external actors, and 2) to ensure a control over resources that promote a dependency of the external environment on the focal firm. The boundaries of the organization's willingness and ability to conform drive the dual predictive dimensions of organizational strategic response related to five institutional factors, which can be identified by five research questions: a) why these pressures are being exerted, (b) who is exerting them, (c) what these pressures are, (d) how or by what means they are exerted, and (e) where they occur (Oliver, 1991:159). Each question represents an institutional factor that explains the rationale underlying an organization's conformity or resistance to institutionalization. She proposes the institutional predictors of the individual organizational environment and uses two dimensions, also called antecedent

conditions, to explain each institutional factor. The institutional factors and their dimensions are presented in Table 2.2. The scale from low to high represents the contribution to the likelihood of selecting a particular strategy. For instance, the strategy of acquiescence is more likely to occur when the proposed green port practices support efficiency gains.
This thesis research considers Oliver's organizational strategic approach, as most suitable to posit strategic managerial choice as another potential source of legitimacy towards the green port organizational change.

2.3 Organizational capabilities, environmental pro-activeness and pro-active strategies

Organizational analysis is also interested in the means by which organizations learn and adapt. The *Resource-Based View* (RBV) theory is considered as the appropriate theoretical approach in examining strategic implications of environmental issues for organizations. The theory posits that competitive advantage is the result of the establishment of valuable organizational capabilities allied to proactive environmental strategy (Hart, 1995; Sharma, & Vredenburg, 1998).
Literature review identifies proactive postures of environmental strategies that vary from *"those that seek to reduce the environmental impacts of operations beyond regulatory requirements"* (Sharma, 2000) to those that demonstrate a voluntary adoption and the willingness to prevent pollution at the source or redesigning products and processes (Hart, 1995), or even to those that choose to redefine their business model (Sharma & Henriques, 2005). For Sharma and Vredenburg (1998) proactive stands for going beyond legal and industry norms and proactive **environmental strategies** (PESs) are strategies that engage practices *"not required to be undertaken in fulfilment of environmental regulations or in response to isomorphic pressures within the industry as standard business practice"* (Sharma & Vredenburg, 1998:733)

- *Environmental pro-activeness*

Since the work of Hart (1995) resources and competences have helped identify the underlying dimensions of **environmental pro-activeness**. The *Natural Resource Based View* (NRBV) perspective applies the resource based view of the firm to environmental strategy (Hart, 1995). The NRBV framework proposes three gradually achieved interconnected strategies -pollution prevention, product stewardship and sustainable development, - that are utilized by firm (internal) diverse resources and capabilities portrayed as rare (promoting a shared vision of sustainable development that secures the firm's future position), socially complex (integrating stakeholders to preempt competition) and tacit (improving costs), (Hart,1995). The Hart's proposal promotes the idea that a firm's environmental management pro-activeness can constitute a sustainable competitive advantage. He identifies three major organizational capabilities and points that these learnt capabilities are hard to imitate:1) *continuous improvement* competences related to green products and processes through which an organization eliminates waste at its source rather than at the "end of the pipe," which yields cost savings via reduction of materials and energy use; 2) *stakeholder integration*, competences in integrating both internal and external stakeholders via which an organization engenders intense learning, gaining knowledge from its suppliers and customers, that yields distinguished products and value chain relationships; while he additionally claims that the capacity to integrate feedbacks from stakeholders is based on previously learnt skills; and 3) *shared vision*, which focuses on the ability to foster a shared vision supporting green practices and on a long-term strategic intent of enterprise sustainability. Hart (1995) suggests that organizations with a capability of shared vision could build up the resources required for developing sustainable business models faster than organizations missing such a capability. A shared vision is likely to sustain organizational commitment (Hart, 1995).

Pollution prevention & SD in the NRBV

Strategic capability	Environmental driving force	Key Resource	Competitive Advantage
Pollution prevention	Minimize emissions	Continuous improvement	Lower costs
SD	Minimize environmental burden of firm growth and development	Shared vision	Future position

Source: Hart, (1995)

Proactive environmental practices are intangible managerial novelties and routines that necessitate organizational commitments towards their greening and which are not mandatory (Hart, 2005). Since several capabilities are path-dependent (Hart, 1995; Sharma & Vredenburg, 1998), Hart (1995) endorsed the relationship between the existing organizational competences and different environmental strategic approaches. For instance, he suggested that organizations that have previously developed capabilities in TQM are more likely to be able to position resources related to pollution prevention, or that proactive practices such as waste minimization programs, design of green products, require a certain technical knowledge. It is thus necessary to have access to technical resources and competences in order to adopt and develop proactive environmental practices.

- *Pro-active environmental strategy*

Empirical research has confirmed that indeed organizational capabilities are associated with proactive environmental strategies (Christmann, 2000; Russo & Fouts, 1997; Sharma & Vredenburg, 1998). Attempts to provide a taxonomy of environmental strategy have been introduced since the 1990's (Roome, 1992; Shrivastava, 1995; Hart, 1995; Aragon-Correa, 1998; Henriques & Sadorsky, 1999), but as a general rule PES has been identified among a variety of reactive practices to patterns of actions that a firm voluntarily undertakes in order to reduce its environmental impact. It seems that any accumulation of these practices determines a proactive posture in an environmental strategy. While some researchers have drawn on resource based view (RBV) to identify pro-activeness as a firm capability (e.g., Hart, 1995; Christmann, 2000), some studies proposed that Proactive Environmental Strategies (PES) include a set of resources and capabilities, that range from creative problem solving to the introduction of innovative technologies (Russo and Fouts, 1997) or even the adoption of collaborative interactions with stakeholders (Sharma and Vredenburg, 1998). PES have also been defined as the capability of coordinating and integrating heterogeneous resources that both reduce pollution and improve firm performance (Hart, 1995; Sharma & Vredenburg, 1998; Christmann, 2000).

Sharma and Vredenburg (1998) analysis on firms with proactive environmental strategies (PES) (in the Canadian oil industry), identified three (3) organizational capabilities: 1) stakeholder integration; 2) continuous higher-order learning; and 3) continuous innovation. Besides the resemblances with the capabilities proposed by Hart (1995), they identified a vital dynamic process via which organizational new knowledge from external constituents set off organizational learning and innovation facilitating response to stakeholder concerns (a short overview is presented below in Table 2.3). They both identify that Proactive Environmental Strategy (PES) fosters the development of rare, unique resources and capabilities which enable more flexibility, continuous improvement, and innovation (Hart, 1995; Sharma and Vredenburg, 1998). Organizations that embrace environmental strategies without these basic-level competencies are less likely to realize their strategic goals (Christmann, 2000). Organizations willing to leverage their complementary assets and/or to improve their internal efficiency are more likely to adopt environmental practices involving creative problem solving, continuous innovation, higher collaborative capabilities, and rapid learning processes (Shivastrava, 1995; Russo and Fouts, 1997; Sharma and Vredenburg, 1998; Lopez-Gamero et al., 2008).

Table 2.3: Proposed constructs of environmental pro-activeness and Pro-active Strategy

study	***Research topic***	***Pro-activeness / Pro-active Environmental Strategy***
Hart, 1995	The role of resources in environmental strategy	• Three environmental strategies: 1.pollution prevention; 2. product stewardship; 3.sustainable development (SD).
Sharma & Vredenburg 1998	Competitive benefits associated with Proactive Environmental Strategy (PES)	"Proactive organizations display a consistent pattern of voluntary actions over time". *Aspects considered*: material use reduction and conservation, use of alternative fuels, energy conservation, less environmentally damaging products, stakeholder integration, public disclosure and research commitment, green training programs for employees • Organizational capabilities related to Pro-active Environmental Strategy: 1.stakeholder integration; 2. continuous higher-order learning; 3. continuous innovation.

Source: own elaboration

Considering that proactive environmental strategies lead to the development of organizational capabilities that are a source of competitive advantage, this research adopts the following organizational capabilities to be explored in the empirical analysis, and considers them as *constructs of port environmental pro-activeness*:

Pollution prevention. Achieving better levels of internal environmental competency is a function of an organization's basic environmental capabilities such as pollution prevention (Hart, 1995). Pollution Prevention is the reduction or elimination of pollutants (or wastes) at source through the use of

materials, processes and practices. Through pollution prevention activities, emissions, effluents and waste are reduced (Hart, 1995). A firm-wide commitment to manage the environment necessitates various levels of managerial support and employee involvement. Without primary having primary environmental capabilities in pollution prevention, embracing more advanced environmental strategies possibly will be more expensive, and therefore have less managerial support (Hart, 1995).
Stakeholder Integration. Freeman, (1984: 46) defines stakeholders as *"any group or individual who can affect or is affected by the achievement of the organization's objectives"*. The ability to manage stakeholders' pressures is a key indicator of organizational effectiveness. For that reason Hart (1995) suggested that integrating knowledge from stakeholders helps an organization design products and processes with lesser environmental impacts. Similarly, Sharma and Vredenburg (1998) identified that organizations with a capability of stakeholder integration are able to integrate outside learning about environmental issues from stakeholders in order to engender proactive environmental strategies. Capability for stakeholder integration includes the capacity to launch trust-based collaborative relationships with a diversity of stakeholders, especially those with non-economic goals.
Higher order learning. Organizational learning has been highlighted in the environmental literature as a pledge to innovation and employee skill development (Russo & Fouts, 1997), higher-order learning (Sharma & Vredenburg, 1998), and learning from outside (Marcus & Geffen, 1998). Capabilities for higher-order learning entail the development of different interpretations of new and existing information. For Sharma and Vredenburg (1998) it is high-quality information processing skills in terms of employee integration knowledge of environmental issues and problem-solving that can lead to improved capabilities in terms of higher order learning, which in turn improve environmental performance.
Continuous Innovation. Studies have described this capability as continuous improvement in minimizing emissions (Hart, 1995); continuous innovation in processes, products, services and systems (Sharma & Vredenburg, 1998); innovation for pollution prevention (Russo & Fouts, 1997). In this thesis study the researcher adopts a continuous innovation approach suggesting that organizational management should look for green opportunities and learn how to exploit environmental capabilities in order to trigger a continuous improvement process (Sharma and Vredenburg, 1998). The capability of continuous innovation allows an organization to stay a step ahead of competitors who do not retain this capability and it is triggered by changes in technologies, processes, specifications, inputs, and products that can stimulate the building-up of internal capabilities and knowledge-based invisible assets, which is in turn triggered by processes of higher-order learning (Sharma & Vredenburg, 1998).

- *On competitive advantage*

For Hart (1995), the firm's competitive advantage is determined by how well the firms develop the resources and capabilities to deal with the changing natural environment. Thus, proactive environmental strategies lead to the development of organizational capabilities that are a source of competitive advantage (Hart, 1995; Sharma & Vredenburg, 1998). However, from another perspective which focuses on beneficial organizational outcomes, the competitive advantage is determined by the firm's capabilities and management's abilities to organize these assets in order to produce superior performance (Grant, 1991).
Christmann (2000) stresses that proactive environmental strategies should be implemented together with complementary assets that enable the firm to gain a competitive advantage. Therefore, the more the environmental practices and other strategic practices are jointly implemented, the greater the benefits for which a firm can strive. For instance, engaging in pro-active environmental policies can help organizations develop political skills, which are valuable resources that can be used to influence public policies in order to acquire a competitive advantage (Russo & Fouts, 1997). Thus, a pro-active environmental policy allows firms to build intangible resources -that are a source of competitive advantage- and to consequently enhance profitability.
What else *does* matter is that the arena of strategic management is normative, as it pursues to direct those aspects of general management which have substantial effects on the existence and success of the business enterprise (Teece, et.al.,1997). Organizational processes have three roles: 1) coordination and/or integration, 2) learning and 3) reconfiguration and thus, when managers perform internal and external coordination of activities, they both appear important but what is even more for

competitive advantage is the way they perform integration of external activities or technologies (Teece, et.al.,1997). Time point also matters. Past decisions shape the firm's position, which is a specific endowment of skills that an organization possesses at a given point in time. Learning tends to be local *thus* opportunities to learn are close to previous activities and therefore, the firm's history constrains its future behavior. *"The notion of path dependencies recognizes that 'history matters"* (Teece, et.al.,1997).

2.4 Research Method

- *Selecting a qualitative research methodology*

A preliminary decision of this thesis research was the data generation methods to be exclusively of qualitative character. The *Qualitative research* is concerned with non-statistical methods of inquiry as well as with the analysis of social phenomena and it is about the modes to produce knowledge by describing something in a way that presents its character (the word originates from Latin: "qualitas" that means character, feature, kind). The method uses comprehensive descriptions from the perspective of the research participants themselves as the mean of investigating precise issues and problems under study. It appeals on an inductive process in which subjects and sets emerge through the analysis of data collected by specific techniques such as *interviews*, *observations* and *case studies* (Lee, 1999). In addition, the strength and productivity of the qualitative method is originated in its capacity to offer researchers a way to *"appreciate the uniqueness and complexity of the case, its embeddedness and interaction with its context"* (Stake,1995:16). The explicit choice of a qualitative method may impose limitations on the generalization of the results. Strictly focusing on a qualitative method is assumed to improve the quality of the data generation process. A multi qualitative method, including interviews and document studies, has been used.
Field research is often used mutually with qualitative research to describe systematic observations of social behaviour with no preconceived hypotheses to be tested (Rubin & Babbie, 1993). Hypotheses occur from the observation and interpretation of behaviour, leading to further observations and the conception of new hypotheses for exploration. The research's initiation thrived during the ThPA 'GreenporTh' project (2002-2003) in the port of Thessaloniki. The author of this thesis was among the Aristotle University of Thessaloniki (AUTh) research group invited by the port in helping them towards EM implementation.

- *Reliability and Validity*

Among the most cited criticisms of qualitative research are the presumed lack of reliability and validity of its findings. As far as field research is concerned, critics doubt the aptitude of qualitative research to reproduce observations (reliability) or to acquire precise responses or accurate notions of the phenomenon under study (validity). Further criticisms pertain to the observer's reactive effects or the interviewer's presence in the situation under study as well as a discretionary perception or bias on the researcher's part. Furthermore, a matter of preoccupation has been the researcher's incapacity to observe all those factors that might affect the situation under study (Schaffir & Stebbins, 1991).
This thesis research has addressed these issues as follows:
Before any initial attempt to observe or collect data from all respondents, who may be affected by the phenomena under study, *purposive sampling* -that is based on literature reviews as well as acquaintance with the focus area- has been utilized in order to opt for the cases under study (see case study selection section). Although quantitative researchers are probable to confront validity risks through techniques such as random selection of participants and the use of controls, qualitative researchers are often confronting validity throughout the data collection and analysis processes. As long as qualitative researchers evaluate more cases, seeking mutual themes and shared patterns and examine the emerging hypotheses, *"they are in essence working to ensure validity"* (Maxwell, 1992). Thus, qualitative researchers also meet issues of reliability and validity through *triangulation* - the usage of diverse strategies to approach the same topic of investigation.

- *Strategy of inquiry*

Denzin et.al. (1998) assert that a research strategy contains skills, assumptions and practices that researchers use *"as they move their paradigm to the empirical world", putting "paradigms of interpretation into motion"*. The Qualitative methodology itself does not support any single method on the data selection. The selected strategy of inquiry relies on the research questions that the study addresses as well as the theoretical framework of the research and the methodological choices that are decided. The strategy of inquiry adopted for the present research incorporates the *case study approach* and it is connected to specific methods of collecting and analyzing empirical materials which will be developed in the following sections.

2.4.1 A case study approach

The objective of this section is to make explicit the match between the research focus of this study and the selection of the exploratory, (qualitative) case study method.

Yin (1989) presents the case study as a method that surpasses at conveying an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research. Yin defines the case study research method as *"an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used"* (Yin, 1984, p. 23). Several reasons support the choice for case studies as part of this thesis strategy inquiry. Case studies emphasize detailed contextual analysis of a limited number of events or conditions and their relationships. It can be suitable to investigate new processes or behavior, and are appropriate for social processes which are slightly comprehensible (Eisenhardt, 2002; Hartley, 1994). Researchers have used the case study research method for many years across a variety of disciplines. Social scientists, in particular, have made wide use of this qualitative research method to examine contemporary real-life situations and to deliver the foundation for the application of ideas and extension of methods. The case study is an ideal methodology when a holistic, in-depth investigation is needed (Feagin, et.al.,1991; Merrian, 1998). It drives to the specifics of a limited number of cases, which is of great significance in order to comprehend processes especially at the organizational level (*micro level*).

Yin (1994) presents at least four applications for a case study model: 1) to explain complex causal links in real-life interventions; 2) to describe the real-life context in which the intervention has occurred; 3) to describe the intervention itself; and 4) to explore those situations in which the intervention being evaluated has no clear set of outcomes. Moreover, case studies are *multi-perspective analyses*. This means that the researcher reflects not just the voice and the actors' point of view, but also of the *relevant groups of actors* and the *interaction* between them. *"This one aspect is a salient point in the characteristic that case studies possess"* (Feagin, et.al.,1991). Therefore, case studies are well suited for providing practical insights, which are essential for understanding how the greening of EU ports via EMS standards implementation evolved during the last decade, as much as for investigating the mechanisms of convergence and/or organizational constructs that enabled diversity on port greening. According to Hartley (1994) a "*case study allows for a processual, contextual and generally longitudinal analysis of the various actions and meanings which take place and which are constructed within organizations*". The flexibility of case study strategies offers a better insight in the practical state of affairs within its 'natural' context. Yin (1993) has identified some specific types of case studies: *exploratory*, *explanatory*, and *descriptive*. Exploratory cases are sometimes considered as a prelude to social research. This thesis case study approach adopts the explanatory type. *"An explanatory case study presents data bearing on cause-effect relationships explaining which causes produced which effects"* (Yin, 1993:5).

The choice for case study inquiry is reinforced by *two other characteristics of the research*. According to Yin (1994), the *'how' type of research questions* is more adapted to case study. This thesis research questions address a 'how' and 'why' type of questions, under the umbrella of the main research question: Why and how have European ports since the 1990's attempted to adopt green policies at the individual and collective level? The Case study research usually answers one or more questions which begin with "how" or "why." The questions are targeted to a partial number of occasions or conditions and their inter-relationships. Thus, the explorative character of the study, in mixture with the type of research question ('how'/'why') endorses the choice of this research strategy. In addition, the second issue to be noted is that the research is rather *contemporary oriented*. An important element of the research is the examination of 'real-life' phenomena. According to Yin (1994), the case study is preferred when contemporary events are examined. However, case studies allow an over-

time social action analysis (George and Bennett 2005), appropriate here. In order to understand the present state of the EU green port field, this thesis study looks at developments from 1993 to2010, as the period of time that the field evolved and focuses on rather contemporary events. This contemporary aspect allowed interviewing and direct observation.
The *design phase of the case study approach* has determined the selection of four port cases and which instruments and data gathering approaches to use. Each port case is treated as a single case. Yin (1994) suggests that single cases may confirm or challenge a theory, or represent a unique or extreme case. *Single-case studies* are also *"ideal for revelatory cases where an observer may have access to a phenomenon that was previously inaccessible"*. These studies can be all-inclusive or embedded, the latter taking place when the same case study includes more than one unit of analysis. Each individual case study consists of a "whole" study, in which facts are collected from various sources and conclusions drawn on those facts. Each case's conclusions can then be used as data contributing to the whole study, but each case remains a single case.

- *Case studies selection rationale*

This study examines the European evolution of "green ports" through the diffusion of EM implementation among seaports from 1993 to 2010. Lam and van de Voorde (2012) consider the flexibility of the method as an advantage in terms of complexity in the port industry, the dynamic relations and interactions. Selecting single cases is a key element. A case study can contain more than one unit of embedded analysis. For example, a case study may include study of a single industry (EU port sector / national port sector) and a firm participating in that industry (port authority PA). This research examines four port case studies using the Port Authority (PA) as level of analysis and addresses each port organization towards greening via individual EMS standard implementation.
The study investigates four cases: the seaports of *Dover*, *Thessaloniki, Valencia,* and *Rotterdam.* The port case studies were selected based on the principle of diversity (Stinchcombe, 2005). They appear similar, active within the ECOPORT network, PERS certified in terms of EMS implementation, yet they differ in basic characteristics such as:

- location, divided over the North-South axis of Europe;
- national [potential Green] Port Policy;
- type of main port activity (passenger versus container traffic/industry);
- overall port size in terms of port area surface, throughput (mil Tons, TEU's, number of vessels - passengers), and employment in the port area;
- type of the PA management;
- potential of cluster port formation.

Finally, the ports also differ in EM implementation timing, within the time frame of the past decade.

- *Data selection and Sources*

Each individual case of the exploratory analysis study consists of a "whole" study, in which facts are gathered from various sources and the conclusions drawn are based on these facts. Data were collected, using multiple sources of evidence (Yin 1994), through the main techniques of:

1) Documentation: a) academic and professional literature, considered as the most "reliable source of documentation" (Yin 2003, p:87), b) ESPO/EPF's publications, c) PA's Annual reports; Environmental, sustainability reports; websites.
2) Participation–Observation: The author was for three years, participant-observer ("GREENPORTh" project – Thessaloniki Port Authority / GR), during the EPF's SDM/PERS implementation in the port. This provided a robust insight into the inter-related actions and reactions and an access to the network in the field.
3) Interviews: After forming an inventory of the environmental policy of each port case study, semi-constructed interviews via an especially designed questionnaire were conducted with key persons in the selected ports.

According to Merrian (1998), the descriptive aspects of a case study are its ability to generate rich, and detailed accounts of a case. The *four annexes* are complementary descriptive case studies of the selected four ports and vital in supporting the analysis. The data selection of these studies also focused on multiple sources of evidence including primary and secondary documents.

2.4.2 Data analysis design – Measuring theoretical variables

A comparative case study methodology is used to guide this study, which is a commonly suggested methodology for testing theory in unexplored contexts. Case studies can contribute to improved validity and reliability by providing qualitative evidence for understanding the underlying rationale or theory (Yin, 2002). This section provides a depiction of the theoretical framework selected. Thus, it analytically explains how this research conducts comparative empirical analysis at the three distinct levels of the conceptual framework that it proposes (see Fig.2.1).

- ***Field level analysis and diffusion mechanisms***

How does an organizational field emerge? By asking how ports in Europe have engaged in "greening" via EM implementation, -based on theory proposed criteria for assessing what an organizational field actually is-, the green port organizational field in Europe (1993-2010) is 'captured' and presented. Furthermore, the first part of the comparative analysis investigates the way European ports have implemented environmental management. Starting at different time periods and using different standards, diversity arises among European ports. The research wants to assess whether diversity among ports in developing EM exists, and to what extent ports have learned from each other's experience. Thus, the examined questions are the following:

1. How have ports in Europe engaged in "greening" via EM implementation?
2. Can a port implement its version of "greening" in different ways?
3. To what extent have ports learned from each other about the implementation of EM?

Comparative analysis aims to capture diffusion mechanisms in the field -in terms of the simultaneously occurred push for standardization and a pull towards diversity. Each port case study offers insight into:

1. How port organizations were triggered to implement EM;
2. How National Green Port Policy if any, advanced these efforts;
3. Which are the port EM characteristics in terms of :
   a) planning objectives (goals);
   b) collecting, reporting information;
   c) how information is used in decision making

Finally, the analysis explores the proposed mechanisms of: 1) problem solving; 2) learning; 3) imitation of practices through direct contact; and 4) indirect transmission through standard adoption.

- **Organizational level – Strategic responses to institutional pressures**

Can a port implement its version of "greening" in different ways? Following this research question, it is likely that ports develop their own distinctive modes of organizing environmental management, depending on the way they perceive this strategic issue. Oliver's (1991) range of strategic responses enables the examination of institutional pressures for change within a context of diverse strategic organizational responses. The (4) case studies' green strategies are identified within the range of acquiesce, compromise and manipulate, followed by the related threefold sub-divided tactics:

Strategic responses								
Acquiesce			***Compromise***			***Manipulate***		
tactics								
habit	imitate	comply	balance	pacify	bargain	Co-opt	influence	control

Source: Oliver framework (1991)

Oliver (1991) points out the dynamic of the interaction between firms and their institutional environment, which drives management strategic decisions to the appropriate response. The strategies range from passive conformity to active resistance, and for each of them Oliver sub-divides three tactics. Our expanded research criteria are based on EMS implementation; and within this context , the selected case studies have implemented EMS standards and have been certified within the research time period. Thus, these ports *have not* selected to *avoid* or *defy* as their green strategic response to institutional pressures.

The institutional factors and their connected predictive dimensions of strategic organizational response proposed in the Oliver's framework are settled and operationalized by empirical indicators to the selected sample of four green ports' case studies. The following Table 2.4 illustrates the Oliver's framework of operationalization aiming to explore how the four selected port organizations dealt with isomorphistic pressures and to evaluate the strategic responses of the four selected ports.

Table 2.4: Factors of strategic organizational response and related empirical indicators

Institutional factors	Predictive dimensions	degree		Empirical indicators
Constituents (actors who exert institutional pressures)				**Who is exerting institutional pressures on ports?**
	multiplicity	low	high	Are the pressures from the constituents on ports multiple and conflicting, or unitary and coherent? Are there any contrary and conflicting demands exercised in the field? Are there pressures evolving from diverse actors' conflicting interests?
	dependence	low	high	To what extent constituents manage the accessibility and distribution of important green port organizational resources? Does a port afford the possibility of alternative resources or resource providers?
Context (environmental context)				**What is the environmental context within which institutional pressures are being exerted?**
	uncertainty	low	high	Does the general business environment affect the port's green strategy? Is there uncertainty on how environmental issues or strategies will affect ports ? Are ports aware of the values and norms of the green port?
	inter-connectedness	low	high	Do ports advance [network] cooperation on dealing with environmental issues? Do ports perceive environmental issues as a competitive force among them?
Cause (underlying rationale of institutional pressures)				**Why are port being forced to confront institutional expectations?**
	legitimacy	low	high	In which way is legitimacy of port greening recognized within organizational interest? Do ports identify the legitimacy evolving from their greening with strategic value?
	efficiency	low	high	In which way is efficiency of port greening recognized as of organizational importance? Do ports identify green efficiency as cost reduction or economic gain?
Content (port perception of greening requirements0				**To what norms or requirements are ports being pressured to conform?**
	consistency	low	high	How institutional pressures acknowledge legitimacy within the field? To what extent do ports identify their internal (organizational) goals compatible with the field constituents' (actors) demands? Do ports recognize validity on institutional expectation?
	constraint	low	high	Does conformity to green institutional pressures impose loss of organizational freedom on ports? In which way green organizational decisions or choices are constrained ? Do ports experience control -to a certain degree- of their own organizational decisions?
Control (means by which pressures are exerted on ports)				**How or by what means are green institutional pressures being exerted to ports?**
	coercion (legal coercion)	low	high	Do legislative requirements impose greening on ports? In which way are ports affected by non-compliance consequences? Are ports confronting regulatory agencies and mechanisms enforcing compliance?
	diffusion (voluntary diffusion)	low	high	Are values, practices, or expectations diffused among ports in the field? Are there early adopters or late adopters of greening among ports in the field? Are there ports that model themselves to other successful green ports? Does conforming to greening become port strategy that brings legitimacy?

Source: Oliver framework (1991)

- ***Port capabilities level***

Nowadays, for ports, *the "license to operate"* includes the key component of environmental m**anagement**. The pro-activity of various green port strategies is related to the way ports can develop strategies in response to their natural environment, since *"to prepare an environmental strategy, they must decide where they want to be on the spectrum from strict compliance to environmental leadership",* (Walley & Whitehead, 1994: 52).

The proactive, -not directly regulated character of port environmental management-, might stimulate various responses. Aragón-Correa and Sharma (2003) underlie the broad applicability of NRBV which provides a theory in order to explain the competitive advantage as an outcome of the valuable organizational capabilities' development, -such as continuous innovation, organizational learning, and stakeholder integration-, associated with a proactive environmental management (Hart, 1995; Sharma and Vredenburg, 1998). The empirical analysis evaluates the constructs of port environmental pro-activeness connected to the variables and the related empirical indicators which are presented in the following Table 2.5.

Table 2.5: Constructs of PEM, variables and empirical indicators

Constructs of PEM	VARIABLES	EMPIRICAL INDICATORS	degree	
Pollution prevention Hart, 1995	EPM capable to be transparent and released to public scrutiny	Environmental policy environmental reports / newsletters	low	high
	Ability to implement EPM on a well-developed quality-management process	Applied EM practices Applied Health and Safety strategy Applied TQMS	low	high
	Ability to develop a people intensive strategy, depending on employee involvement	Employee (continuous) training Employee involvement on consultations related to environmental issues	low	high
Stakeholder integration Sharma & Vredenburg, 1998	Ability to communicate with stakeholders on environmental issues	**collaboration within the port community** / **collaboration in the port-city interface**	low	high
		Regular meeting / Regular meetings		
		Capability of explaining port's point of view		
	Ability to collaborate with stakeholders on environmental problem solving	**Collaboration on problem solving**	low	high
		ad-hoc meetings / ad-hoc meetings		
		Ability to solve problems collaboratively		
	Ability to guide developments through public consultation process	• Port culture of approaching the port community level • Port culture of listening to local communities and environmental groups	low	high
Higher order learning Sharma & Vredenburg, 1998	Level of employee integration in environmental information exchange	Integration of different levels of employee for information exchange and dissemination around environmental practices Feedback systems for reporting environmental performance	low	high
	Continuous expansion of knowledge on port environmental issues	Level on knowledge base of environmental information and biodiversity data Constantly updating knowledge on environmental issues Formal and informal channels of environmental information exchange	low	high
	Ability to look for alternative solutions on problem solving	Ability to understand the environmental impact of port activities Awareness of alternative solutions on problem solving	low	high
Continuous innovation Sharma & Vredenburg, 1998	Ability to innovate and continuously improve operations while reducing environmental impact	Capability of constant experimentation Ability to take a long-term view of experimental actions Capability on constant technical operational knowledge	low	high
Continuous Improvement Hart, 1995	Ability to experiment on the business/natural environment domain	Port culture of innovativeness Ability to make continuous improvements in environmental management processes Ability to act before the rest of the industry	low	high

Source: Hart, (1995); Sharma & Vredenburg, (1998)

- The analysis explores *how* port organizational capabilities enhance proactive environmental strategies.

To conclude, the purpose of this study is to gain a level of understanding the case -and its context- of the collective and individual European port responses to greening within a specific timeframe. Thus, in this chapter, after presenting the theoretical perspective and the related conceptual framework which was employed, the author argued *why* the qualitative method -and particularly the exploratory case study design- was considered the most appropriate. There is also information provided on how the individual port case studies were selected and the sources of data selection used. Finally, the data analysis design, namely how the different theoretical variables are to be empirically tested, was also presented.

CHAPTER 3: Green integration in EU Seaports (1993-2010) A background narrative

This chapter is organized twofold. First, it provides descriptive analytical information about the institutional context within which the greening of European ports has arisen. Secondly, it introduces the emergence of the green port organizational field within the timespan from 1993 to 2010. Both sections analytically provide insights into the initial knowledge of *how* green integration in the EU seaports evolved, based on extensive literature review that boosted this research.

3.1 Green awakening of the EU port sector (International law-conventions, EU legislation, EU policy, associations)

- *International law-conventions, EU legislation*

Compared to land industries, ships (the main port's users) release much less pollution into the environment, but their sporadic spills and routine discharges can cause profound effects on the marine and coastal environment (Roche, 2006). To prevent and control pollution from ships a wide range of legislation has been advanced by the International Maritime Organization (IMO), United Nations Conference on Trade and Development (UNCTAD, 1993), the United Nations (1994, 1996), Comité Maritime International (CMI), International Navigation Association (PIANC), World Bank (Davis et al., 1990) and others. At an EU level the reduction of pollution from shipping is an integral part of EU's maritime safety policy since its beginning, in 1993. The *Erika* (1999) and *Prestige* (2002) incidents were catalytic in this respect and enormously affected the subsequent legislation (Wooldridge & Couper, 2006). Both the *Erika* 1 and *Erika* 2 legislative packages and the third Maritime Safety Package were intended to strengthen the safety aspects of the integrated European Maritime Policy (Roche, 2006) and were structured around two major themes: pollution prevention and dealing with the aftermath of accidents. Today, a vast amount of EU regulatory instruments (directives and regulations), which deal with maritime safety, aim at protecting the environment.
Unlike vessels, *there is no international body that regulates ports*. For the first time, the Agenda 21 (UNECD, Rio 1992) identified that the port activities affect the coastal environment. The main issue of chapter 17 in Agenda 21 is to achieve a balance between the diverging interests by means of precautionary and preventive measures so as to "*check the gradual destruction of the marine environment ... and to make an integrated economic use and development of coastal areas possible*". The International Law as reflected in the provisions of the UN Convention on the Law of the Sea, (UNCLOS) - also referred to specific chapters of the Agenda 21-, sets forth rights and obligations of states and provides the international basis upon which to pursue the protection and sustainable development of the marine and coastal environment and its resources. In a specific jurisdiction, the port may be regulated by the city, a specialised port authority, the marine or environmental agency, or the state the port is in. In some port cities, the shipping and port activities are far from where people live and work, while others are close to dense population, and this fact leads to different priorities with respect to environmental regulation.
Ports are parts of larger transport networks and they *do* have a significant impact on the marine and coastal environment, but their environmental protection mostly concerns transport or shipping issues. The existent International conventions and policies apply to all port operators. These are predominantly produced by the UN and its departments such as the International Maritime Organization (IMO). The green IMO conventions have been ratified by most countries. Each country is responsible to adapt the conventions into its legislation system. Moreover, many countries have adopted these conventions, but they don't truly enforce them in everyday practice. These conventions set the standards for many aspects, such as the MARPOL convention 1973/78 and its annexes for the pollution from ships, which set the regulations about the prevention of pollution by oil, noxious liquid substances, garbage, and the latest, air pollution from ships. The existing international legislation forms an environmental framework covering the most important environmental aspects to prevent or regulate the possible pollution emerging from people's activities. The main pertinent international/UN legislation, which relates to port authority activities are summarized in Table 3.1.

Table 3.1: Green International Conventions for ports

UN Legislation:	**IMO Conventions**:	**International conventions**:
UNCED - UN Conference Rio, 1992 **UNCTAD** - Sustainable development for ports (Report 1993) **ESCAP** – Assessment of the Environmental impact of Port Development, 1993	**MARPOL 73/78** – International Convention for the prevention of pollution from ships **UNCLOS** – UN Convention on the Law of the Sea, 1982 London Convention – Convention on the Prevention of Marine Pollution by Dumping of Wastes, 1972 **OPRC** – International Convention on Oil Pollution Preparedness and |Response, 1990 **Basel Convention** - on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, 1992 International Convention for the control and management of **Ships' Ballast Water** and Sediments, 2004 International Convention on control of Harmful Anti-**fouling Systems on Ships**, 2008	**RAMSAR** Convention on Wetlands, 1971 **HELCOM** – The Baltic Marine Environment Protection Commission, 1992 **OSPAR** – The Convention for the Protection of the Marine Environment of the North-East Atlantic, 1998

Source: own elaboration

The *European Environmental Policy* (EC, 1995, 1996) is based upon others for *sustainable growth in transport sector; and "thus transports should achieve their economic and social role, maintaining at the same time less harmful for the environment*". Transport is considered as one of the main causes of urban degradation and *therefore* significant attention has been given to the transport sector, where rather recently (1996) ports were incorporated. One of the EC's objectives was to integrate, as extensively as possible, good environmental practice across the full range of transport activity, including *seaport activities*, despite the fact that *the maritime sector is recognized as the least polluting and the most energy efficient of all the transport modes.*

Since the 1990's the EU Commission has had a long range of efforts, encouraged by different factors and aiming at a common transport policy, by means of a coherent European infrastructure network through the concept of the Trans-European Transport Networks (TEN-T), (Chlomoudis & Pallis, 2002). In the case of ports, the proposed 'one size fits all' reform created several concerns and obstacles towards coherency and through the years has deemed upon the lack of significant progress towards a common port policy. The problem was not only that 'each port is unique', but also that the different port traditions generated diverse contemporary port management and organisation strategies, (Trujillo & Tovar, 2007).

In 2007 a 'new' start was initiated. After 2007 the new European Port Policy (EPP) mainly relied on 'soft law', and has taken a broader perspective. Thus, it included themes which were never properly addressed before -such as the integration of European transport systems, sustainable port development and level playing field. In addition, further attention was paid to the effects of different stakeholders' associativity on the EPP development, (Pallis & Verhoeven, 2009). During the last two decades, the European attempts for the development of a specific EU policy framework for ports with the keystones of this process are portrayed in Table 3.2.

Table 3.2: An overview of the European Port Policy (EPP) since the 1990's

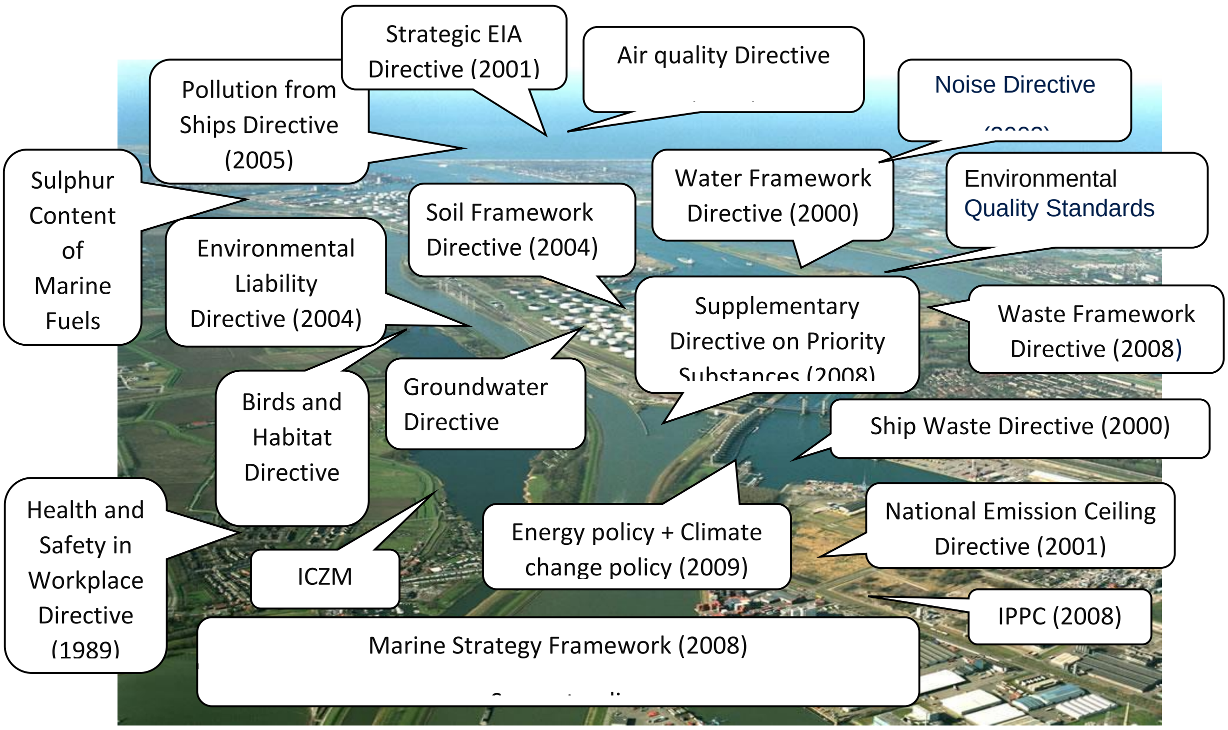
1970: First Commission note on port policy
1991: The 'horizontal' maritime policy gives special attention to the maritime economy as a whole
1992: Maastricht Treaty and the **Transport Policy White Paper**
1993: European Parliament Report Seaport Policy
1995: Short Sea Shipping Communication
1997: **Green Paper on Seaports and Maritime Infrastructure**
2001: **Port Services Directive I & TENs**
2004: Port Services Directive II
2006: Withdrawal of the Directive and a new start
2007: **The 'new' EPP communication covers a broad range of issues**; the focus on 'soft law'

Source: Chlomoudis and Pallis 2002; Verhoeven 2008.

In Europe, however, there isn't any explicit policy regulating port environmental issues. The main European legislations that are directly or indirectly applicable to port operations, planning and development are summarized in Fig 3.1. The EU defines the framework for environmental policy-making for particular periods of time and also outlines actions that need to be taken to achieve them. For instance, the 6th Environment Action Programme of the European Community 2002-2012, refers to the development of seven thematic Strategies in the field of: soil and the marine environment (in the priority area of biodiversity), air, pesticides and urban environment (in the priority area of environment, health and quality of life) as well as natural resources and waste recycling (in the priority area of natural resources and waste) (Decision 1600/2002/EC). The Thematic Strategies constitute the framework for action at the EU level in each of the concerned priorities. In addition, in June 2006, the EC published a Green Paper on the upcoming Community maritime policy, highlighting Europe's maritime distinctiveness and governance which is worth preserving at a time when environmental pressures are threatening the future of maritime activities. The policy aims to encourage a maritime industry that is innovative, competitive, and *environmentally-friendly*, while it includes the issue of life quality in coastal regions. Moreover, it starts up a reconciliation process between the development of maritime transport and environmental conservation -against the background of the constraints imposed by EU regulations under Natura 2000 and the Birds and Habitats Directives- to fulfill the need to extend ports for further developing intermodal transport services.

European ports are also subject of the National Law based on inputs from international Conventions and EU legislation. There are many important EU Directives regarding the protection of the environment which may focus on different aspects related to port activities (also summarized in Fig 3.1). Together with the national rules, EU Directives are obligatory for all EU member states and are to be adapted in the national legislation within a logical period of time. The imposed EU Directives, whilst they set regulations and limits about different forms of pollution, partly form an environmental policy- such as setting the quality standards but also how and when to be measured-, yet they do not form a concrete environmental policy for the ports. Although the intention of the Directives was to be 'competition neutral' their 'translation' into national, regional and even more local laws, in many cases, resulted in a distorted 'level playing field' and increased port competition (Journee, 2003).

Fig. 3.1: The main EU environmental legislation applied to ports



Only recently have seaports emerged on the green EU policy scene. Since 1992, the EC's White paper on EU transport policy (see Table 3.1) has been recognising the critical role played by ports to stimulate environmentally friendly modes of transport such as short sea shipping. On the other hand, EU environmental legislation often sets limitations on port development *thus* causing significant economic impact onto PAs and adding one more aspect of inequitable port competition.

The impact of new port projects on the environment is strongly influenced by two EU Directives: the Birds Directive (79/409), as much as the Habitats Directive (92/493) and the network for protected areas known as "Natura 2000". The "Birds" and "Habitats" Directives are the cornerstones of EU biodiversity policy, requiring from the Member States to designate specific terrestrial and marine sites,

which together constitute the Natura 2000 network. This network consists of Special Protected Areas (SPAs) -protecting bird species and Special Areas of Conservation (SACs), with the aim to guarantee the long-term survival of Europe's most endangered species and habitats. In addition, provisions of the directives include a strict system of species protection, as well as monitoring and reporting schemes. Despite the substantial investments made in order to realize high environmental standards, legal uncertainty and ambiguity created by the EU nature conservation legislation continues to put an greater than before pressure on vital port development plans and has caused substantial delays. Especially the European Birds and Habitats Directives rank high in the list of environmental legislation causing implementation problems. Port development and dredging projects have suffered from the serious delays (delays from 1-7 years) in the approval process, caused by a combination of factors: the designation process of the Natura 2000 sites, the decision-making procedure under article 6 of the Habitats Directive, the terminology in the Directives and the multiple approaches to transposition in EU member states, (Mink & Hoenders, 2007).
Ports today have also incorporated the management of industrial estates in their business spectrum and consequently, the impact of their operations has exposed environmental issues typical of other large industrial sectors (Dalley & Deeming 1994). The European environmental legislation related to port operations is aimed at the industries situated in the port area. This legislation is mainly included in the Directive 2008/1/EC of the European Parliament concerning integrated pollution prevention and control. It replaces the Council Directive 96/61/EC of 1996 on industrial installation, which refers to "Integrated Pollution Prevention and Control", on the same subject matter; they are both commonly referred as IPPC Directive. From 2005 to 2007, the effect of the Directive was assessed and in 2010, a revised wording was published, integrated with 6 other European directives regulating large industrial sites, into the Industrial Emissions Directive, IED for short.
Most of the port activities are usually integrated in legislation for industry, -which is applicable at a national or regional level-, and they are becoming increasingly more severe and compulsory with the possibility of resulting in serious sanctions. *But* regulation concerning environmental conditions' indicators for port complexes is even more complicated. There are general laws about industry when it comes to precise responsibilities for activities and ownership, yet legislation under the umbrella of larger EU policy frameworks -for instance concerning air or water quality-, should also be taken into consideration by the responsible organization.
The "picture" is further complicated by inconsistencies in the interpretation of legislation among different regions in the continent and even among countries in the same region. This is also related to issue-specific legislation that is regulated by the international law. The implementation of this type of legislation, such as the MARPOL convention (concerning ship waste reception), or the OSPAR convention (concerning sea dumping of dredged contaminated material) varies from one country to another hampering the harmonization among the EU member states. Besides the fact that the rules are not implemented equally among countries, difficulties are further raised by unequal implementation across jurisdictions and insufficient enforcement (Wooldridge & Couper, 2006).

In sum, in the case of ports, the recently developed *strict legislation* is a complicated mixture of international, European and national provisions much of which has some relevance to ports (Couper, 1992; Warren & Wallace, 1995; Wooldridge & Couper, 2006). The multitude of legislation has resulted in legal uncertainty and has posed a major obstacle to PAs. Although, there is hardly any specific EU (other) legislation for ports, legislation has been the major driver for many of the environmental activities in ports. The demand for legal certainty, also aiming at a better balance between environmental and economic concerns, initiated the port's sectors unified response (Wooldridge et al., 1999). EU ports themselves have identified that they needed a more consistent legal framework, and that the "soft law" proposed after 2007 has offered a better perspective to achieve legal certainty and respect the diversity of the sector at the same time, (Verhoeven, 2007).

- *European Port Policy*

This section highlights the issue of port governance and its effect on the role of the PA today. The following Box 3.1 presents what policy issues are considered as *"open"* within the EU Port Policy. Most of the issues may be considered as being included within renewed interest in port governance or the evolved role of PAs in a regional context.

Box 3.1: European Port Policy – open issues

- Completion of internal market
  (equal access to the provision of port services);
- Fair competition within & between ports;
- State Aid;
- Tarification (including infrastructure charging)
- Increasing maritime traffic
- Congestion;
- Port labour schemes;
- Safety issues: pilotage;
- *Port development versus growing environmental constraints*.

Source: Trestour, 2007

The supra-national level of the European Union stands above national and local and has the potential of setting a more independent legal and policy framework for PAs, a potential which up to now has not really seen its full implementation yet (Verhoeven, 2009). Political and market integration in Europe and thus the increased proximity of ports, added an additional 'proximity' dimension, enabling the Commission to develop port policy initiatives (Pallis 2002; Pallis & Verhoeven, 2009); while a consultation culture has emerged underlining the EU policy-making process (Pallis & Verhoeven, 2009). Although, EU law and EU policy regarding ports have, for instance, implicitly favoured a landlord-type governance system, initiatives like the port services' Directive (EC, 2001), advocated a rather strict landlord role. The Commission's ports policy communication (EC, 2007) explicitly supported (financially) autonomous PAs, which take responsibility for the strategic development of their ports, stimulated dialogue between all possible stakeholders and proactively intervened in market processes to maintain the overall concerns of the port, (Verhoeven, 2009). Reform processes seem incomplete in several EU countries and there is demand for management reform schemes accompanied by an adequate legal framework. Although it seems that the Port Packages were to some extent a missed opportunity, the ongoing process (until 2010) of a common EU port policy provided an additional opportunity.
Verhoeven (2009) proposes four governance-related factors that may make the difference toward a new role for PAs. The power equilibrium between the government standing out as a principal factor which effects the legal and statutory framework, (the financial capability) and the room for pro-active management principles at the corporate level of the port authority (PA), while he highlights the importance of the supra-national EU level policy setting for more independent PAs, (Verhoeven, 2009). Scholars also introduced the role of PA as a community manager with a coordinating function which was meant to solve collective action problems in and outside the port area, (Van der Horst & De Langen 2007). This new role also aims to shape the accommodation between conflicting interests in order to defend the port's "license to operate" by promoting the societal dimension of the role (De Langen 2007; De Langen & Van der Lugt 2007). De Langen (2007) suggests that although other bodies, such as private sector associations, may also accomplish the community manager function, it is the PA which is in many cases best placed to accomplish this role.

In sum, the main significant outputs from policy related issues concerning seaports and environmental protection are: 1) *specific E.U. policy for the port's environmental protection does not exist*; and 2) for this reason, and because the objectives of EU Transport Policy, to encourage greater use of the maritime mode and divert traffic from roads and the environmental credentials of ports, were not clearly established, there has been, since the 90's, a great demand *for* tools and methods capable of keeping strong the capacity of ports to maintain and improve environmentally and, beyond that, *for* sustainability standards, (ESPO, 2004).

- ***The role of Port Associations***

Like any other business sectors, the various port stakeholders participate in associations. In Europe, the Commission has been active (intentionally or not) in this associability, (Pallis & Verhoeven 2009). Back in 1974, a Port Working Group from major European PAs representatives was set up , with the scope to create a representative independent organization. Pallis and Verhoeven (2009) describe the response of the PAs as being 'passively reactive'. However, the result was two separate organisations established in 1993: the European Sea Ports Organisation (ESPO) representing PAs, and the Federation of European Private Port Operators (FEPORT) representing private stevedores and terminal operators. Until the setting up of ESPO, *"port affairs"* had been handled by port representatives working jointly with the Commission, but ports were lucky to have the professional assistance of an independent organization *"funded and organized by its members"*, (Wooldridge, et.al,1998).

Port reform processes, worldwide and in the European countries, renewed the interest in the role of Pas and generated public debate (Verhoeven, 2006). To that extent, the increasing international and national regulations to control port environmental pollution, which also intensified port-city public debates (Olivier, 2007), put port environmental concerns in the agenda. The same concerns occurred among a number of inter-jurisdictional bodies and professional associations who intensified efforts in order to provide guidance on the greening of ports. The most active among them were:

IMO – UN agency responsible for prevention of marine pollution by ships.
PIANC – international (independent) organization specialized in waterborne transport infrastructure issues, including environmental issues.
IAPH – the world's port industry representative association.
CEDA – an international association focused on dredging and marine construction.
AAPA – American Association of Port Authorities.
ESPO – European Sea Ports Organization.

IAPH, AAPA and ESPO extensively renewed the attention for the role of PAs in the port governance and the port's environmental protection. Although, green information and guidance were provided by all the aforementioned organizations, the three port associations robustly pointed the weak and uncertain position of ports regarding why and when ports should act to control their environmental pollution and thus, they were highly engaged in assisting port greening. ESPO in particular, since 2000, has held regular conferences and seminars on port governance issues and has issued several publications in this field, while in 2008 an ESPO Port Governance Committee was established to exchange know-how and expertise among the European PAs. Its contribution on port greening is extensively introduced in the following section.

In 2006, the IAPH Green Port Survey was published in collaboration with AAPA, revealing interesting issues on port environmental protection worldwide. Of the total of 247 surveyed ports (221 IAPH member ports and 26 non-members) environmental information was found for only 57 ports (23%); among the 57 ports included in the review, 3 ports did not have environmental initiatives of any kind and among the remaining 54 ports extreme variation in scope, format, and level of environmental information appeared. Knatz (2006) observed two types of "green port" initiatives, policy-based and program-based, with few ports to have both, see the following Table3.3.

Table 3.3 : IAPH (2006) Green Port Survey – Findings

policy-based green port initiatives	program-based green port initiatives
"Green Policy" defined as: Explicit organization – wide declaration listing strategic goals & objectives to improve environmental performance	**"Green Programs" defined as:** Mostly departmentalized environmental measures with no larger policy framework

Source: Knatz, 2006

Among the 12 (of the 28 policy-based ports) providing program details in their "green policy", there are only 2 European cases, the Associated British Ports (UK) and the Port of Rotterdam (NL); and in the second category few European ports are providing details in their "green program", (the Spanish ports of Barcelona and Valencia were among them). The most "green policies/programs" and indicators are organized by category: air; water; wildlife and habitat; soil; sediment; sustainability; community, (Knatz, 2006). Innovative programs were mainly issue-based and observed mostly in ports members of the AAPA and Australian ports. As far as Europe is concerned, the best practices were highlighted -such as in the Port of Rotterdam providing an innovative program on *renewable energy purchasing*; the Associated British Ports and the Port of Helsinki on *greenhouse gas reduction measures*; the Port of Marseille Authority on an *independent Sustainable Development Advisory Committee to oversee environmental policy development*. The survey indicated the lack of additional information from Asia; the need of information dissemination on green ports, and the guidance on green port indicators development. Finally, the survey pointed the development of a *"green port certification" process in Europe*.

About the same time, a key theme of the EU short-sea shipping policy initiated an umbrella dialogue in Europe among various port stakeholders and the EC attempting to institutionalize a debate among PAs, port users, and port service providers, that have all formed active EU level associations (Pallis, 2006). Similar initiatives were established in the context of the Commission's 2006 communication on logistics (CEU 2006), in the five years' debate on the Port Services Directive (PSD) and EPP communication, "*generating a kind of 'coming of age' period"* (Pallis &Verhoeven 2009). The main attainment was the informal dialogue between various port stakeholder organizations that supported the new EPP communication and promoted an official port stakeholder dialogue installed by the Commission.
In the case of ESPO, it made members reflect about their role as PAs and strengthened the internal cohesion of the organization (Drankier 2005). Since 2000, some ports stakeholders have associated to advance cooperative initiatives such as common 'ethical codes' and 'business practices'. The collective actions of PAs within ESPO offer an demonstrative example. This new era implied *"a co-operative 'cultural' effect"* (Pallis &Verhoeven 2009). At the beginning of its history, ESPO, representing sea ports, focused its attention on encouraging policies and perspectives of the European ports with the related European authorities and other international bodies, and subsequently on studying all problems related to the port industry in the context of the treaties established by the European Community. Through the years, ESPO's main activity has evolved in the interface between European seaports and the institutions of the EU, (ESPO, 2004).

Since 1990, a stakeholder debate has been also produced at the port-city interface. The requirements of the port are today considerable in terms of space and they will be even more so in the years to come. The challenge for each community is to obtain balance between the development strategies of the port and those of the city. The association explicitly engaged in port-city issues is the International Association of Cities and Ports (IACP), an international network of economic and political bodies representing port-cities. It was created in 1988 as an initiative of cities, ports and their institutional and economic partners in order to establish a permanent structure for the exchange of information on port-city projects. IACP has been focused on a mandatory role as an advisory organization working to help port-cities to put in place instruments that will enable them to attain their objective toward SD challenges in a regional context and in the most efficient manner.

3.2 EU port sector's response to environmental protection

3.2.1 The role of ESPO

Although the environment, and particularly the marine area, has always been of the highest importance to the maritime sector, it is only recently that the port got engaged into environmental action. This has largely caused from *structural changes* within the sector and predominantly the establishment of ESPO, (Wooldridge, et.al., 1998). Since the beginning of the 90's, ports in Europe have started to operate more as commercially independent organizations competing and working most effectively, when their management is allowed to respond to pressures autonomously. This independent approach also produced green awareness of the port's activity impact on its local environment, and the need for this impact mitigation (Wooldridge, et.al., 1998).
ESPO has given *priority to the environment*. The need to take responsibility and act toward environmental protection was highly promoted among the ESPO members. Port greening was one of the first issues addressed by ESPO and had always remained important on its agenda as a policy priority (Whitehead, 2002). This commitment involves not only the responsibilities of monitoring and replying to new legislation and policy, but also of providing recommendations about the action that ESPO members should take to improve their environmental situation and performance. The first document that ESPO published was the Environmental Code of Practice (1994); the first ESPO Conference addressed environmental issues (Lisbon, May 1998); the first ESPO conducted survey assessed European ports' environmental problems (1996), and the first research project carried out by ESPO members dealt with environmental management (ECO-Information 1997/1999).

In 1994, ESPO published the very first *Code of Environmental Practice*, which was fully revised and adapted to changes in the EU law in 2003. It was the very first time that European port executives had articulated a collective 'green port' view and approach. The Code was envisioned to be a clear manifestation of their collective commitment to environmental upgrading. It, therefore, made a series of important recommendations about the integration of environmental protection policies into all aspects of port operations. The Code responded to the growing interest in effective Port Environmental Management (PEM), to meet the challenges of increasingly stringent regulations as it is also reflected in the development of standards for EMS (ISO 14001 and EMAS). It stimulated a new awareness of the forthcoming environmental rules and their implications, spreading the message that environmental effectiveness meant cost-efficiency as well as encouragement of the port managers to implement environmental plans and manage environmental issues. It should be noted that positive contributions to the development of the ESPO Code (1994), such as the port environmental policy or objective statements, were provided by the British Port Association (BPA) (Wooldridge, et.al.,1999).
The 1994 **ESPO Code of Practice** aimed at the integration of environmental protection policies into all aspects of port operations, setting out the basic principles of EM applicable to all types of ports. ESPO has defined *the main areas, which need to be addressed by all European ports*. Above all, the intention was for ports to be encouraged in order to develop their own individual plans, including: a) EM actions; b) monitor of the environmental conditions; c) reception of port and ship waste; d) planning and development plans; e) emergency response, dealing with dangerous goods; and f) plans for training and education. Port managers were encouraged to implement environmental plans and manage environmental issues based on what was actually provided by the Code and to promote exchanges of information about the best environmental practice. What actually the code aimed was to identify the main environmental impacts from port operations and the best ways to tackle them, (Wooldridge, et.al,1999) and it illustrates the sector's acceptance of the environmental protection argument, (Stavrakouli & Wooldridge, 2004). The latter is easily observable upon some of the main environmental objectives which the EU ports should aim to achieve and which are presented in the following table 3.4.

Table 3.4: ESPO Code promoting environmental objectives for the EU PAs

EU Policy implementation	▪ Self-regulation and a bottom-up approach, based on knowledge and technology, developed by the port sector itself, addressing day-to-day practice, is expected to provide a port-accepted background to be used as a basis for EU environmental policy. ▪ Port contribution to the development of a sustainable logistics chain, as ports are key elements of the Trans-European Network.
Environmental Impact Assessment (EIA)	▪ Appropriate Environmental Impact Assessments for port projects and strategic Environmental Impact Assessments for port development plans
Port Environmental Management	▪ Use of Environmental Management Information System tools (such as environmental audit, environmental review, environmental management system, decision support system, port visitor internet tool, (developed by the ECOPORTS Foundation).
Monitoring	▪ Based on environmental performance indicators, to measure environmental port practices; (recommended by the 2001 ESPO Environmental Review)

Source: ESPO Environmental Code of Practice, 2003

The ESPO Code has promoted clear objectives: a) intensive *communication* (based on *environmental reporting*) with stakeholders and EU Institutions for a better understanding of the role of ports and their efforts towards sustainability; and b) *increase awareness of environmental concerns* and integration of the SD concept into ports' policies (see Table 3.5). It strongly encourages ports to prepare a *publicly available environmental policy* setting out their strategies and methods of achieving them -with a future score to promote Corporate Social Responsibility (CSR) on ports.

Table 3.5: ESPO Code advancing the sector's perspective on port environmental protection

Port development	▪ Consultation, dialogue and cooperation between port administrations and the relevant stakeholders at local level (port users, public, NGOs) to facilitate the reconciliation, at an early stage, of differing interests and the acceptance of port projects by the local community.
"Level playing field"	▪ Cooperation between port administrations in the field of environment, facilitating exchange of experiences and of best practices implementation on environmental issues, avoiding unnecessary duplication and enabling port administrations to share the costs of environmental solutions. ▪ Participation of port administrations in a *network*, which will be coordinated by the ECOPORTS Foundation, aiming to create a *level playing field* by limiting poor environmental practice as a competitive factor between port administrations.

Source: ESPO Environmental Code of Practice, 2003

A crucial issue to be taken into account was the outstanding *diversity of the port sector*. Ports deal with environmental problems related to the location, size, type of operations as well as national and local policies; and since port activities have a range of impacts on the environment, which are as varied as the port themselves, it was therefore crucial that this diversity would be taken into consideration. The Code underlined the fact that the ports' problems are different and depend on the port size, its activities and its location: (a) *Large ports* located near towns and cities and with industrial complexes connected to them will involve a range of land and marine environmental issues; and furthermore, by concentrating large volumes of traffic within their immediate hinterland, their impacts will not be confined to the port. (b) Other ports may exist in areas, which are designated for *special protection* under the terms of the Birds and Habitats Directives and this poses extra controls on them, especially for new developments. (c) *Estuarial ports*, which can stretch deep inland, often requiring extensive dredging, create their own unique problems. All these factors were taken into account in the ESPO Code and the *main recommendation was to have detailed planning as a key to successful port environmental management (PEM).*

A crucial issue was the ambiguity created by EU nature conservation legislation that put increased pressure onto ports, causing substantial delays in port development plans, (ESPO, 2007). Especially the European Birds and Habitats Directives ranked high in the list of environmental legislation causing implementation problems. *This is why ESPO decided to produce a specific Code of Practice on the implementation of these Directives*. This new publication was introduced at the GreenPort Conference, in 2007.

> "*This Code has the multiple aim of providing useful guidance to port authorities, port planners and local regulators, contributing to a better dialogue with NGO's and stakeholders as well as attracting the necessary attention of EU policy makers to a number of unresolved problems and questions*",
> (Hoenders, ESPO Policy Advisor, 2007),

The new Code aimed to provide PAs with recommendations on *how to better position themselves in discussions dealing with the different demands for space in coastal areas and to increase their involvement in spatial planning exercises*, (ESPO, 2007). Through the new Code ports are recommended: a) to become more involved in all relevant spatial planning exercises; b) to participate in Integrated Coastal Zone Management (ICZM) activities; c) to draw attention to EU Trans-European Network priorities; d) to play an active role in harmonizing different uses in the wider port area.

Box 3.2: ESPO facilitating dialogue on Birds and Habitats Directives at the European level

ESPO Code of Practice (2007) pointing outstanding issues :

• Transport policy priorities and port capacity should to be more clearly integrated into spatial planning; spatial planning concepts which aim at improving the balance of economic and ecological objectives should be studied; National Transport Ministries should consult all ports concerning new environmental legislation which might affect them;

• More *guidance* should be developed:

- on how to incorporate initiatives of industry itself;
- on how a proactive approach of the plan or project developer could lead to more legal certainty;
- on acceptable ways of carrying out human activities in designated areas and how these can be included in a management plan;
- on how costs can be shared amongst all the relevant stakeholders who can benefit from general initiatives aimed at integrating all the human activities potentially affecting designated areas;
- on how it can be avoided that individual interests block the process of finding proactive solutions by port authorities together with environmental agencies, NGOs and competent authorities;
- on how plan or project developers can best discuss their approach with competent authorities at an early stage;
- on how it can be determined, objectively, that enough alternative solutions have been assessed;
- on how to address the compensation requirements in a more flexible manner and
- how plan or project developers can cooperate with environmental agencies and NGOs on this issue.

Source: ESPO Code of Practice on the Birds and Habitats Directives, 2007

The negative decision concerning the port expansion plans for Dibden Bay in Southampton, indicated to the port sector the impact of the alternative solutions' assessment and '*imperative reasons of overriding public interest*' (IROPI), since this development process was cancelled because the assessment could not fulfill all legislation requirements. The Dibden Bay decision was the sector's starting point in approaching the Birds and Habitats Directives with criticism (see Box 3.2). ESPO presented the 2007 Code of the Practice to the EC with the invitation to use it as a basis for official EU guidance on the implementation of the Directives in port areas; and thus, *"enhancing legal*

certainty for port developers", (GreenPort, 2007). The list of outstanding issues displayed in Box 3.2, were presented by ESPO as an input for review of the Birds and Habitats Directives.
Compliance with an increasingly restrictive environmental legislation has become a sector-promoted variable to be taken into account. The ESPO main activities have been twofold. The association encourages ports to be proactive in protecting the environment, and elaborates detailed information about EU legislation to its members, namely the EU PAs, while it tries to influence the legislative process, and minimize negative effects for the economic well-being of ports (Hoenders, 2008).
In addition, ESPO provided background to EU legislation and promoted self-regulatory instruments, aiming to address day-to-day port practice. Since the mid-1990's, the EU port sector's response towards greening has been to encourage compliance through voluntary schemes of self-regulation, (Wooldridge & Couper, 2006), and it appears that self-regulation promoted by the sector itself has engaged ports in greening, despite the large volume of environmental legislation and enforcement attempts since the 70's.
ESPO's Environmental Code of Practice has envisaged a way toward port greening, encouraging ports to get a better knowledge of the environmental effects of their activities, by using environmental management and monitoring tools; while it was highly recommended that:

"*by adopting such a pro-active approach, they will be in a stronger position to negotiate*" (Whitehead, 2002).

The sector's approach of self-regulation towards port greening enhanced cooperation between port administrations in the field of environment and facilitated the exchange of experiences and the implementation of best practices on environmental issues mostly under the need to avoid unnecessary duplication and enabled port administrations to share the costs of environmental solutions. This has been achieved through the participation of EU ports in a network, coordinated by the ESPO counterpart, the EcoPORTS Foundation (EPF). Next to generating new knowledge and combining environmental effectiveness and cost efficiency, the aim was to create a level playing field by limiting poor environmental practice as a competitive factor between port administrations.

3.2.2 The role of UK Port Sector

The UK port industry mostly consists of private ports, in addition to trust and municipal ports, (see Annex1, pp:7), that compete each other and operate as stand-alone, self-financing commercial enterprises and all of them have an important role to play supporting employment in their hinterlands and in their local and regional economies, (BPA, 2006). A crucial challenge for the UK is to ensure fair competition between ports through the promotion of cost recovery principles within the EU, (Baird & Valentine, 2007).
Worldwide, fully privatized ports (which often take the form of a private service port), can be found mainly in the United Kingdom (UK) and New Zealand. The UK is the only example of a European country that has lengthy experience with *comprehensive port privatization*. Outright sale of port land combined with a transfer of traditional public port tasks, such as safety and environmental oversight, *remains an exception* - other EU countries have also introduced significant privatization schemes, but mostly with respect to port and terminal operations. According to the World Bank's "Port Reform Tool Kit" (2007:121), the main conclusion concerning the UK model of port privatization is highly determined by local factors and ideological considerations that are unique in the British experience.
Contemporary UK port policy is elaborated in 'Modern Ports: A UK Policy' was published at the end of 2000, (see Annex1, pp:10), and affirms the independence of port authorities as *commercial organizations*, specifying that the port industry has responsibility for its own commercial decisions and even port development and endorses, in line with EU port policy, the "user pays" principle. Brooks (2004:175) notes that in the UK *"the business of port regulation, as distinct from port management, has been minimalist at best".* Indeed, the basis of the national port policy confirms that ports themselves will retain the major role in bringing forward operations and development plans towards environmental constraints. Gilman (2003) identified that, port managers will be required in designing port investment projects to address sustainability concerns in the development's application process, and validated that the UK government has reaffirmed its desire not to be involved in the business of port management. Researchers referred to the turbulence in the commercial environments in which UK ports operate the business deregulation, the rapid introduction of new technologies and the development of intense competition between UK and (subsidized) continental European seaports

(Heaver 1995; Saundry and Turnbull 1997). Baird and Valentine suggest that the UK has gone further than any other country, in transferring port regulatory powers to private port successor companies, and thus, there is no specific state regulatory body for ports. Employing a rather pessimistic view, they conclude that, although the state expects the market to deliver sustainable sea transport and coastal/short-sea shipping solutions, the market itself heavily invests in competing land transport modes, *thus* resulting in a *"distorted market",* (Baird & Valentine, 2007). In contrast to the above, Bennett and Gabriel (1999), in an empirical study, conclude that, apart from the increased tendencies to behave as learning organizations, *privatization* has in reality resulted in a greatly enhanced market focus among the UK seaports.

Nevertheless, what really applies is that in the UK, more than any other European country, the *national legislation* reflects a *special scientific interest* in the protection of the marine environment and habitats, as a *policy result*. This is applicable:

1. at the *national level*, in which the voluntary designations of nature-conservation, such as Sites of Special Scientific Interest (SSSI) and Marine Nature Reserves, played an important role; and
2. at the *organizational level,* namely the port which has the statutory concern for conservation within its jurisdiction and thus, it has to consider the effects from its activities, operations and developments in the regional flora and fauna, as stated in the national legislation (Transport and Works Act 1992).

With the UK port industry facing, through the years, increased cargo volumes, the need for port expansion of landside facilities became eminent, but such an expansion more often than not, leads to the loss of intertidal areas of high nature conservation value, as the estuaries and soft coast of the UK are of exceptional wildlife importance, (Huggett, 1995). The UK ports compete with continental ports of certain types (for example deep-sea containers), and while UK ports receive virtually no financial assistance from the public purse, the same cannot be said of many continental ports. The lack of a "level playing field" is always of concern, (UKMPG, 2008), both at a national policy level and in the UK port sector perspective. Through the years, a growing acceptance that ports desire to increase capacity is, at least to some extent, justified; but it is also increasingly recognized that ports have an important role to play in reducing their environmental damage, (Huggett, 2002).

The UK port sector was the first to address environmental issues in Europe. Aligning with the national policy, the UK ports needed to verify their good intentions through additional knowledge, sound planning, and relevant targets identification. The HR Wallingford Report (1999:36) ascertains that UK ports "*as commercial enterprises, strongly aware of competitive pressures and with a high profile in the local community, ports have tended to act alone*". In alignment to this, throughout the 1990's the involvement of UK ports in various environmental research programs resulted in environmental management knowledge gain. Collaborative work on environmental projects was carried out between ports and external agencies at national and international levels.

The UK ports proactively responded to environmental responsibilities, in terms of management programs and projects applied; training; monitoring; and mainly, research in coastal zone management and conservation issues. The result was that individual ports were able to demonstrate well established environmental management practices in different areas and issues, associated with technical solutions and related costs, while the most important outcome of these green efforts was the integration of environmental management into the day-to-day business plans of the port. This resulted in a "*machinery*" for the materialization of port environmental management (PEM), (Wooldridge, et.al.,1999).

Paipai (1999) advocates that the UK ports' environmental policies evolved due to the growth of legislation and contributed to increasing awareness of the potential regional scale impact of port pollution. Moreover, according to research suggestions, Port's Environmental Management (PEM) systematic review and revision grounded on issue-based, scientifically valid, performance indicators consists a necessity (Wooldridge & Couper, 1995; Vandermeulen, 1996; McMullen,1997; Howe, 1998; Cole, et.al.,1999; Wooldridge, McMullen & Howe, 1999, Rogers, et.al.,2006). This approach was extensively promoted by guidelines developed through UK surveys and projects, which encouraged ports to share experience and expertise in ways previously unavailable, led them to recognize the environmental challenge as an important policy field, as well as a commercial asset (Wooldridge, McMullen, Howe, 1999). Authoritative guidance on both a regional and international port sector level was provided by the UK port industry regulators and widely-acknowledged research organizations. The *British Ports Association* (BPA) was the first to present an Environmental Statement and Code of Practice in 1992, which was eventually superseded by the European Sea Ports Organization's (ESPO) Environmental Code of Practice in 1994, as it was soon evident that this approach needed to be adopted Europe wide. Undeniably, the UK port sector has contributed a great deal to building the green credentials of the collaborative network around ESPO.

o The British Port Association (BPA)

Established in 1992, BPA represents the interests of its 89 full members, and numerous associate members. BPA's membership comprises all port types, with impressive scale and diversity of port operations, which range across ferries, containers, oil, leisure, fishing, bulk goods and general cargo. The Association had initially two main objectives in dealing with the *environment*: firstly, to provide information to members on new legislation and policy and to respond to government consultations; and secondly, to be an active participant in European environmental projects and use these projects to develop environmental management and certification schemes on behalf of its members. The BPA was committed to *"research that can provide ports with the means of assessing their environmental performance and methods of sharing information on good practice"*, (Whitehead, 2004). In addition, the association endorsed the highly suggested political target on coastal and estuarial management, suggested to be organized on a local basis through agreement between the relevant authorities and by consultation with users and interest groups. Many of its members have participated in estuary and coastal management initiatives.

At the European level, BPA was a 'prime partner' in the 'Eco information' project (1997-1999) carried out in collaboration with the EC and ports from five other EU member states; at the international level, it is committed to cleaner seas through MARPOL and it is a member of the Marine Pollution Advisory Group which liaises between government and industry on MARPOL policy and legislation.

3.2.3 Networking

Since the 1990s "*the justification for sound environmental management was largely accepted by the port industry"* (Couper & White, 1995). PAs were increasingly aware of the costs in terms of both poor public relations and publicity, and financial penalties for neglecting their environmental duties (Naniopoulos, et.al.,2006), while they were lacking confidence in how to apply certain regulations and responsibilities. The lack of knowledge of environmental laws, problems and solutions had been recognized. This lack of knowledge discouraged several port authorities to put effective environmental management practices in place, and undertaken practices seemed not to be sufficient to get the preferable results. *A plan to activate this knowledge within ports proved to be necessary.*

ESPO confronted the task to make members reflect upon their (green) role as PAs and gradually strengthened the internal cohesion of the organization (Pallis & Verhoeven, 2007). In parallel, aiming at "sustainable growth" in port industry, the European Union in collaboration with ESPO, responding to ports' needs for guidance concerning the implementation of environmental legislation, promoted various inquiring programs and environmental projects. The focus was twofold:

1. *practical environmental management tools and methodologies that ports could apply; and*
2. *exchange of information and experiences*.

o **ECEPA - Eco-information project – ECOPORTS project**

Environmental Challenges for European Port Authorities (*ECEPA*) was initially a platform of over 25 European ports, aiming at joint effort to avoid *competition on environmental issues.* It started in 1993 as a task force of the ESPO Environment Committee and it was established to provide a vehicle for setting up joint environmental research projects between ports from different member states (De Bruijn, 1997). ECEPA had close contacts with the EC and received funding from the various framework programs; in 1997 it completed work on *soil recycling* and *noise reduction*.

Specifically, the Soil Recycling project (1995-1996) developed a guideline for port management in relation to contaminated soil and demonstrated the practical benefits of sharing knowledge on technological and procedural solutions for the re-use of contaminated port sites. While those projects were going on, it was noticed that many ports had already developed concrete solutions on specific issues, and the accessibility of these knowledge and experience was poor.

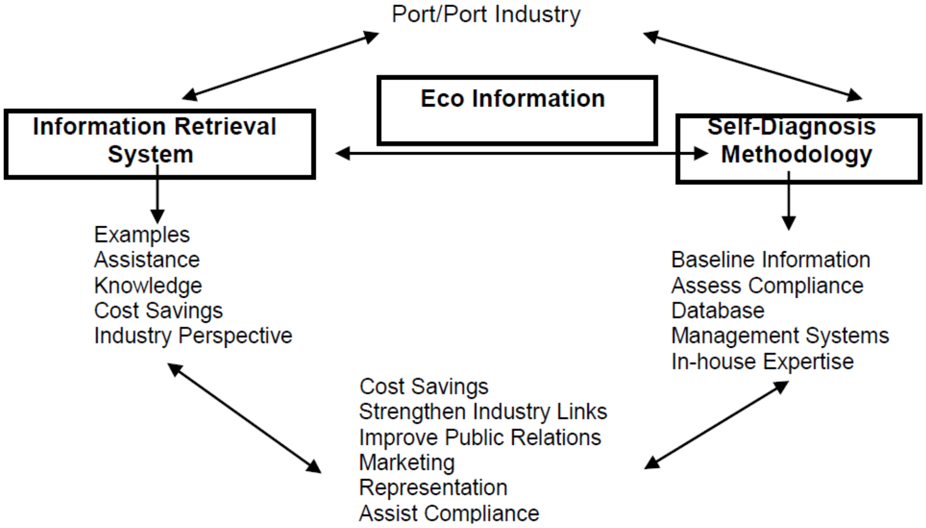
One of the important motivations for ECEPA was removing the element of competition between ports over environmental matters, something which was demonstrated by the success of the initiated projects in terms of port participation.

- **The Eco-information project (1997-1999)**

With only a few ports ready to participate from the very beginning, the next **ECO-Information project** finally involved 50 ports, each of which was inputting to the research. The results of the ESPO survey (1995) contributed to the growing volume of information about port environmental issues and provided important preliminary data for the **Eco-Information** project (EC/DG-7, 1997). This project was more ambitious than any of its predecessors in that it took a holistic perspective of port environmental management rather than the *issue by issue* approach which had been characteristic of any previous research. The European port sector was very well represented in the ECO-information project. When the different environmental issues confronted by European ports had been analyzed, it became clear that ports were faced with different issues and different levels of environmental challenges, which were further affected by particular circumstances in each port. However, all European ports shared a common challenge, which turned out to a common need: to grow in a common manner, enhancing the quality and status of European ports. The ECO information project provided a practical focal point for ports at a European scale and a collaborative approach towards tackling port environmental issues and more. It was the independent intermediary for co-ordinating environmental information exchange and therefore, it was the initial focal point of valuable green port resources for the European port sector.

The Eco-Information project was represented, as a systematic approach helping ESPO members to respond to international and European environmental legislation, in a unified manner through shared experience and self-monitoring. Its main components were: 1) a data base configured as information retrieval system, and 2) a methodology for assessing compliance and supporting decision making. Its main objectives were to: a) assess the actual environmental situation in European ports ; b) exchange practical experiences between partner ports; c) support managers in policy development and response options (Journee, 1997). The project reflected the day to day operations and the term development challenges faced by ports. It was developed, as a network active participation of the partner ports on a non-competitive basis and it was grounded on their willingness to provide detailed information for a common cause to mutual advantage, as much as a co-operative venture within an industrial sector of a partner port (Journee, 1997). The concept and components of the integrated framework of the project are shown in Fig.3.2

Fig 3.2: The Concept of the Eco-Information Framework

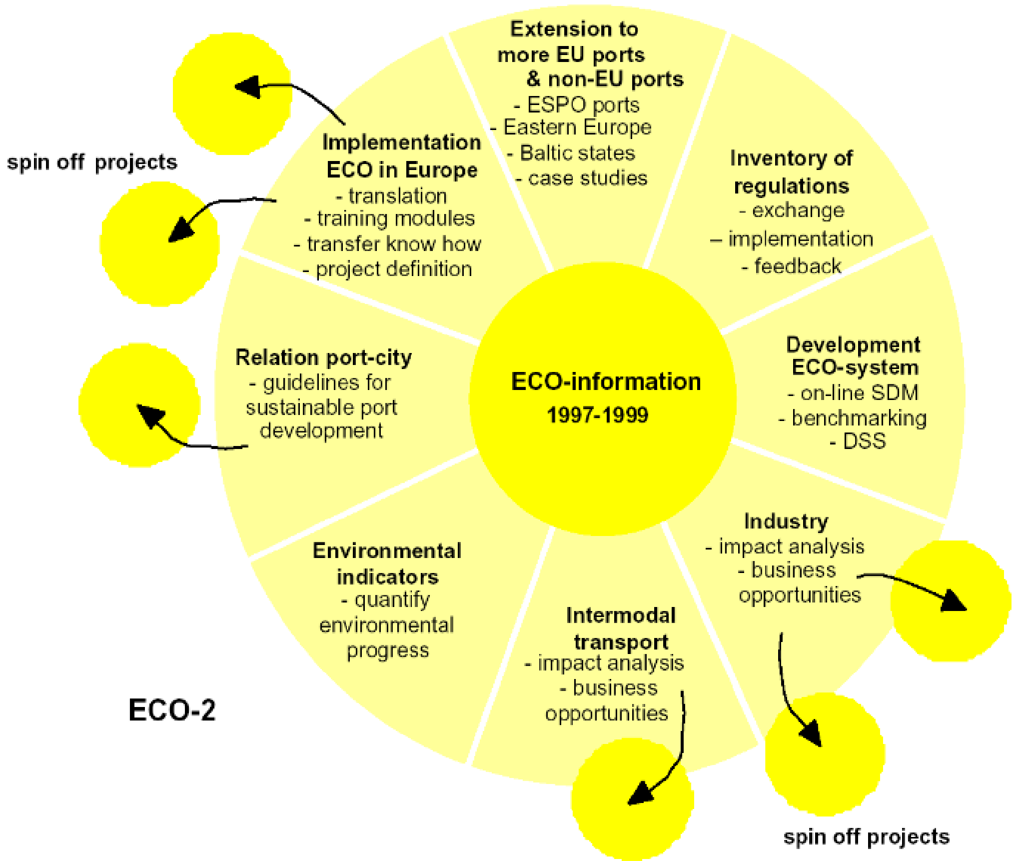


Source : Wooldridge et. al., 1999.

The project has identified a list of the most important environmental issues, for which port managers are seeking concrete, practical and above all, cost-effective solutions. These issues can have an impact on different levels, for instance on the port and the companies located in the port itself, on the people working at the ports, but also in the surrounding areas like the city and the natural resources.

The ECO-information project (1997-1999) developed three (3) significant environmental tools for port environmental mangers: 1. *an audit tool* [Self-Diagnosis Method (SDM)-98; 2. an information engine (Database and Methodological Guide); and 3.a communication platform. More importantly, the project developed an extended network of port authorities; more than 60 European ports participated in the test-run of these tools. In total the ECO-information project, -for an overview see Fig3.3-, acted as one of the first catalysts *for action* amongst many of the European port authorities and stimulated considerable progress in port environmental management.

Fig 3.3: The European ports' ECO-information project – an overview



Source : ECO-information project / Final Report - September 1999

- **The ECOPORTS project**

The next active response of the port sector to environmental challenges was another collaborative project, the ECOPORTS project (2002-2005), which eventually resulted in the ECOPORTS Foundation (EPF). In 2002, EU ports took a further step by starting this 3-year voluntary project on "information exchange and impact assessment for enhanced environmental conscious operations in European ports and terminals". The project continued helping ports with their environmental objectives on the basis of joint efforts, *thus* sharing the costs while developing solutions to common environmental problems. It developed effective tools which can help ports establish their *own* system of environmental improvement via EM implementation. The main goal was to harmonize the EM approach of PAs in Europe, by exchanging experiences and implementing best practices. The ECOPORTS project was the starting point of working groups collaborating for a diverse objective. Special study groups were focused on research related to: logistic chain, waste, noise, dust, habitat and water-framework, port city links, environmental training, port area EMS, performance indicators and dredging (Wooldridge, 2004).

The ECOPORTS project precisely aimed to create a *level playing field by limiting the environment as a competitive factor*. In this project, PAs assist each other even more to avoid double work and share the costs of development of joint solutions. The envisaged products of the project include an **Environmental Management and Information System** (EMIS), a training system to familiarize port managers with EMIS tools and an extended network of PAs, which, as it was promoted, continued to interact and exchange best-practice information after the end of the project. The project developed important tools aiming to help PAs *put recommendations into action*. A **Port Environmental Review System** (PERS) was created to be used as a standard for reporting and a list of **Environmental Performance Indicators** (EPIs) to assist the PAs measure their progress.

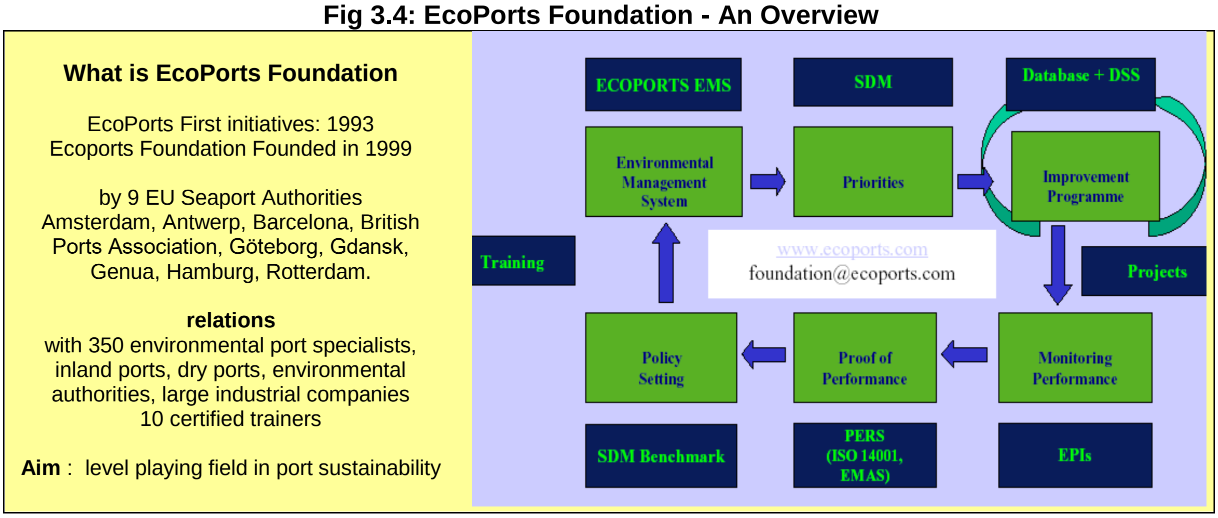
3.2.4 The ECOPORTS Foundation (EPF)

The “ECOPORTS” network progressively evolved through inquiring the environmental initiative of the European Union, the Eco-information project and the ECOPORTS project. Throughout the aforementioned projects, port professionals and managers stressed the need for the development of practicable, cost-effective tools and methodologies to assist the ports in dealing with their environmental liabilities and responsibilities. The network was supported by the European program "Competitiveness and Sustainable Development". The ECOPORTS Foundation (EPF) was a nonprofit organization established in 2002, as an initiative network platform where the European PAs could exchange environmental experience. In fact, it was the formal version of the initial network.

The ECOPORTS project’s (2002-2005) fundamental objective was the assessment and improvement of European ports environmental impact, due to the available and evolving experience and practice on port environmental issues. The EPF was expected to disseminate the results of the project until the end of 2005 and facilitate the participation of as much European port administration as possible. It was further envisaged that EPF would continue to service the port sector after the end of the ECOPORTS project. At least 150 European seaports and terminals were involved in its green port network, until 2010. All EPF members were having access to the new tools developed (for an overview see below Fig:3.4), national workshops of port environmental managers, environmental training sessions and assistance of other member ports in the implementation of best practices. By exchanging relevant experience, applying EM due to programs of education and jointly confronting multiple and complex environmental questions, the sector created the required know-how for effective EM implementation. The anticipated results aimed to eliminate the environment as a competitive factor between ports and *thus*, create a level playing field on port EMS implementation in Europe.

“The networked approach of ECOPORTS has combined the knowledge and experience of many port partners avoided duplication of effort, concentrated on a harmonized response and produced a flexible framework capable of addressing the wide range of environmental issues” *(Journee, 2006).*

Fig 3.4: EcoPorts Foundation - An Overview



Source: Journee, (2008)

The foundation focused, already from the very beginning, on jointly developing a unified environmental management system that was accepted as an important step forward, making port environmental obligations in Europe transparent and fair. The produced port specific EMS standard was introduced to the network as cost-efficient and environmentally effective, enabling potential focus on business opportunities of environmental solutions. The cooperative confrontation of environmental issues reflected the expected value of ECOPORTS. The *"ports assist ports"* approach, based on learning from colleagues, *did* enable avoiding double work and sharing the costs of the jointly produced solutions, while enhancing benchmarking within the sector. The knowledge produced by the EPF's projects was brought in the ESPO Environment Committee to discuss policy-making and implementation, enabling network members to benefit from policy proposals and action introduced to policy makers, at a national as well as a European level.

3.2.5 Port environmental management and the Ecoports tools

During the 1990's, there were not unified monitoring methods available to overview and assess the environmental situation among European ports. The ESPO Code of Practice recommendations suggested that each port should develop environmental plans tailored to its own circumstances that should not only identify priorities but also raise environmental awareness at all levels of port activity, including staff responsibilities' allocation. It was accepted that although the Code represented a useful starting point, more needed to be done collectively by the sector in order to provide practical assistance to ports.
The ECO-information project was developed to create the *practical tools* needed for the implementation of the Code. The project exposed the existed (*or not*) EM competencies of the port industry. The involved ports succeeded in developing a self-screening system assisting them to prepare for future standards implementation and potential certification. They developed a platform to flexibly react to actual issues and to handle the emerging environmental problems. These were all prerequisites for becoming a 'self-regulating' industry, but the process towards 'self-regulation' should be cared for and encouraged.

The ECO-information project promoted *'self-regulation'* towards environmental improvement. When the project was initiated, there was already extensive legislation affecting all aspects of port environmental impact. Although legislation will always have a clearly important role to play, equally important was the effort made by the port sector not only to comply with the letter of the law, but also to go beyond strict requirements by promoting EM standards implementation. Experience gained from individual port's research projects and the former ECEPA project were incorporated into the final design of this new assessment tool, which was produced based on EMAS and ISO 14001 requirements. These features make the tool even more useful in the case of EMS certification's interest. In addition, the SDM (see below) application at a European level allowed monitoring the results of environmental measures in ports. Effects of new legislation or the need of regulations' explication also derived from this review process.
By the end of the decade in the UK, a series of guidelines on port environmental management (PEM) were developed for British ports and in the mid of the 2000's, at the European level, the EC Ecoports project (2002-2005) provided a unified approach on PEM, via training programmes and encouraging self-regulation by EMS implementation. The PEM tools available, included:

• Self-Diagnosis Methodology (**SDM**): In 1999, the results of the ECO-information project included an environmental review method, specially designed for PAs. SDM is a user-friendly, check list of a port's current environmental management capability that can serve as a baseline of individual PEM performance, providing an overview of the major environmental issues in a port area and following a specific structure (see Table 3.6). The main goal of the SDM has been a port's self-assessment scrutiny. The tool allows ports to review their environmental situation, by supporting environmental port managers to periodically assess their port's environmental performance and the progress achieved through time.

Table 3.6 : Self-Diagnosis Method (SDM) Structure

	Section
1	Port Profile
	Main features that characterise the port
2	Environmental Management & Practices
	Check management organisation and practices to deal with the environmental performance within the port
3a	Issue Specific Strategic Questions
	Check current situation and current actions to deal with each issue
3b	Strategic Issue Overview
	Overview of reasons for concern for each issue
4	Self-Analysis
	Processing of information gathered in the previous sections. Overview of environmental performance in the port.

Source: ESPO Environmental Review, 2001.

• Port Environmental Review System (**PERS**): It is a "new standard" of performance specifically designed for port authorities that wish to develop an EMS. Until 2010, ports could choose to have their procedures reviewed independently and a certificate of validation was issued to successful ports by Lloyd's Register on behalf of the Foundation. PERS is a methodology of implementing the recommendations of the ESPO Code that serves the expanded scope of *SD principles implementation specifically in ports.* It is based on international best practices of port issues and remains a port-specific system developed by ports for ports.
PERS, as an EMS standard, has been promoted as an explicit proof of a port's green policy and a stepping stone to ISO 14001 or EMAS, incorporating the requirements of these EMS standards. It defines a basic standard of good practice for the port sector. This particular EMS standard concerns port-area related issues, port management and port-industry topics. It does not cover shipping, ship-related reporting or other maritime issues enforced by maritime legislation, nor any other maritime international agreements. Its implementation -focused on a voluntary basis-, recognises the particular characteristics and requirements of each port and could be adopted by each port authority at any time scale.
The standard is drawn from the experience of the SDM approach but it focuses on providing the actual evidence of the environmental management performance. The information compiled can directly provide feedback for the preparation of a periodic environmental report. The spectrum of this port specific green EMS standard's application is clearly provided by its documentation that consists of seven (7) sections presented in Table 3.7.

Table 3.7: PERS Documentation

Section 1.0	**Port profile**
	General information on legal status, geographical characteristics and commercial activities
Section 1.1	**Environmental Policy Statement**
	Port's intentions with regard to environmental performance and its framework for action
Section 1.2	**Register of Environmental Aspects - Legal Requirements - Performance Indicators**
	Documented Evidence of environmental aspects, impacts and relevant legislation
Section 1.3	**Documented responsibilities and resources related to environmental aspects**
	Identification of key personnel and structure of the organization
Section 1.4	**Conformity review of environmental policy and legal requirements**
	Review of legislative compliance and formulation of action plans
Section 1.5	**Environmental Report**
	Requirements of preparation of annual reports
Section 1.6	**Selected examples of best practice or management solutions**
	Successful management options or solutions to environmental challenges.

Source: Kourbeti, 2003.

The PERS standard has been set up with three further main objectives. These are to: a) assist ports in the preparation of an annual environmental report; b) establish a benchmark standard of environmental review for the port sector, by using a unified methodology; and c) encourage ports to

actively engage in the ECOPORTS network by contributing experience and sharing knowledge (Kourbeti, 2003). The EPF provided EU ports with additional useful supporting ‘green port’ products including: 1) a methodology to identify significant environmental aspects; 2) a decision support system for dealing with environmental issues; 3) a database of best practice solutions and Handbook of Environmental Performance Indicators; 4) guidelines for the development of EMS for ports and port areas; and 5) training packages delivered to groups or individual ports in any country.
The ESPO Code and the above-mentioned collaboratively produced EM tools, clearly show the efforts of the industry to work on the evolved topic of port environmental protection and demonstrate that it is feasible. ESPO introduced green priorities to the EU ports and showed the way of how to integrate EM in their organizational management.

“The work that ECOPORTS partners have pioneered will soon be viewed as an industry standard requirement"

(Mr Jordi Vila Port of Barcelona, 1st ECOPORTS Conference, 2003)

The creation of PERS standard emerged mainly *because* ports needed *a proof of green action* towards pressures practised by international and European legislation, society showing continuous interest in the environment, and local societies influenced by port activities (Wooldridge, 2004). The obvious question to be asked is if these tools were indeed adopted by ports and in which way!

CHAPTER 4: The 'green port' in Europe (1993-2010) Organizational field and the mechanisms involved

4.0 Introduction

This chapter provides an analysis on the way European ports moved *from* a posture of vehement resistance towards environmentalism *to* a posture of proactive environmental management and it is organized twofold. The first part introduces the evolved European 'green port' organizational field based on an institutional theory perspective. The analysis discusses the way green legitimacy spread among European ports, explores convergence in environmental management implementation and argues about the characteristics of the EU green port organizational field as a derivative of structuration within the field.

The second part explores the field dynamics that shaped individual port approach in greening and as a result, it introduces the mechanisms through which green port practices were developed or adopted. What is actually investigated is the way in which European ports have implemented environmental management. The four investigated ports implemented EMS standards at diverse time points within the last decade and they used different standards. This part of the research assesses whether diversity among ports in developing EM exists, and moreover to what extent ports have learned from each other's experience. Thus, the examined questions are the following:

- How have ports in Europe engaged in "greening" via EM implementation?
- Can a port implement its version of "greening" in different ways?
- To what extent have ports learned from each other in the implementation of EM?

The context of the analysis emerged from the dual desire to understand the change which has arisen both at field and organizational level. As standardization involves various actors, *"from original innovators, proselytizers and proselytes, to successful actors all of which contribute collectively to the wide diffusion and eventual institutionalization of standards"* (Delmas & Montes-Sancho, 2011), with EMS standards diffused within the field, it is expected that green ports play a part in the *"development of pressures and values, act accordingly and thus contribute to the characteristics of the organizational field"*, (Boons and Strannegard, 2000:9). This part of the research analysis aims to add to the knowledge of how the standards are created and adopted in organizational fields.

4.1 The emergence of the green port organizational field

European ports provide their services in a growing environment which calls for continuous expansion of port facilities and connections and which in turn creates ecological and societal pressures, (Verhoeven, 2007), not to mention the demands for environmental protection during their daily activities. In the 1980's, the call for port greening was divided among various departments of port management and the ports did not apply environmental policies implemented by the appropriate administrative, procedural or technical options, (Paipai, 1999).

- *A quest for a standardized approach in port greening*

Since the 1990's, the environmental management of port operations has increasingly come into focus. More restrictive environmental legislation; a complex framework of international, European and national law; the fact that the environmental credentials of ports were not clearly established; the societal demands for environmental protection which derived from the port-city interface, all the aforementioned initiated the development and implementation of port environmental management (PEM). Additionally, the requirements for transparent action in environmental protection were increased, as a response to both societal demands and unfair competition among ports located in different national contexts. However, back in the 1990s, it was highly arguable whether some form of greening would benefit the port authorities and their constituencies and whether the costs related to environmental protection negatively affected the optimal port rates. What remains beyond dispute is the direct impact of more extensive and strict legislative control on the grounds of introducing and implementing environmental management, (Wooldridge, 2004; Hoenders, 2007; Alexopoulos, et.al., 2008, Dabra, et.al.,2004). Furthermore, *"competition between ports becomes more severe, more unequal and more unfair"*, (Journee, 2005). Thus, both competition and legislation provided pressures on ports to build their "green image". As a result, within the time period from 1993 to 2010

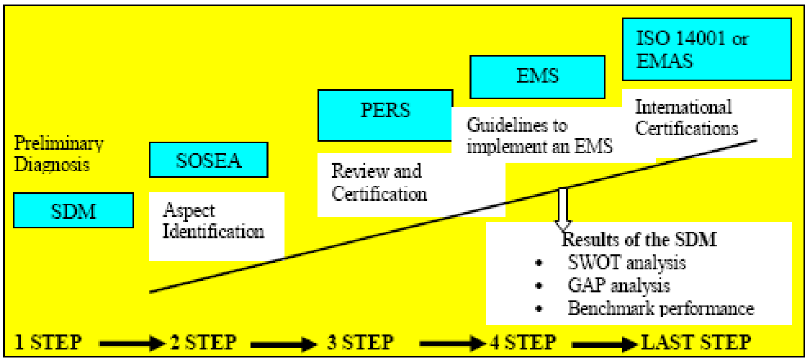
environmental management was upgraded from an issue-specific project to an important strategic planning demand among European seaports (Wooldridge & Stojanovic, 2004) and PEM has become a focal point for the European port authorities (PAs).
Part of the EU legal framework that provided such pressure was developed at a time when the port sector was not organised at a European level and it had virtually no lobby influence. Therefore, the implementation of regulations like the Bird and Habitat Directive in national states proved to be a sudden awakening for many ports, especially after the negative decision about the port expansion plans for Dibden Bay in Southampton (UK). This was a starting point for ports to critically approach legislation at an EU level. The Directives created further legal uncertainty and ambiguity and *"put an increased strain on vital port development plans and caused substantial delays"*, (ESPO, 2007). However, a debate at the GreenPort conference in 2007 showed that, in-between European ports somehow managed to work with legislation, often finding win-win solutions with environmental NGO's and local stakeholders (GreenPort, 2007). The port sector, at least its most representative and proactive members, recognized that *"environmental issues themselves need not be a direct competition parameter between them"* and furthermore, *"that a level playing field for the implementation of legislation and regulation is desirable for all ports"*, (Wooldridge 2006). These factors created the push for standardization, leading to a common belief in the *"need for green outcomes"* (ABP, 1998; ESPO, 2002).
Port Authorities (PAs), port managers and terminal operators have been traditionally facing a complex web of regulations and standards. For some years, Quality Management and Health & Safety were the key *"drivers"*– but currently, environmental issues are at the top of the agenda, (Chlomudis, et.al., 2011), as coercive pressures have promoted environmental strategy to a priority. In response to that, in Europe the seaports' association (ESPO) establishment (1993) was the catalyst for a series of port-based initiatives offering a positive response to the increased demands of legislation. The trend of effective environmental management in industrial operations has been progressively applied to the European ports since the mid-1990s; nevertheless, it was profoundly supported by the UK port's sector which had already established green port experience. At the EU level, the sector's collective response toward environmental management evolved into the PERS Certification standard carried out by the EcoPorts Foundation (EPF), the counterpart of ESPO in its environmental commitment to green self-regulation. PERS, as a cornerstone for the ISO14001 and EMAS certificates (Wooldridge 2006), ensures that the certified port is to some extent environmentally alert. EPF extensively promoted the standard among the ESPO port members, suggesting that "PERS is a tool that can help ports to meet their environmental goals" (Journee and Wooldridge, 2002).

- *The green port organizational field*

Since the mid 1990's, ESPO environmental guidelines - as presented in its Code of Practice (ESPO, 1994; 2003; 2007)-, port collaborative various research and development projects -i.e., Ecepa 1993, the Eco-Information (1997-2000) and the EcoPorts project (2002-2005)-, have provided a range of tools (including the PERS standard) to assist port managers deliver legislation compliance and EM implementation (Kourbeti, 2003; Wooldridge & Stojanovic, 2004; Alexopoulos, et al., 2008).
It was the beginning of the "green port" era. ESPO, representing more than 800 European ports, has focused on the development of a *common EU port policy*. Until the setting up of ESPO, port issues had been supervised by co-work between the Commission and individual port representatives *"without the benefit of an independent organization funded and organized by its members"*, (Wooldridge, et.al., 1998). Through the years, ESPO's main activity evolved in the *"principal interface between European seaports and the institutions of the EU"*, (ESPO, 2004). European port authorities, through ESPO, have eventually found a structured way of getting their voice and concerns heard in the preparation of new legislative proposals. Although individual PAs have promoted programmes to address environmental issues, there is no doubt that the over-arching framework provided by ESPO–EPF has made a substantive contribution to the goal of continual environmental improvement by facilitating *"collaboration and harmonization in the development of cost-effective and practicable environmental management"*, (Wooldridge, 2004).
The sociological framework of the institutional theory promotes organizational action to be shaped from external pressures. Emphasis is put on legitimation processes able to produce institutionalized organizational structures and procedures taken for granted, while the institutional theory recognizes

that competitive advantage must be created within a broader scope of social legitimacy (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). Standards are a proper and effective way for legitimacy gains. ESPO, through its policy, has encouraged compliance with legislation via voluntary schemes of self-regulation, while the European ports have been collaboratively working towards "a level playing field" in terms of environmental standards' enforcement. The ESPO-EPF scheme produced a standardized process for the 'green port' implementation through a specified EMS standard- promoted by the optional PERS certification-verification scheme-. The two most significant products produced, which are available to all port members of the EPF are: The Self-Diagnosis Methodology (SDM), a checklist to assemble facts and figures of the port area and PERS -a review system with guidelines for a basic EMS implementation. The port's environmental efforts can be PERS certified, if an International Certification Body verifies that the port complies with the PERS specifications. The certification works as the credential of the port's green commitment towards ISO14001/EMAS (see Fig.4.1)

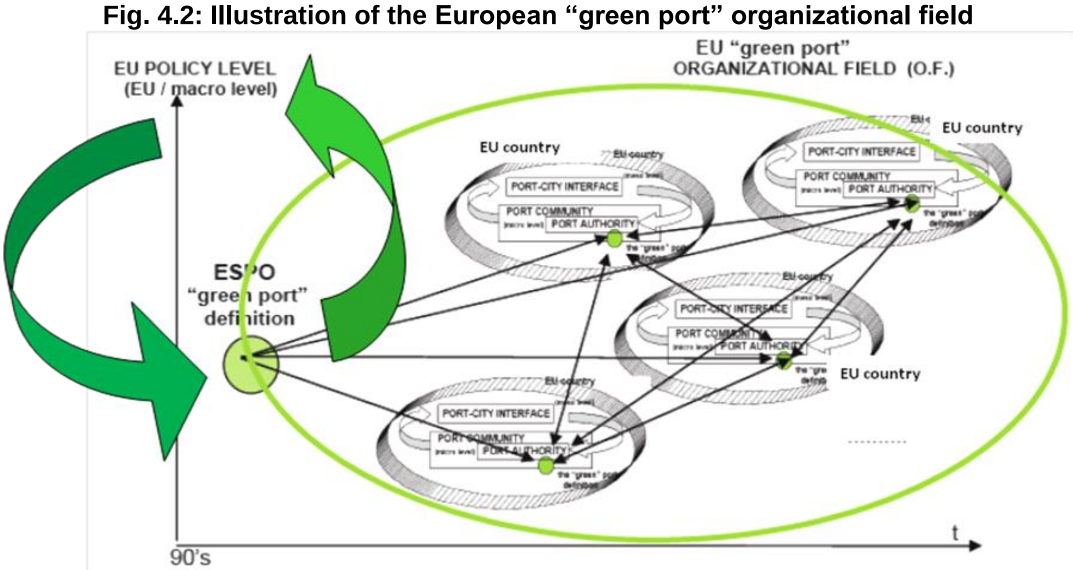
Fig. 4.1: EPF tools indicating toward ISO 14001/EMAS



Source: Alexopoulos et.al., 2008

The institutionally defined *isomorphism* creates and diffuses values, norms and rules, and produces the same organizational structures and practices across organizations that share a common organizational field. The organizational field is vital for the theory's application allowing *"to isolate a system of organizations that are directly or indirectly linked",* (Scott, 1998). In Europe from 1993-2010, ESPO -the main port representative association-, PAs along with a wide variety of other actors in each port- (including customers, port terminals, shipping lines, logistics services, etc.)-, port and city planners, municipalities, non-governmental organizations within the individual port's national context along with EU policy-makers and regulators, academics, and consultants, were engaged in an active debate over the meaning of the "green port" and the values that it should represent, via collaborative initiatives toward self-regulation and EMS standards implementation. The following Fig.4.2 illustrates, in a subtractive way, the total of the actors involved in the European "green port" organizational field.

Fig. 4.2: Illustration of the European "green port" organizational field



Source: Own configuration

Until the end of 2010 EPF was acting as a focal point for port environmental managers to exchange environmental best practice experiences on sustainability in ports and logistic chain; while the support of both ESPO and the EPF was considered *"fundamental to the long-term ability of the sector to maintain credible voluntary, self-regulation"*, (Wooldridge, 2004).

The European port sector's *greening approach* recognizes that environmental issues themselves do not need to be a matter of direct competition between ports and that a level playing field for the implementation of legislation and regulation is desirable for all ports (ABP, 1998; ESPO, 2002). With this approach as a starting point, EU ports embraced the necessity for green outcomes and became involved in collective action that has been addressing, progressively for almost fifteen years, the need to deliver the sector's wide environmental support services for port environmental managers, (Journee, Stamatoukos, Wooldridge, 2006).

By the 1st of January 2011, the EPF had dissolved and EcoPorts is now officially integrated within the structure of the ESPO. This integration signifies the beginning of a new era. The EU port sector achieved significant progress in the field of EM from 1993 to 2010 and this was largely driven through the long-standing close cooperation between ESPO/EPF and the EcoPorts network. Until the end of 2010, 35 European ports had obtained a PERS Certificate, while some of them were ISO14001 and one EMAS certified. The EU ports certified under the PERS certification, are presented in the following Table 4.1. The total number of the (19) UK ports representing almost the 30% of the EU certified ports, confirms that port environmental consciousness has been strong among UK ports and indicates the flourishing of the standard within this national context, which was highly supported by the representative bodies of the UK ports and the initiatives that were in place (Wooldridge, et.al,1999).

Table 4.1: Diffusion of PERS - PERS certified EU ports

	Private ports		**Trust Ports**	
	ports	**PERS certified**	**ports**	**PERS certified**
UK (19 ports)	Felixstowe	2006	**Dover Harbour Board**	**2002 (1st)-2006 (2nd)**
	Larne	2005	Harwich Haven Authority	2003 (1st) - 2006 (2nd)
	Associated British Ports (ABP)		Port of Tyne	2003 (1st) - 2007 (2nd)
	Barry	2005	Aberdeen Harbour	2003 (1st) - 2007 (2nd)
	Cardiff	2005	Fowey Harbour Commissioners	2005
	Goole	2006	Port of London Authority	2005
	Grimsby	2006	Port of Peterhead	2008
	Hull	2006		
	Immingham	2006		
	Newport	2005		
	Port Talbot	2005		
	Southampton	2006		
	Swansea	2005		
	ports	**PERS certified**		
IRELAND (3 ports)	Port of Cork	2006 (1st) & 2008 (2nd)		
	Port of Dublin	2008 (1st) & 2010 (2nd)		
	Killybeg Harbour Centre	2008		
NL (5 ports)	Havenschap Moerdijk	2005 (1st) & 2008 (2nd)		
	Port of Amsterdam	2005 (1st) & 2008 (2nd)		
	Groningen Seaports	2005 (1st) & 2008 (2nd)		
	Port of Rotterdam	**2008**		
	Harlingen port	2010		
FRANCE (2 ports)	Port of Marseille Authority	2005		
	Port of Calais	2010		
GREECE (2 ports)	**Port of Thessaloniki**	**2003 (1st) & 2008 (2nd),**		
	Piraeus Port Authority	2004		
SPAIN (2 ports)	**Valencia Port Authority**	**2003 (1st) & 2006 (2nd)**		
	Castellón Port Authority	2006		
ITALY (1 port)	Trieste Port Authority	2004		

Source: ECOPORTS - Retrieved from: http://www.ecoports.com/ (October, 2010)

4.2 Field characteristics

Organizational fields are not fixed groups of organizations. On the contrary, they evolve over time through different stages of increasing structuration (DiMaggio et al., 1983). The process by which an organizational field comes to be organized consists of: *"increased organizational interaction, development of intra-field structure, increased information load, and sense of a common enterprise",* (DiMaggio & Powell, 1991:277). *Collectively defining their approach to greening, EU ports aimed to structure* their new social identity (Scott, 2001) and turn them into being green ports. This section identifies the field's characteristics based on the criteria that are analyzed below.

4.2.1 Increased awareness

Port environmental awareness has vastly increased during the last two decades in Europe. Originally the need for environmental protection in European ports commenced from coercive demands. Since the environmental legislation increasingly requires from the port management to act in an environmentally friendly way, the threat of non-harmonization with environmental legislation is considered to be a major issue for PA's agenda- in terms of penalties, charges and negative publicity. Thenceforth, society and stakeholders perceive "greening" as a necessity for the acceptance of the port in the local economy and *thus*, ports willing to keep their "license to operate" have been forced to become aware. Consequently, since the 1990's port management plans ought to have been worked out, while port managers have been increasingly bound to make decisions concerning environmental issues and, as a result, this has raised organizational awareness and has increased the quest for the information available.

- *green awareness at the field level*

ESPO, as well as individual ports in the UK and Northwestern Europe, proposed a scientific, legal and moral argument for environmental protection. However, the ESPO's environmental Code of practice was the expression of the *port-sector's awareness and collective commitment* to environmental improvement. Its duty was to stimulate the green responsibilities of ports and make them environmentally alert and it was often updated by incorporating newly evolved green demands. In 1994, the Code was a combination of recommendations about a management approach along with a succession of objectives and targets for the most important and priority issues, (ESPO, 1994). Its widespread adoption has encouraged strong interest in environmental issues and has served as a catalyst for dedicated research programmes that aimed to raise awareness on the necessity of effective port environmental management plans (Wooldridge, Tselentis, Whitehead, 1998). The revised Code in 2003, set out 10 objectives which the EU port sector aimed to achieve (ESPO, 2003), serving *"as an extent of agreement on what guides activities within the field"*, (Scott, 2001),

As a result, in terms of environmental management in the field level, the sector *"has raised its profile substantially and demonstrated competence to deliver both environmental protection in many areas of its operations"*, (Wooldridge, 2004). The dissemination of projects' results and publicity about the Ecoports status as well as the competences of the PERS certified ports, has engaged more ports into being environmentally aware. Moreover, publishing the advantages of implementing EMS in a port context has also increased awareness about port environmental problems and port greening.

- *green awareness at the port organization level*

For ports willing to learn how to be green ports, the Ecoports tools have been predominantly supportive in the matter. Particularly the SDM tool allows a regular review and is designed to provide a whole overview of the environmental management situation, mainly aiming to promote environmental awareness. From this point of self-increased awareness ports can begin their path to implement an EMS using the PERS standard as a first step. Thus, at the individual PA level, the Ecoports tools have increased environmental awareness and have forced PAs to integrate environmental factors in managerial process and to, consequently, demonstrate their competence through EMS standard implementation, (Wooldridge, 2004).

In *sum*, the EU green port organizational field was grounded on the *common belief* that it is important to be engaged into the *"sustainable port development and management, which have become an imperative on several grounds"*, (ESPO, 2003). Divergence of opinions and the struggle between actors in an organizational field, may concern what is actually important to them, (Sahlin-Andersson, 1996); regarding the European "green port" organizational field, struggles did not revolve around *why* it is important for ports to be green, but around *what* exactly the "green port" involves or indicates and how it could be implemented. Any answer to that incorporated new knowledge, in both technical and managerial terms, has upgraded awareness in the field. In its most optimistic version green awareness in the field raised the point that *"ports themselves understand that an environmentally friendly attitude can also be a strong commercial argument",* (ESPO, 2003).

4.2.2 Increased information exchange

The European port sector's policy of voluntary, green self-regulation has been implemented:

> *"Through a network of port authorities working within an overall framework based on the free exchange of environmental knowledge and experience backed by the development of cost- effective and practicable management tools and methodologies"*, (Journee, et.al., 2006).

Under the ESPO umbrella the EU PAs did not only lobby together, but they were also associated to develop joint initiatives such as common 'ethical codes' and 'business practices'. Although, there was no legislation for port EM per se, a wide range of legal and regulatory documentation related to statutory duties (ABP, 2003) asked for a systematic management framework. As a result, since the mid-1990's the sector's self-regulation towards voluntary greening has been promoted through collaborative research and development programs supported by EC funding (Kourbeti, 2003). The ESPO Code and the produced collaborative projects (illustrated in Table 4.2), were indeed ***catalysts of action*** *within the port sector and positive responses in the sector's greening* (Wooldridge, 2004).

Table 4.2: Positive Responses by the European port sector – ESPO Code / R&D projects

BENCHMARK EVENTS BY THE PORT SECTOR as catalysts of action	
year	**event**
1993	ESPO establishment
1993	**ECEPA** (Environmental Challenges for Port Authorities)
1994	**ESPO Environmental Code of Practice**
1996	ESPO Environmental Survey
1997-1999	**Eco-information Project**
2001	ESPO Environmental Review **further recommendations on environmental management**
2002-2005	**ECOPORTS project**
2003	**New ESPO Environmental Code of Practice**
2004	ESPO Updated Environmental Survey
2005-2008	**NOMEports projects**
2005-2010	Continuity of R&D into specific issues as: dust, dredging, logistic chain, Water Framework Directive plus Certification of PERS carried out by the EcoPorts Foundation
2007	**ESPO Guide document on port development and Natura 2000**
2008	**Good Practice Guide on Port Area Noise Mapping & Management**
2009	ESPO/EcoPorts Port Environmental Review
2010	**ESPO Code of Practice on Societal integration**
onwards:	Numerous individuals port projects

Source: Wooldridge, 2004; Hoenders, 2007.

In the 2000's, port greening was promoted, through the Ecoports network and port related stakeholders sharing environmental experience for the benefit of ports and port communities. Collaborative action was formed progressively and in this network, tools and methodologies were developed, specifically designed to assist port managers in delivering compliance with legislation and effective EM implementation (Wooldridge & Stojanovic, 2004; Journee, et.al., 2006; Hoenders, 2007; Journee, 2008). ESPO, EPF and Ecoports members have provided the communication network through which the results of such programs were communicated throughout the European port community (Hoenders, 2007). 'Know-how' was developed, particularly on environmental monitoring indicators and processes (Dabra, et.al.,2004).

In addition, it became clear that an exchange of experiences and best practices between port managers would be beneficial in order to increase the cost effectiveness of environmental policies development for individual ports. EPF and its EcoPorts network were constantly engaged in initiatives to develop new green procedures, thus enabling the EU ports to exchange environmentally effective solutions. The PERS certification standard, carried out by EPF, was the result of such collaborative "*networked solutions*", (Journee, et.al., 2006). The EPF fervently promoted "green port" commitment through SDM and PERS implementation, aiming to deliver environmental support services for port environmental managers. Thus, practical know-how was transferred among port communities in Europe which delivered support on what and how PAs should implement, ensuring that the green outcomes will be cost as well as environmentally effective and up to standards set, (Journee, 2005).
A practical approach, at a European sector scale was essential, according to PAs. Port environmental problems are as diverse as ports themselves, but despite the great differences among port profiles in the EU, *environmental information exchange* was considered a significant element to facilitate effective environmental practices. Co-operation amongst ports has turned to be crucial for sharing costs, avoiding (environmental) competition and avoiding double work, (Journee, 2008). The importance of co-operation should not be overlooked or underestimated. In a sector, as diverse and competitive as ports, *development of consensus*, agreeing objectives and sharing of information are aspects which had to be gradually developed.

Surveys conducted by ESPO observed that the environmental questions concerning ports continuously gain more attention from their administrations, (Eco-information-Final Report, 1999, ESPO Environmental Review 2001; ESPO Environmental Survey, 2005). Thus, additional information exchange occurred through the total of ESPO surveys, among which the most illustrating was the "ESPO/EcoPorts Port Environmental Review" in 2009, (Michail, et.al.,2010). The survey not only identified the issues which were at stake for EU ports in the field of environment, but it also established a port sector's European benchmark of environmental performance which identified the most significant environmental issues presented in the following Table 4.3. The surveys illustrated the implications of the problems and indicated the main focus of those needed further collaborative action.

Table 4.3: 10 most common issues in port environmental management

	1996	**2004**	**2009**
1	Port development (water)	Garbage / Port waste	Noise
2	Water quality	Dredging operations	Air quality
3	Dredging disposal	Dredging disposal	Garbage / Port waste
4	Dredging operations	Dust	Dredging operations
5	Dust	Noise	Dredging disposal
6	Port development (land)	Air quality	Relationship with local community
7	Contaminated land	Hazardous cargo	Energy consumption
8	Habitat loss / degradation	Bunkering	Dust
9	Traffic volume	Port development (land)	Port development (water)
10	Industrial effluent	Ship discharge (bilge)	Port development (land)

Source : ESPO / EcoPorts Port Environmental Review 2009

Thus, the significance of noise and air quality in 2009 clearly informed that priority should be given to issues related to the health of people working or living around ports, which was also in-line with the European political agenda. Port development (land related) stays in the top 10 of the list, mainly because of containerization and new infrastructure for handling the cargo. The review pointed that some highly prioritised environmental issues for a large majority of European ports, -namely dredging operations, dredging disposal, dust and port development-, has consistently appeared within the top 10 priorities in Europe in the last 15 years, and formed the basis for further green collaboration in the port sector and additional information exchange.
In addition, ports' needs for guidance concerning the implementation of EU environmental law (EU Directives, which raise specific concerns to EU ports), also reflects the ESPO's several initiatives aiming to help them better understand the environmental legal framework in which they operate. Information is disseminated through publications that review the various EU environmental rules applicable to ports, provide guidelines to implement them- especially publications on the Water Framework Directive (WFD)- but also implementation guides that assist ports with planning projects in Natura 2000 sites.

4.2.3 Increased interactions

Following institutional theory scholars, the European green port organizational field was *drawn upon and structured in action*, (Barley& Tolbert, 1997; Boons et al., 2000). The action had its origins in the port-inspired Eco-Information project and the various Ecoports research and development projects that were partly funded by the EC; whereas the sector's "green outcomes" can point to an established and successful interaction between ESPO, professional port managers, university researchers and specialist advisors that were constantly interacting within the field.

Among the self-regulation initiatives under the ESPO umbrella, the most significant effort driving port to turn green, were the Ecoports tools. Port organizations around Europe showed a particular interest in this new development, as the need for PEM constantly increased (see Table 4.4).

Table 4.4: Progress in Port Environmental Management (PEM)

Environmental management component	1996[(1)] %	2004[(2)] %	2009[(3)] %	Percentage change (2004-2009) %
Does the PA have an environmental policy?	45	58	72	+14
Is the policy made available to the public?	-	59	62	+3
Does the policy aim to improve environmental standards beyond those required under legislation?	32	49	58	+9
Does the port publish an annual environmental review or report?	-	31	43	+12
Does the port have designated personnel?	55	67	69	+2
Does the port have an EMS?	-	21	48	+27
Is environmental monitoring carried out in the port?	53	65	77	+12
Has your port identified environmental indicators to monitor trends in environmental performance?	-	48	60	+12
Is there a defined procedure for consulting with the local community on the port's environmental programme	-	36	37	+1

[1] ESPO Survey 1996, [2] Eco Information Final Report 1999, [3] ESPO Survey 2004
Source: ESPO Environmental Survey 2004 – Final Results, 2005

Increase of environmental planning and awareness of environmental policy issues was evident in the field. Dabra, et.al. (2004) suggest that, although there were a number of factors influencing this tendency, -including evolved legislation and recognition that port environmental problems are common among ports-, a prime factor was the ability for port professionals to use tools and methodologies derived from collaborative research.

The ESPO seminar in Genoa (2002) almost simultaneously with the EPF establishment, decisively pointed out the need for *collective industry action*, and suggested frequent interactions of ports under the ESPO umbrella. During the next years, -up to 2010-, the Ecoports network facilitated the voluntary exploration of appropriate management options in the field and the effective implementation of port environmental policy statements. A constantly increased number of ports were engaged in order to make the difference. All of them frequently interacted in conferences, workshops, ad-hoc meetings and exchanged experience from research and development programs and information from the EPF database, which was produced from Ecoports' selected best practices (Alexopoulos, et.al., 2008), (see Table 4.6). An extensive *system of relations* appeared.

These relations evolved between the PAs and various actors -within and outside the port community- that define their activities as being concerned with similar issues, (Sevon, 1996, Sahlin-Andersson 1996:74), i.e. the greening of their ports. As by definition, environmental issues are often trans-boundary, -they involve several systems in terms of aspects, significance and pathways-, and their effects may have an impact on air, soil, sediment, water and ecosystems (Whitehead, 2002)-, port managers throughout Europe were confronted with daily environmental considerations and ad-hoc situation when they needed to combine development needs with ecological and urban requirements. The result was increased interactions and newly evolved relations between ports from different national contexts -or within a specific national context- that endorsed the need for collaborative approach towards PEM implementation, aiming to create a cohesive response and a level playing field in Europe regarding port-related sustainable management issues, (Darbra & Royston, 2007).

Table 4.5: ESPO- EPF / EcoPorts network interactions towards greening

ESPO- EPF / EcoPorts network interactions	
year	**event**
1993	**ESPO** establishment
1994	**ESPO Environmental Code of Practice**
1997	**Eco-information Project** EC R&D project co-sponsored by port sector
1998	**Self-Diagnosis Methodology** (**SDM**)– development and evaluation
1999	Completion of **Eco-information Project** permanent structure of the **Ecoports Foundation** (**EPF**)
2002	**ECOPORTS project** Major R&D project to deliver practicable tools for EMS
2003	**New ESPO Environmental Code of Practice** (revised Code with recommendations for best practice)
2004	**ESPO Conference**, Rotterdam NL/ 1st EPF Conference, Barcelona ES.
2005	**EPF Secretariat** / 2nd EPF Conference, Marseille F. Continuity of R&D into specific issues as: noise, dust, dredging, logistic chain, Water Framework Directive plus Certification of PERS carried out by the EcoPorts Foundation onwards: Numerous individuals port projects
2006	**ESPO Conference**, Stockholm S / 2nd EPF Conference, Genoa I.
2007	ESPO Guide document on port development and Natura 2000
2008	**GreenPort/EcoPorts Conference** including NoMEport results
2009	**ESPO Review** of environmental benchmark performance
2010	**EPF/EcoPorts transition to ESPO** Port Performance indicators (PPRISM) R&D Project
onwards	ESPO new EcoPorts portal launched (www.ecoports.com)

Source: Wooldridge, 2004; Hoenders, 2007; Journee & Wooldridge, 2010.

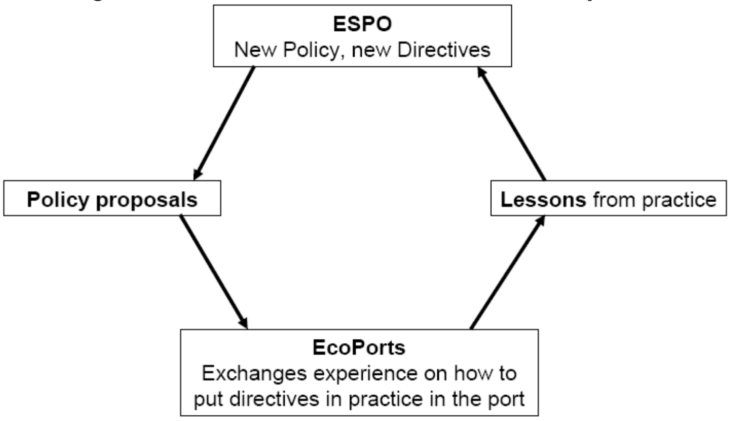
Although it has long been recognized that ports have a major role to play in environmental protection and that they are significant components of any coastal zone management system, it was only in the 1990's that the sector started to take a *collective approach* to the common challenges and opportunities posed by environmental concerns, (Paipai, 1999). Since the beginning of the 2000's various EU ports have been in the process of implementing EMS standards aiming at certification outcomes; the most successful of them by the end of the decade incorporated their environmental policy in the sustainability and CSR concept (ESPO/EcoPorts, 2009; Naniopoulos, et.al., 2006). The complexity of the involved issues, -especially for those matters related to sustainability (Roome, 2001)-, brought realization of the difficulties that any port would face in an attempt to manage them. Therefore, the complexities and the non-sensory nature of environmental and sustainability problems, most of which necessitated scientific knowledge, created the need and *power of experts*. The experts, represented by scientists and consultants for various academic environments and research institutions, interacted within the Ecoports networks at both national and EU level.

In addition, increased interactions and new relations also appeared at a local level, where port administrators and various port community and societal actors were engaged in port greening. As the environment evolved as a *"fundamental element for ports' integration in the wider community"*, the ports became engaged in *action* which eventually promoted them as *"laboratories of environmental solutions"*, (Hoenders, 2007). The two new entries in the 2009 'top-10' port environmental issues (see Table 4.3), namely the relationship with the local community and energy consumption, reflected the political priorities for energy efficiency and climate change as well as the realization -by the port sector- of the significance of good port-city relations and the societal integration for the operation of a sustainable port. Both signify that the previously established interactions and relations at the port community and port-city interface level were to be further enhanced.

4.2.4 Patterns of dominance and coalition

Until the end of 2010, ESPO and EPF were acting as a focal point for port environmental managers in order to exchange environmental best practice experiences on sustainability in ports and the logistic chain, while ESPO was considered as the recognized counterpart of EU institutions (Hoenders, 2007). ESPO, the main European port representative, and EPF its counterpart in forming its environmental policy, made up the *coalition* that provided a level playing field, in terms of port environmental protection. Their scope was the harmonization of the environmental management approach of ports in Europe through sharing know-how, exchanging experiences and implementing good practices in environmental issues (Darbra & Royston, 2007).
However, for industries with technological characteristics -like the port industry-, the standardized procedures do matter. A knowledge network that can provide this kind of valuable information holds a *position of power* within the field, especially when competition depends on standards harmonization. The support of both ESPO and EPF was considered fundamental for the long-term ability of the sector to maintain credible voluntary self-regulation (Wooldridge, 2004).

Fig. 4.3: Relation between ESPO and Ecoports



Source: Journée, (2008), presented at the GREENPORT–ECOPORTS Conference in Amsterdam 2008.

The ESPO and the EPF/Ecoports members' relation was a *clearly defined structure of coalition and dominance* within the field (see Fig.4.3). Since the 1990's, the issue of the constantly evolved legislation and the implementation related costs has turned the majority of ports extremely skeptical in terms of port greening. Port greening was partially promoted by the fact that by the end of the 1990's a blossom of ports (especially among North Europe) depended increasingly more onto their own forces (although with the EC support) in order to tackle the environmental questions that were mainly raised from legislative demands. The result was significant knowledge gained in port environmental issues, based on their willingness to co-operate and exchange ideas and information (Wooldridge et al., 1999).
However, it was only after the EPF official formation that the Ecoports approach blossomed. Although individual port authorities promoted programmes to address environmental issues, there is no doubt that the over-arching framework provided by ESPO-EcoPorts Foundation made a substantive contribution to the goal of continual environmental improvement by facilitating *collaboration* and *harmonization* in the development of cost-effective and practicable management response options (Wooldridge, 2004).
The standardized approach promoted by the ESPO/EPF synergy in the field involved a variety of organizational procedural, operational and technical options, aiming at green integration in EU ports. They were the model that provided the templates for the design of green port organizational structures: "the positions, policies, programs, and procedures of modern (port) organizations" (Meyer and Rowan 1977: 343). Following Scott (2004), models exert their power, not via their effect on the network participants but on stakeholders and audiences external to the organization. Their adoption by the organization earns social **legitimacy** (Scott,2004). Certified Ecoports members are considered green ports. They were worth their 'license to operate', they had proper credentials and through the ESPO–EPF/Ecoports coalition, they *finally had a structured way* of getting their voice and concerns heard in the preparation of new legislative proposals, (as the example of the Waste Directive demonstrates).

4.3 Exploring diffusion mechanisms in the field

Although institutionalism has been, first and foremost, applied at the organizational level, on the other hand, the individual level has been also engaged at an analytical level. Scott pointed out that institutions could operate at the level of *'localized interpersonal relationships'* (Scott, 2001). In this part of the study, empirical analysis draws on exploring the individual mechanisms that would be functioning in individual ports' EM development.

4.3.1 How individual ports developed their EM

The ports that were examined in the following case studies, have followed different paths to the design and implementation of their EMS, each one adapting to its specific requirements and organizational plan. The following comparative Table 4.6 illustrates the differences of the port characteristics among the four selected ports.

Comparative Table 4.6: Port characteristics

Case study	Type of port	Location	Main Activity	Size (land area)	Tonnage (tones in 2007)	Main freight units (TEUs 2007)	Passengers (2007)
DHB (UK)	***Trust port*****	Southern UK	International ferry port	0.95km2	25.114 tons	2.364 TEUs	1.487.318
ThPA (GR)	***Land port model***	Eastern Mediterranean N. Greek coast	Regional container-cargo port	1.55 km^2	16mil tons	370.000 TEUs	220.000
VPA (ES)	***Land port model*** Cluster port	Western Mediterranean Spanish coast	Large container port	600ha	53.6mil tons	3.042.665 TEUs	474.814
PoR (NL)	***Land port model*** Cluster port	Rhine-Meuse Delta in the Netherlands	International container port	10500 ha	406.8mil tons	10.791.000 TEUs	-

****** *Trust ports (an English concept) are independent statutory bodies, governed by a board of Trustees.*

Dover is one of the world's largest international ferry ports, situated at the closest location to Continental Europe, providing facilities available to Ro-Ro ships, fast ferries, cargo vessels, cruise ships, private yachts and some private fishing boats. The port authority of Dover (DHB) is one of the most successful in the UK, and Dover is classified as a port of national significance (Potter, 1990).

With no industrial activities in the port area, the environmental impact in the port of Dover is mostly a result of land and water transport movements.

The *Port of Thessaloniki* is a major Trans-European Port, in terms of the Greek National Port Policy and, as an important part of the Greek transport network, is a vital link to markets beyond Greece. Since 2001, under the national policy of reform implementation, Thessaloniki Port Authority (ThPA) is the port managing company, on public listing at the Athens Stock Exchange with the state being the major stockholder (51%). ThPA is exclusively providing port services, rather than hosting production and processing units, including containers, conventional dry and liquid cargo transport (handled through private oil companies within the port zone), services to coastal and cruise ships, and passengers, plus one of the 27 Free EU Zones.

The *port of Valencia* follows a different model as port organization. Since 1985, Valencia Port Authority (VPA), has been responsible for three state-owned ports: Valencia, Sagunto, and Gandía. Valencia port, is the leading Spanish container traffic port in the Western Mediterranean and among the top ten EU ports. Port activities include: containers, solid and liquid bulk, general goods, multi-purpose and Ro-Ro terminals, passenger, cruiser transport, trade and navigation services as well as fishing docks.

The fourth port that is presented is the Port of Rotterdam (PoR). The Rotterdam port area, including a large industrial complex, is an important transit site because of its geographical location. With an atypical range and scale of activities (Paipai, 1999), the port complex stretches over a length of 40 km. In the 1990's, the central issues in modern debates over the port's future became the distinctly different character of the old and new segments of the port and the different opinions regarding the potential for each of the two areas to accommodate new demands.

Since 2004, PoR has been a non-listed public limited company with the municipality of Rotterdam and the Dutch government as its major shareholders, operating as the manager and developer of the port

and industrial complex. The port is a port-cluster concentrating port, maritime and related activities, numbering thousands of businesses and organisations, but just like other companies, the PA will have to give account of its economic, social and environmental performance, in consideration of its corporate image, (De Langen, 2004).
The following comparative table 4.7 summarizes the port environmental impact in each case study and illustrates the green national context for each port, pointing out the green national policy key characteristics that affected their green policies.

Comparative Table 4.7: Individual port's environmental impact and its green national context

port	Environmental impact	National policy
DHB (UK)	air, soil and seawater pollution, dredging and disposal of dredged materials, port waste and sewage, effects to biodiversity and conservation	• UK scientific interest on marine environment and habitats. • Since the end of the 1990s Integrated Coastal Zone Management policies
ThPA (GR)	air and seawater pollution, dust, noise, solid waste and sewage disposal, oil spills and leakages, dredging and material disposal	• Attempt to align with EU green policies with dubious results.
VPA **(**ES)	port waste and sewage, air, soil and seawater emissions noise pollution	• Attempt to align with EU green policies. • Since mid-2000s the "Quality of coastal waters in seaport areas" policy
PoR (NL)	port development impact, serious air pollution problems, noise pollution, soil and river-seawater pollution, impact on sea environment (physical, chemical biological) due to dredging and dredging material disposal	• Late 1980s green national context • National Strategy for Sustainable Development (2001) • National Strategy for Seaports Sustainability (2008)

4.3.2 *How* and *when* was the EMS implementation initiated?

In the early 1990s, concerning the port of **Dover**, obtaining license for dredging and port development was crucial, as much as the main reason for environmental considerations and information, (Paipai, 1999). DHB gradually included environmental plans into its management program, reacting to the evolving national legislation that specifically aimed at protecting biodiversity in the coastal and marine environment. Since then, green plans and actions have been progressively performed by tackling different environmental issues in the port area, aiming to employ a regime of 'compliance plus' in terms of environmental management (Paipai, et.al, 2000).
Dover evolved its EMS based on a series of gradual developments that produced environmental performance indicators, specific to its special geographical and hydrographical port characteristics. The environmental data that were produced revealed benefits in terms of resource conservation and data provision for EIA studies. Gradually, green results proved that environmental management integration into the port's business and operational plans had an effective impact and tangible cost-benefits. These productive outcomes advanced further planning, corporate representation in negotiation, in-house expertise building and self-regulation, (Paipai, et.al, 2000).

In **Thessaloniki** port, in the 1990's, the port's environmental considerations -which were mainly technical and procedural operations concerning port development (land area)- included a best practice implementation with regard to the contaminated seabed reclamation in the port area. The latter initiated an issue specific cooperation with the local Aristotle University of Thessaloniki (AUTh). In the early 2000's, responding to the demands for daily port operation, management of environmental issues according to the ESPO Environmental Code of Practice (Kourbeti, 2003) as well as coercive pressure of the EU 2000/59 Directive on port reception facilities of ship waste and cargo residues but also the related Greek Law 3418/07/2002, the previously established collaboration with the local university progressively evolved and ThPA began the process of a gradual EM development and implementation. In 2002, the ThPA and AUTh 's collaboration resulted in a feasibility study on the port's ability to progress towards ISO 14001 or EMAS standards, likewise exploring the EcoPorts approach. The PA decided to engage the PERS standard in evaluating the PA's administration

development stage, organizational and environmental training program and the high costs of applying and maintaining any other EMS certification, (Palantzas, et.al., 2005).
In 2003 the ThPA became a member of the Ecoports network and since then, the AUTh consultant partnership has expanded resulting in the completion of the SDM and PERS documentation and an initial Environmental Policy, (Kourbeti, 2003). In 2003, the port was the 5th European and the 1st Mediterranean port to obtain the PERS certification from the ESPO and ECOPORTS foundation.

In Spain, ports, including the port of **Valencia**, sought to conform with EU regulations, although some actions were taken relatively late. In the mid 2000's National and EU policies (ROM Programme, Water Framework Directive (2000/60/CE) solely triggered port water quality managerial tools in Spanish ports. However, the Valenciaport pioneer environmental awareness, had already launched the innovative ECOPORT project ''Towards An environmentally friendly Port Community'' since 1998. It was a cooperation between Valencia Polytechnic University and the IPEC Foundation, co-funded by the EU within its LIFE-Environment programme. The project focused on EMS in industrial harbours and developed procedures for Eco-Audit EU regulation 1836/1893 (EMAS) implementation in port facilities (ECOPORT Valencia, 2000; Peris-Mora et al., 2005). In 2000, the VPA made the first attempt to implement such a system in collaboration with seven companies covering various activities within its port area (Autoridad Portuaria de Valencia, 2001; Peris-Mora et al., 2005). The VPA ECOPORT project was completed in January 2001. The applied port EMS tools became a benchmark within Europe. The ESPO mentions the project in its environmental review from 2001, (together with the Swedish METESPO), as one of the two finest examples of EM implementation in European ports. Additionally, VPA enhanced its EM with a *real-time monitoring system* of different environmental aspects. VPA's EM progressively focused on environmental port effects in terms of air, water, noise pollution waste generation and disposals energy and raw materials consumption, (VPA, Annual Environmental Report, 2009).

Since the 1970's, the port of **Rotterdam** has had a clear growth strategy to remain an important international player. In the 1990's, with the approval of the "Port Plan 2010: Future Vision of a Mainport", within the ROM-Rijnmond framework, it was agreed to develop its container sector, (Kreukels & Wever,1996). Since then, discussions have focused on the port's expansion, infrastructure improvement and the environmental and societal implications of these plans.
Despite complaints about the strictness of the Dutch environmental policy and port related costs, the national, regional and local government have been cooperative, (Polder Model) and the transition of *quantity to quality* was one of the main targets of the Rotterdam's Port Plan 2010. Until the end of 1990's the plan's operationalization was weak. The port environmental policies have been generally enforced by sectoral legislation and were issue-specific, such as the Rhine Research Project POR I-II for dredging & dredged disposal.
In 2008, the governmental port policy document on "Seaports as hubs towards sustainability", set special focus on: 1) air quality, 2) energy, CO2 and residual flows, 3) use of space, 4) conservation and development of nature, 5) water quality and management, while port management is considered to play a crucial role in stimulating and coordinating sustainable initiatives in port areas, (Dekker et.al., 2010). Consequently, PoR prioritized its new ambitious objectives set in terms of SD and competitiveness with the implementation of the port development plan "Port Vision 2020: Room for quality" (PoR Annual Report 2004, p:4-25). Since its initiation in 2004, the Port Vision 2020, has constituted an interesting example of the role of port management in sustainability planning beyond EMS implementation. Due to the size of the port (in terms of surface area as well as throughput volumes) and its contribution to the Dutch economy, the Port of Rotterdam plays a major role in several initiatives, including Rotterdam Climate Initiative - Rotterdam: CO_2 hub of Europe; Maasvlakte 2 – sustainable port and energy port. Although the implementation of the objectives was collaboratively obtained with the city of Rotterdam (Decker et.al., 2010), the PA embraced environmental management and the ESPO/ERF approach, leaning on efficient EMS standards such as ISO 14001 and PERS. In smooth delay, the PA acknowledged the role of EM implementation, so in 2008 the Rotterdam Port Authority obtained the EPF's PERS certification, seeking to be certified according to ISO 14001 in the future (ECOPORTS 2008). The different approaches in EMS

implementation are presented in the comparative table 4.8, in which the actions of each port are listed and compared.

Comparative Table 4.8: Individual port's planning goals in EMS implementation.

Dover	Thessaloniki	Valencia	Rotterdam
2003: 1st Environmental policy, PERS certification by EPF 2006: PERS re-certification by EPF 2008: ISO 14001 certification	2002: GREENPORTh project • Ship's waste reception and handling plan. • Preparation for EMS implementation - exploration of ISO 14001 certification capability. 2003: 1st Environmental Policy Statement PERS certification by EPF 2005: GREENPORTh II project Implementation of environmental projects under the PERS standard re-evaluation: • Energy auditing of electricity and oil consumption; • Monitor Safety and Health issues; • Monitor and mitigation plan of dust emissions; • Integrated port waste management plan 2006: GREENPORTh III: exploration of EMAS certification capability 2008: 1st PERS/ EPF re-certification	1998-2001: VPA ECOPORT / LIFE project - 1st European case of the introduction of EMAS in port communities VPA ''Guide for the implant of EMS in port installations" 2000: 1st VPA Environmental Policy Statement 2003: PERS certification by EPF 2006: VPA revised Environmental Policy PERS re-certification ISO 14001-2004 certification 2007 : EMAS II Regulation Certificate 2008: Incorporation to the EMAS Register of the Valencian Region	1984 onwards: Rhine Research Project (POR) Since 00's: "Port Plan 2010" Since 2004: "Port Vision 2020" • Rotterdam Climate Initiative (RCI) • Rijjnmond Regional air Quality Action Programme - Plan of Approach to Air by the PA • Rotterdam: CO2 hub of Europe • PA's shore side power for inland barges (pilotMaashaven) • Environmental indexing seagoing vessels • Noise Management system for industrial noise • Soil Quality Management Scheme (SOQUMAS) • Species and habitat management scheme • Cases for port-city transformation • Realization of wind energy in Rotterdam Port Area 2008: 1st PERS/ EPF certification

4.3.3 What shape did EM take?

EMS was shaped in a different manner for each port, adjusting to its specific needs and requirements of function. The following Table 4.9 summarizes *how* **information** was used in decision-making for the individual port EMS implementation. The section provides more details.

In 1992, the port of **Dover** began monitoring the environmental impact within its port area. In 1998, it started to use the SDM in assessing the port environmental impact and started to implement green actions. The next step of the DHB was to apply an accreditation by PERS to EMS. This was considered to be more manageable than certification according to other standards (ISO, EMAS). Dover became the first port within the European "green port" community to receive the EPF /PERS certification in 2003; and received PERS re-certification in 2006.

The initial phase of PERS implementation was helpful in understanding green activities and operations in the port area on a daily basis. The EMS standard proved to be easy to implement, flexible and similar to Health & Safety management systems that the port had already experienced (Jenkins, 2003). As a result of its certification, Dover won a national environmental award in 2003 for the best environmental industrial contribution. After the second re-certification, the system is still considered, by the port's Environmental Officer, as a useful tool, now available to all port personnel (Marsh, 2006). Materialising the national political will for scientific validity in environmental performance, DHB enhanced the port's "greening" processes in its EMS, by introducing DHB Environmental Occurrence Reporting System as an important EM component applied in 2004. This is a computerised environmental incident reporting system, (available to staff 24 hours a day), able to produce monthly statistics, which are used as a measure of environmental performance and improvement. Because of this system, DHB was able to successfully apply for ISO14001 certification in 2008. DHB considers that this certification demonstrates the continuous improvement in the form of external audits and reporting, (DHB, 2008).

Comparative Table 4.9: EMS implementation - How information was used in decision-making

Dover	Thessaloniki	Valencia	Rotterdam
Since 1998: • Progressively produced environmental performance indicators used in forward planning, and reporting • External EM consultants e.g.: ESPO, BPA, local universities scientific institutions and authorities. • In house EM structure: Environmental working group / Safety and Environmental Department Since 2003: In house EM structure: Environmental Office	2003: Environmental coordinator: appointed to the Board of Directors and the Managing Director (assistance in the port's EM development and improvement) Since 2005: Department, Environment, Health & safety: Environmental officer (small group)	00's onwards: Managerial decisions for innovative steps in terms of port management. 2005 onwards: Environmental Department Internal projects: • INDAPORT II development of port environmental indicators • HADA project - automatic tool for environmental analysis, to control pollution R&D projects (national – EU level): • 2002-2005: ECOPORTS information exchange and impact assessment in EU ports and other terminals. • 2004-2008: SIMPYC LIFE Environmental integration of Ports and Cities. • MADAMA, EUROPHAR	prior PERS certification environmental issues were included in the departments of port planning and development & public affairs. EM implementation based on: • regulations and technology • upgraded stakeholder integration 2008 onwards: (after PERS certification) • Environmental Department responsible for EM • Environmental issues are also included in the Corporate Strategy Department
EMS according to PERS ISO 14001	EMS according to PERS	EMS according to PERS ISO 14001 EMAS	EMS according to PERS
key personnel identified by name and workplace	key personnel identified by name and workplace	key personnel identified by name and workplace	key personnel identified by name and workplace

In the port of **Thessaloniki**, the group effort with the local university secured compliance with legislation, utilised expertise know-how and cooperation within the Ecoports network. In 2002, the ThPA endorsed the Ecoports approach and began a progressive course to incorporate environmental requirements in the port's daily operation, under the PERS standard, (Palantzas, et.al., 2005). The research project that set up the port's environmental policy framework and initiated EMS implementation was GREENPORTh (I-II). AUTh and Cardiff University (UK) consulting teams, coordinated and advised the EMS application, (Naniopoulos, et.al., 2006). Furthermore, a progressive R&D collaboration between ThPA and AUTh assisted the port's environmental policy implementation, by providing research on key components. Various issue specific environmental plans were integrated in the port EM (see Table 4.8), (Palantzas, et.al., 2004; Koutitas, et.al, 2005; Vafaki & Palantzas, 2005; Naniopoulos, et.al.,2005; Naniopoulos, et.al., 2006). The port re-evaluated its position towards EMS standards, seeking to develop an integrated EMAS, and in 2006 commissioned the GREENPORTh III feasibility project which only resulted in a 2nd PERS certification in 2008.
ThPA's environmental responsibility is monitored by the board of directors. An environmental coordinator (External Consultants Team or port personnel) is appointed to supervise the port's EMS development and improvement, reporting to the Board of Directors and the Managing Director. The designation depends upon the environmental case/aspect/problem. ThPA has set up a flexible and appropriate organizational structure and designated staff to address the specified policy statement objectives. Since 2004, ThPA has established the Environment, Health & Safety Department, a small environmental group, run by an Environmental Officer. Key personnel responsible for specific environmental aspects within the port are identified by name and workplace according to PERS standards. External Consultants provide, on demand, environmental monitoring with the valuable collaboration of the AUTh. The Environmental officer, yearly reviews the responsibilities documented, using the annual SDM reviewing method.

The port of **Valencia** implemented its strategy by using the ECOPORT methodology. This in-house developed methodology, selected EMAS standard as the best tool to prevent or reduce the possibility of port pollution while offering compatibility with other EMS standards (Orejas & Monfort, 2001). The standard implementation revealed the need for more specific environmental performance control mechanisms (Peris-Mora, et.al., 2005). The VPA Environmental Policy was first established in 2000 and it was revised in 2006. Its objectives consisted of designing tools for controlling and monitoring environmental quality (e.g. air quality, water quality, noise, etc.). Self-enhancement capabilities within the port's EMS framework, regarding air and water quality, waste management and communication-awareness, indicated a successful implementation of responsible environmental policies, whereas R&D projects and international cooperation (Sapina-Garcia, 2007) promoted collaborative learning (see Table 4.9).
During the last decade, VPA has increased its commitment to EM, allowing its own EMS to mature, progressively incorporating new challenges and achieving all possible environmental certificates, while it has been conscious of the importance of environmental information being spread and it has also published environmental newsletters on a quarterly basis. The port's first Environmental Report was published in 2001 and contained quantified information on: air, waste control and port waters quality, consumption of natural resources and emergency situations. The first EMAS Environmental Statement of the VPA was published in 2002 (the first in the Spanish port system and one of the three in Europe) and has been published annually since then, specifying VPA environmental protection activities in relation with environmental management parameters and indicators.

The municipal PA of **Rotterdam**, in the 1990's, was an active participant in a series of environmental research programs. The pollution prevention and "*the polluter needs to pay*" principle was highly applied to licensing and monitoring protocols. Environmental criteria and targets (particularly in licensing) were ensured by the involvement of the regional DCMR environmental protection agency, while the PA secured private legal agreements with various partners in its industrial complex aiming to be proactive and act beyond mandatory enforcements. The PA attempted to implement environmental management, - based on clear regulations and practicable technology-, and to avoid a bureaucratic driven system, (Paipai, 1999).

Since 2004, guided by its Port Vision 2020 plan, PoR has identified greening plainly as an essential part of its daily management. The port aimed to be clean and green and the urgency of adequate environmental policy was obvious. An extensive array of innovative projects and plans (see Table 4.8) demanded for a constant dialogue between the PA and its stakeholders and new ways of reporting. As a result, the port's monitoring system was upgraded, based on the new ambitious environmental objectives. In 2008, the PERS standard application aimed at the promotion of the port's ecological innovations and the systematization of environmental activities (via the SDM implementation), mostly in terms of economic savings. Within the EMS implementation, the PA launched its Environmental Department inside the Port Planning and Development section. This section is responsible for strategic SD, which "enables the port and industrial complex to function optimally and sustainably, retaining space for growth", (PoR, 2010), with activities under the broad environmental themes of air quality & climate, nature, water, soil and waterbed. The Environmental Department accomplished cross-sectional integration through the port's conventional management after the PERS implementation had ensured the adequate functioning of EM for all environmental aspects.
Above all, the EMS introduction intended to reinforce the port's competitive position, as much as a positive green image effect, so that other companies in the port area would be inspired by the overall objective of the cleanest port-city in the world (PoR, 2008). Consequently, the PA also appointed the Corporate affairs department with the responsibility of implementing Strategic EM throughout the PA. In this context, in 2007 the PA organized the "World ports for a better climate" Conference, promoting the role of EM as an important instrument of environmental protection within the port area, while it began to produce its CSR reports on a yearly basis.

4.3.4 How did the port relate to the development of the standard?

Over time, ports networking and green efforts information exchange may modify institutional norms and behaviour and *thus* push institutionally influenced green path dynamics along new pathways, (Leanch, et.al., 1999).

- *How did then each port case-study relate to the development of the PER standard?*

Dover has embraced the ESPO Environmental Code of Practice since its issue in 1994, and has been working with the EPF since 1998. In order to implement its EMS, -and apart from maintaining its status as a leading port regarding the longest SDM records (from the baseline year SDM98)-, it remains, until today, one of the most pro-active ports in Europe, in terms of collaboration with the EPF on R&D activities related to environmental management. In parallel, the port focused on building its environmental management on scientific evidence, and through the years, it has developed a number of communicative and collaborative schemes with green scientific agencies, producing in-house expertise. Through these activities DHB has developed in-house knowledge of how to confront environmental issues.
Dover has been pro-active since its initial response toward greening via the PERS standard, although this also appears to be a UK response (17 UK ports among the 35 PERS certified, see table 2). In this respect, via EPF/PERS standard, the port was the first to lead a group of green certified ports in this part of Europe; while within the highly connected "green port" network promoted by ESPO/EPF it was among the ports that played an influential role, especially in the setting of norms and standards.

Thessaloniki initiated EMS under the PERS standard for the first time in 2003. The EMS implementation made a significant difference in ThPA's green approach, by incorporating structural changes. The port was among the first European and the first Greek port to engage into the ECOPORTS network and it benefited valuable information exchange while integrating its green policy making a statement for "green goals" by reporting on environmental issues (Naniopoulos, et.al., 2003). On the way to PERS re-certification in 2008, the declared Environmental Policy of the port was actively supported by external consultation, including training support (Vafaki, 2008). ThPA's green efforts were clearly following an acquiescence strategy. The port imitated the peer case of Dover and/or UK ports and complied with the normative pressures of the green port OF, successfully utilizing its relations with the scientific and academic community within the Ecoports network. Although the port of Thessaloniki has carried out some important changes towards greening, mainly in terms of green policy engagement, by aligning its green objectives to the limited of the EPF/PERS standard, greening has not been fully integrated compared to Dover and Valencia. The compliance to coercive and normative pressures in the field has just brought a new organizational green attitude in the port.

Success in green standards is, in general, directly related to the degree of organizational engagement during the standard's development and implementation phases. The **Valenciaport** top management went through all the possible EMS standards' options, having a clear goal towards EMAS implementation. The VPA ECOPORT (I-II) Project, was the first European port with EMS application introducing EMAS in port communities. For both projects, the primary scope was to spread environmental management among PA's and the companies linked with port activities, (Orejas and Monfort, 2001). Already in 2001, VPA released a ''Guide for the implant of EMS in port installations'', -a set of guidelines helping port facilities (including PA's) to plan, implement and ultimately certify an EMS, following the requirements of ISO 14001 and EMAS, (Autoridad Portuaria de Valencia, 2001; Dabra, et.al., 2004; Sapina-Garcia, 2007). As there is not an international ISO standard with specific structural model of an integrated EMS for the community of organizations, the attempt of EMAS implementation, at both levels (PA and port community level), is particularly interesting. The VPA's EMAS methodology, primarily aimed at the green engagement of diverse organizations within the port community, enabling the PA to work toward a common set of shared goals. Different organizations actively engaged in the implementation and development process of EM, are crucial for building, at least, a conscious green community. On the other hand, effectively enhancing port community involvement in greening processes is a totally different perspective in port EM which does not initially focus on problem-solving. The integration of diverse individual EM implementations within a port community under the EMAS standard, added value to the green image, not only for VPA but also for a whole range of interested parties of the port community (42 companies engaged, 22 certified according to ISO14001 up to 2011), (Ferrer, 2012). Being discrete in strategic planning and making it possible by EMS standard implementation, can be a possible catalyst for new ways of delivering environmental performance. In 2002 the VPA EMS model was introduced into the ECOPORTS package and as Dabra, et.al., (2004) point out it *"can be considered as a link between the PERS and international standards"*.

Since the early 90's the **Rotterdam** Municipal PA (RMPM) has been involved in all available European level collaborative projects (i.e. ECEPA, ESPO/Eco-information project). In 1999, along with the Amsterdam Port Authority, RMPM was among the nine EU ports willing to develop ECOPORTS, based on environmental information exchange and the production of tools improving port EM. Finally, in 2007, and after its corporatization, RMPM presumed the ESPO/EPF tools as valuable and in 2008 it was certified according to the PERS standard. Although PoR was particularly active in networking and provided advanced information to EPF partners at a national and EU level, regarding best practices or even innovative sustainability plans (like Rotterdam Climate Initiative (RCI); Rotterdam: CO_2 hub of Europe; Maasvlakte 2 development; R3 project in industrial ecology), the port's individual EMS implementation was delayed and implemented in compliance and by following the norms within the Ecoports green port community.

4.4 Standards as a way of diffusing PEM and the mechanisms involved - Concluding remarks

The European port system, through its diversity, constantly initiates new challenges for the sector. Introducing the green port in Europe has been, for over the last two decades, the ultimate challenge since ports, as places where different transport regulations converge (Lak, 1998), solely relied on European and national policies for environmental protection. However, the acknowledgement that *"the environment is a factor that might help break the isolation"*, -which the port areas have historically had- and *"which has resulted in a delay in the integration of the environmental elements during port planning and management phases"* (Joaquim Tosas, *President PA of Barcelona,* 1st ECOPORTS Conference, 2003)-, launched a *new era*.

In this era, the port's pollution and its causes are identified and port sustainability is a critical matter for discussion, (Journee, 2005), while an ever increasing number of EU ports are committed to implement an environmental policy and manage environmental aspects through EMS standards adaptation. However, managing the environmental aspects of their activities, according to a systemic and preventive approach, requires that ports have a considerable infrastructure, in terms of human, financial and technical resources, regardless of the specific national and/or regional context in which they operate. Constraints and drawbacks-as i.e. resource availability- could compromise ports' participation in voluntary green EM schemes, like EMAS and ISO 14001 standards, as well as their adoption. Establishing a specified port management system, to facilitate, promote and disseminate EM among European ports has been an ongoing objective since the mid-1990s.

In the case of European ports, networking was the evolved effective way to overcome this type of constraints. EPF/EcoPorts, supported by ESPO, has provided a platform for the European port sector to put environmental policy into practice, through EMS standards implementation. Collaboration between port partners, universities and other specialized organizations, has proved effective in the development and delivery of a networked package of management options and offered useful support services designed to assist in the implementation of EM (Journee & Wooldridge,2005). The success of such a venture up to 2010 could be measured, in terms of ports' accredited EMS standards (see Table 4.1). Most of the ports were PERS certified (35), followed by ISO 14001(14). It could also be measured by the ever-increasing number of ports in Europe which are gaining interest in environmental management systems (EMS) and the diffusion of the EPF/EcoPorts tools among diverse ports in Europe. Until 2010, several ports (including ports from France and Germany) were in the process of PERS certification or re-certification while the number of SDM submissions within the Ecoports raised its database to over 80.

The empirical analysis of the selected case studies provided insights to the evolution and diffusion of EMS standards within the green port organizational field, and particularly the *mechanisms detected that allowed the adaptation of the PERS standard in a diverse context*.

- The uncertainty about the consequences of an environmental management activity, or goal ambiguity, is a predictor of ***imitation*** and, as a result, firms may copy characteristics from other firms that are perceived as successful (Boons, 1998). The port of Thessaloniki (ThPA) is an illustrative example of other PAs unsure of the likelihood of possible outcomes and end up to be receptive to information inherent in the actions of others. In this particular case, ThPA -using a pre-existing academic networking connected to the EcoPorts-, imitated Dover's EM implementation in its initial efforts to develop an EMS based on the PERS standard.

- The mechanism of ***indirect transmission*** includes norms diffused through professional networks, consultants, and standardizing agencies (Boons,1998). Within the EcoPorts network the European PAs shared common language, perspectives and assumptions about the nature of PEM. While PAs were urged to employ and implement strategies and policies aimed at safeguarding the environment, which required effective managerial instruments to monitor and control port operations, normative perceptions evolved within the network defined what the port managers ought to do or even limited potential reflections to alternative considerations. Especially, the use of PERS -a sector-specific EMS standard- created a strong potential of further diffusion. Even in the case of the port of Rotterdam (PoR) -a port located in a country, which has advanced respecting environmental regulations, and where the Dutch regulations and laws in the port industry have progressively set specific priorities related to environmental sustainability- the PA, based on long experience of solving environmental problems collaboratively, managed to proceed into gradually building up its own unique sustainability programs and plans (e.g. Maasvlakte 2 development; Rotterdam Climate Initiative; R3 project), aa well as (although in delay) was convinced to employ the PERS standard. On the contrary, the port of Thessaloniki (ThPA) working within the ECOPORTS network, based on the indirect transmission mechanism, has progressively developed self-designed projects to further fulfill the standard requirements.

At the organization level, the firm responds to these pressures through pre-existing channels of communication traditionally employed to engage these occupational communities and interpret and act upon their demands, but in the case of the European ports a pre-existed problem-solving mechanism is evident in all four ports that sought to address multiple and complex coercive demands.

The following comparative Table 4.10 illustrates the detected diffusion mechanisms that shaped both field and individual port greening.

Comparative Table 4.10: Diffusion mechanisms that shaped both field and individual port greening

mechanism	Dover / UK DHB	Thessaloniki / GR ThPA	Valencia / ES VPA	Rotterdam / NL PoR
Detected diffusion mechanisms at the organizational level				
Problem solving	Confrontation with evolved issue specific national legislation that required scientific evidence in tackling environmental issues **PERS, ISO14000 certification**	Confrontation with severe national and European coercive pressures **PERS certification**	Self-defined environmental awareness focusing on port community greening **PERS, ISO14000, EMAS certification**	Extended experience in collaborative problem solving regarding diverse and complex environmental problems **PERS certification**
Learning	Continuous expansion of knowledge on the port's environmental impact and knowledge base of environmental information on biodiversity data Gradual integration of an innovative environmental performance reporting system to port's EMS Continuous upgrading of staff cooperation in environmental information exchange	External consultancy from the academic community Strict use of the Ecoports tools (SDM-PERS)	Self-promoted ambition to understand port environmental impact on port community level Continuous expansion of knowledge to look for solutions to port environmental problems via EMS implementation Pioneer port gradual upgrading of EMS standard in line with the ESPO suggestions Ability to work with stakeholders on environmental solutions at the port community level	Capability of promoting innovation through public consultation processes Ability to work with various stakeholders on environmental solutions Ability to engage in sustainability plans beyond standard driven PEM
Detected diffusion mechanisms at the field level				
Imitation		Imitating the pioneer Dover within the Ecoports network		
Indirect trans-mission through standard adoption	Pioneer in implementing the Ecoports tools (SDM-PERS)	Gradual adaptation of the PERS standard Advanced networking within the Ecoports	Pioneer in transfusing EM tools and best practices to the EPF network Pioneer in EMAS application	Leader position in networking within the Ecoports, contributing a unique green vision. Delay in PERS application

- At the organizational level a ***problem-solving mechanism*** is evident in all four ports. In all of them, it was initially employed to efficiently manage the impact of the EU, national and regional regulatory demands in terms of obligations and liabilities the PAs had to respond since the 1990s. However, as the EMS is a problem identification and problem-solving tool that provides organizations (PAs) with a method to systematically manage their environmental activities, and helps them achieve their environmental obligations and performance goals (US EPA, 2003), all for case studies progressively employed this type of problem-solving mechanism to manage their greening efforts. The PERS standard itself as a port specific voluntary green standard, includes the dimension of creative problem-solving in environmental strategies (Jennings & Zandbergen 1995; Russo & Fouts 1997). Strict environmental legislation has traditionally forced ports to embrace continuous compliance, but since the mid 2000's the EU PAs have not been afraid to submit their EMS to an external verification or to disclose information, regarding their environmental performance, to the public. It is also evident, that the mechanism appears in different periods of time since each port, according to its individual characteristics, had to face unique challenges in implementing EM. The evolvement of national policies, social environmental awareness as well as vision realignment, were some of the issues involved. In the case of Thessaloniki, the mechanism appears to be more evident; since compliance with severe coercive pressures -in the lack of any national policy- created a more pressing need (see Table 4.10).

Proactive environmental strategies are path-dependent upon unique organizational actions and learning under a period of time (Hart 1995; Sharma & Vredenburg, 1998). All examined ports were proactive in terms of their voluntary green strategies that required and involved creative problem-solving in the search and adoption of green managerial practices.

- The degree of pro-activeness varies depending on the involved ***mechanism of learning*** that each port organization develops. All four investigated ports were connected to the EcoPorts network and applied the PERS standards. Two of them, namely the ports of Dover (DHB) and Valencia (VPA), used the standard's implementation, as a threshold to ISO/EMAS standard, and a key point for introducing continuous learning procedures in PEM implementation (see Table 4.9). However, learning at the organizational level was highly affected by the individual port characteristics and/or the way the pre-existed regulatory demands' problem-solving mechanism evolved to a point affecting the EMS standard's implementation. VPA's gradual upgrading of all possible EMS standard was based solely on the organizational ambiguity to understand and tackle port environmental impact at the port community level. In this case, EMS standards used for continuous expansion of knowledge searched for solutions to port environmental problems and gradually reinforced the PA's ability to work with stakeholders on environmental solutions at the port community level. The port of Dover (DHB) case, as well as, the extraordinary success of PERS among the UK ports, can provide us with an insight. DHB's PERS implementation was extremely successful based on the PA's pre-existing knowledge on the port's environmental impact and the established in-house learning mechanism related to the national policy quest for scientific knowledge and knowledge basis of environmental information on biodiversity data. The PERS implementation advanced the integration of an innovative environmental performance reporting system to port's EMS. Respectively, the PERS standard diffusion in the UK, can be explained by the "proactive" environmental attitude of the national port policy. In addition, a high level of environmental culture and networking processes willing to encourage environmentally friendly PAs have stimulated and facilitated the UK ports to participate in green schemes. In the port of Thessaloniki (ThPA), the use of the EcoPorts tools -and especially the PERS application- initiated the port's learning mechanisms correlated to the employment of environmental practices. Finally, the port's of Rotterdam (PoR) delay to apply the PERS standard, was exaggerated by the already established organizational EM practices, which were managed from various departments and based on a continuous updated knowledge related to various regulatory regimes' demands and technological innovation, as well as, upgraded stakeholder integration. Hence, the port advanced a learning mechanism that has provided it with the ability to engage in sustainability plans beyond standard driven PEM.

Detecting the mechanisms, through which practices were developed or adopted in each case study, we followed each port's path to greening. Through the diversity of the investigated ports, it has become evident that regardless of how EM was initiated or shaped in each individual case, all four ports, in some way, benefited from the use of this sector specific, self -regulative EMS tool, as the PERS standard. Having implemented EMS and being accredited according to the PERS standard, is considered to be a positive differentiator (Dabra, et.al, 2004), that opens the path to the above comprehensive standards, as well as, a voluntary scheme that proves its efficacy on the (green port) field by leading to an important improvement of environmental performance. Respectively, individual ports' EMS implementation, although in varying degrees, contributed to the advancement of the standard. The green port organizational field was shaped in action, and detected mechanisms were part of the factors that produced action at both the field and the individual organization level.

CHAPTER 5: Individual port strategic responses to the emergence of PEM

5.0 Introduction

Over the last fifteen years, following ESPO recommendations, the EU ports have made some important steps in EMS standards implementation. Within the European green port field, each individual port's green efforts and results constituted the basis for information exchange while the various ESPO surveys added to benchmarking and to a meaningful debate on port EM implementation in Europe, *but* methodologically, research into environmental behavior within European ports has certainly some way to go. An instantly triggered question by the theoretical background would be:

- Is it possible that conforming to institutional pressures *is not* an exclusive option -though a tempting one- in order to gain legitimacy?

This question follows the possibility that ports develop their own distinctive modes of organizing environmental management, depending on the way they perceive it as a strategic issue. Port organizations provide an interesting research context in terms of a dynamic international business environment in which regulatory, market power and social demand factors may recount each port's strategic choice towards greening. Although there is an emerging literature on environmental management in the port sector, institutional theory driven perspectives have not been applied in order to explore what actually induces individual port organizational strategies towards greening.

In this chapter, a case-studies analysis aims to fuel the understanding of the institutional factors' impact that affects the individual PA strategic choice on greening via PEM implementation. The analysis addresses the following questions:

- How did port organizations deal with isomorphistic pressures?
- What were the strategies of leaders-laggards?

The development of a coordinating institution for the EU port's transformation towards greening is most logically expected to confront different reactions from the various actors involved in the field. Oliver's (1991) range of strategic responses enables the examination of institutional pressures for green change within a context of diverse strategic organizational responses. Her framework introduces different variables representing strategic responsiveness, which vary from *active* to *passive* and, from *conformist* to *resistant* (Oliver, 1991:151), with the possibility of achieving various gains. This part of the research uses the Oliver typology, as a first step to test the variety of green port responsiveness and adds to the detection of the different port leaders-laggards' strategies within the European green port organizational field. Organizational responses to institutional pressures towards conformity will depend on *why* the environmental pressures are being applied, *who* is applying them, *what* pressures are being exerted, *how* they are applied and the nature of the environment in which they occur (see Table2.2 p:46). The answers respectively correspond to the five institutional antecedents (cause, constituents, content, control and context) that are held as predictors of the organizational response (Oliver 1991:159).

The analysis' expanded research criteria are based on EMS standards implementation; and within this context the selected case studies implemented EMS standards and were certified within the research time-period (1993-2010). They have considered EMS standard implementation as a strategic necessity and thus, these ports <u>*have not*</u> selected *avoidance* or *defiance* as their green strategic response to institutional pressures. Consequently:

- The four port case studies' green strategic responses are identified within the range of ***acquiesce**, **compromise** and **manipulate,** followed by the related threefold sub-divided tactics.*

The following sections 5.1 to 5.5 present the analysis of the factors that are employed in order to characterize the institutional context and conditions under which the selected port organizations have embraced or resisted institutional pressures and thus, they illustrate the individual port managerial perceptions of institutional antecedents in adopting EMS standards. The final section 5.7 of this chapter summarizes the characterization of each of the five antecedents and their predictive factors and presents the analysis' conclusions on the individual port strategic responses to the emergence of environmental management.

5.1 Perceptions of constituents: multiplicity and dependence

(Who is exerting institutional pressures on ports?)

The Oliver's (1991) constituents' factor observes the multiplicity of the actors imposing the green pressures as well as the dependency of the port organizations on them, by asking *who* is exerting pressures. According to Oliver (1991) multiple potential competing actors prevent compliance with the institutional demands and encourage resistance strategies. Conversely, the extent of the relations among network members (institutional field) that provide access to valuable green resources determine how organizations are dependent or not on highly influential constituents, when alternative sources of valued resources are limited or unavailable.

5.1.1 Multiplicity

"Ports in the European context operate within an ever-changing environment which has put strong pressure on the traditional role of PAs, while PAs were influenced by a large number of external parties to produce green results" (Eco-information project - Final report, 1999).

- **Multiple pressures on ports derived from diverse environmental regulators.**

Port literature has already identified that green matters driven by regulatory compliance are an increasing part of port agendas (Chlomoudis & Pallis 2002; Beresford, et.al., 2004; Adams et.al., 2009; Verhoeven 2010; Acciaro, 2013). However, the 2004 *"ESPO Environmental Survey",* reviewing EU ports' performance on PEM, highlighted the multiplicity of agencies responsible for environmental protection which revealed constraints for the majority of PAs. The 2009 *"ESPO/EcoPorts Port Environmental Review"* pointed out the difficulties that EU PAs were facing in implementing the environmental legislation mainly because of the immense number of authorities and stakeholders they had to deal with (ESPO, 2009). ESPO exceedingly indicated the raise of controversial demands among the two main EU legal instruments- the Birds and Habitats Directives and the Water Framework Directive (WFD), that affected port extension and dredging works (ESPO, Annual Report 2004). Indeed, legislators seemed to acknowledge the critical significance of dredging for ports. ESPO plainly pointed that environmental decision-makers -in EU as much as at national levels- are often unfamiliar with the functioning of ports and their environmental complexity (ESPO, 2004). Moreover, among EU member states, national sustainability policies have been adopted and enforced based on the UN SD concept and on various EU treaties that have incorporated the aim for SD: climate change mitigation -which also have an impact on individual port environmental policies. National policies promoting Integrated Coastal Zone Management (ICZM) were also relevant to port obligations. Multiplicity and conflict may also rise from further institutional interaction. Around Europe, the coastlines are affected by several environmental regimes which evolve pressures from diverse institutions. Apparent examples are the Baltic Sea as much as the Mediterranean Sea which are both affected by several green international and regional regimes.

Already in the 1990's, the UK ports were confronted with a complex mandatory framework of many different national, EU as well as international laws and conventions, regulations and agreements, (see annex1 p:2). The *port of Dover* (DHB) environmental manager confirmed the multiple and diverse legal requirements the port had to deal with:

"We had to follow the application of huge amount of relevant mandatory demands, following national policy guidelines, EU and international environmental regulations. The diversity of the environmental law, we had to conform with was such, that it almost advocated the port to develop its EMS."

In the 2000's, important steps towards unifying the patchwork of legislation that had governed UK's marine environment were taken and since 2008, a coherent UK marine policy in terms of Integrated Coastal Zone Management (ICZM) has been in place, (see annex1 p:2). Since the 1990's, DHB's environmental policy has demonstrated the port's continuing commitment to the environment and according to the environmental manager it was developed on a scientifically based approach following constantly upgraded national policy demands and guidelines:

"The UK national policy makes specific reference to safeguarding our coastline sensitive sites. This mainly supported the need for the port to develop its environmental policy on a scientifically-based approach."

In Greece, the port environmental legislative context has been mainly formed from the harmonization process of the national legislation with EC Directives and international treaties (see annex2 p:2). The *port of Thessaloniki* (ThPA) was conscious in delivering compliance with the national legislation to keep away from enforcement actions, but in the beginning of the 2000's, the ThPA administration faced mandatory pressures from the need to confront multiple EU Directives and regulations. While the environmental legislation was enriched with new requirements, the national policy for environmental protection included only general guidelines related to ports without indicating or advising specific greening actions, which the Greek ports had to follow. Therefore, complying with the law was the main concern of the port's administration. The port's environmental manager explained:

"Before the EMS implementation our Legal Affairs Office was responsible to scrutinize the legal requirements according to the national law for environmental protection.
In 2002, we were aware of the forthcoming pressure of EU legislation and the multiplicity of the regulative agencies that we had to confront after the harmonization in the Greek context, but we had to show results of responsible environmental behavior to avoid penalties. The application of national legislation and EU Directives requirements has been the main priority."

The *port of Valencia* (VPA) also confirmed that multiplicity derived from diverse environmental regulators but the interviewees put it in a different perspective. VPA's administration considered that their business response to a green pro-active attitude would be advanced no less multiple but a more *"efficient environmental legislation"*. However, the emergence of the national policy on sustainability has been supported by an extensive set of environmental monitoring indicators for various environmental aspects (see annex3 p:3). As a result, the Spanish port sector benefited research projects- at a national level- that produced sector specific monitoring indicators and related environmental monitoring guidelines (see annex3 p:25).

"The PA follows the rules under EU, national and regional legislation implementing its environmental policy since 2000. The quest of efficient environmental legislation is critical. Our management system has to review constant changes in different kinds of legislation, applicable in each specific environmental aspect related to the port's activities. Multiple demands could be applied within the least time and effort"

Most of the interviewees in the *port of Rotterdam* (PoR) insisted that the port was confronted with highly diversified requirements from all kinds of environmental legislation at the European, national and local level. The port's large investment of the Maasvlakte2 expansion required procedures at the local, national and even EU level. The country's national environmental policy has been an ecosystem-based policy integrating different areas of environmental concerns based on 'themes' of environmental problems (see annex4 p:2). Its revised version in 2001 incorporated quality of life concerns as a core theme and 'transition management' as key governance paradigm (see annex4 p:4). In the case of Rotterdam, a mixed type of national, regional and local policy framework supporting environmental protection in the Rotterdam port industrial complex- in terms of living quality in the surrounded residential areas-, the so-called ROM-Rijnmond program, was running until 2010 (see annex4 p:12). This original political approach and the institutional changes in the management of the Rotterdam PA (see annex4 p:8) was a political modus vivendi that supported the final agreement for the Maasvlakte II expansion and consequently, the port's competitive position as Mainport. The ROM-Rijnmond plan's framework -which was a direct effect of overall national legal context for key planning decision - although it did not regulate it aimed to increase confidence in the parties involved while allowing the government and the PA to develop the Mainport vision for the port. However, indirect governance is also performed by regional and national government through means of (environmental) regulation and permits (de Langen, 2007). Beyond compliance with regulation, the PoR Mainport vision- incorporated two main objectives in its environmental agenda: the introduction of the SD concept into the port's development and the internationalization of the port's environmental policy (see annex4 p:11). Schrijnen (2003) suggests that the PA found itself in a totally new institutionalized project-driven setting. The interviewees stated:

"The port's daily operations are exposed to multiplicity and complexity concerning environmental legislation. We have to deal with environmental legislation related to different kinds of activities that take place in the port like shipping, tenants and various firms, infrastructure maintenance and port development."

"In the context of ROM-Rijnmond plan, as agreed, the further development of the port will take place on the basis of two objectives of equal value: improving the economy and the living environment. It is the first time that the port's expansion will go hand in hand with improvements in the living environment."
"Since 2004 the PA is government corporation and thus should execute all of its policies including environmental according to the terms of the Dutch Corporate Governance Code."

- **Multiplicity and conflict derived from the port-city interface**

For ports in different points of the continent, -besides the environmental pressures from diverse agencies-, a noticeable growing lobby pressure from citizens, municipalities and other stakeholders has also evolved with a clear and rather motivated message: *"ports have to advance in sustainability"* (EcoPorts Conference Barcelona, 2003). Thus, following societal demands the need to ensure their *"license to operate"* (De Langen, 2004; Adams, et.al., 2009), even in cases where it is not expected to operate in the public interest, it forced ports to advance green practices and inform the related outcomes in a reliable and transparent way. They were occasionally forced to afford different kinds of investments for environmental protection reasons, which was even more essential in case their strategic planning involved development plans.
A depiction of what exactly the port-city interface may stress -*in terms of conflict and multiplicity of greening demands*- is illustrated by the following definition of the *'environmental port-city interface': "Area where responsibilities of the PA and local administrations converge and where environmental aspects generated in one of them could generate environmental impacts on the other."* (VPA, SIMPYC project –see annex3 p:26)

In the *port of Dover* (DHB), the urgent need for good relations in the port-city interface has prioritized action to avoid complaints. Introducing the port's managerial response to these particular pressures, the environmental manager revealed that beyond regulative demands for greening in the port's daily operations, intense pressures derived from two different needs: *First*, the port's necessity to expand and *second*, the need to sustain good relations with its surrounding community. The aforementioned compelled the management's support for environmental quality in EMS implementation. He explained:

"It's not always a matter of conflicting demands -although occasionally this is the case during consultation dialogues in port-city issues- but rather than multiplicity of demands emerged from different types of environmental agencies. We need to work with the Dover District Council to monitor and improve the air quality within the local Air Quality Management Areas and to carry out water quality analysis of Dover Beach on a weekly basis throughout the bathing water season and publish the results to inform the public."

and further:

"Port development planning involved understanding of the environment, and required compliance with multiple wildlife legislative requirements. We carry out specialized surveys in marine ecology, over-wintering and breeding bird surveys and a terrestrial habitats survey. When it is required different bio-diversity objectives are taken into account when developing policies and programs".

In Greece, although since the 1990's environmental concern appears to be rising in general, environmental claims are declining. Generally speaking, organizational greening is developed by conformity to the law, although law enforcement is limited (see annex2, p:4). According to the interviewee for *Thessaloniki port* (ThPA):

"We were determined to show results of responsible environmental behavior, mainly from the environmental legislation and subsequently from societal demands, although we did not face any pressure for greening from the local municipal authority, nor from environmental organizations."

This is also clear due to the port's 'isolation' from potential local and regional planning. Even the crucial aspect of its 6th pier development was always faced from a political, economic, legal and technical feasibility without confronting implications to the port's regional context; nevertheless, the implementation phase has been acknowledged as technically environmental friendly best practice (see annex2 p:17-18).

In contrast, the *port of Valencia* (VPA) has been actively engaged in the local societal pressures for greening by integrating the demands within the port's strategic position in order to invest in sustainability. The SIMPYC project (2004-2008) (see annex3 p:30) produced a port-city interface Environmental Action plan and a model for a port city co-ordination instrument aiming to confront multiplicity and prevent conflict. The interviewees clarified:

"As we work to grow a sustainable port, we must first understand trade demand and how we can ensure collectively that we have the ability to meet this demand, while balancing the potentially conflicting pressures of competitiveness, efficiency, (safety), environmental protection and local and national communities' needs and aspirations.";

and further introduced the port's efforts towards local pressures:

"VPA worked on an environmental integration system (delivered by the SIMPYC project) for both the port and city goals to get a sound knowledge of the different environmental aspects affecting port-city relationships (noise, air-quality, visual impact); to co-ordinate environmental management processes, carried out in port and city environment; and to develop joint initiatives for environmental monitoring in the port-city interface."

In the *port of Rotterdam* (PoR) case, both seaward movement of the port and the recent trend of port regionalization foster new relationships between port and city. As its cargo hub became more and more automatized, the port's ongoing growth, *especially in terms of efficiency*, had impact on the quality of life in the city. The PA was facing a negative image as residents perceived port expansion mainly in terms of negative effects for the local community, i.e. noise and air pollution, road congestion, landscape disturbance that influenced public support at the local level.

In the 1990's, the port's municipal management shifted its organizational focus *from* the port's growth and development *to* societal and environmental priorities. Both the city and the PA got engaged in developing a common strategy based on a vision which was supported by two fundamental cornerstones: strong economy and attractive city. Sustainability concerns were incorporated in the two significant development projects in the port area that were part of that vision: the development of the Maasvlakte2, as part of the Mainport Development Rotterdam project (see annex4 p:23-25), and the redevelopment of the City-Ports. The interviewees highlighted:

"The PA has invested in gaining public support for commercial activity in the Rijnmond area; we had to earn the license to operate. This was the main reason to be engaged in cooperation at the local and regional level. After the ports corporatization, we have been continuing the same path by pursuing an ambitious Corporate Social Responsibility policy."

"We have learned through the years that setting up strategy and plans, there is no other way than involving all possible stakeholders. This is not an ad-hoc practice; we have to be constantly in dialogue with them. We use stakeholder management as a necessary instrument."

The following Table 5.1 comparatively summarizes the individual port perception on the multiplicity of the actors involved that exerting institutional pressures on them.

Table 5.1: Multiplicity as predictive dimension of individual port strategic response

Multiplicity	
Who is exerting institutional pressures on ports?	
Dover	• Multiplicity of pressures from diverse national and EU environmental regulators. • National context towards sustainability promoting advanced scientific knowledge on port greening. • Multiple demands derived from the port-city interface.
Thessaloniki	• Multiple pressures under the harmonization of EU legislation in the national context. • Deprived port specific guidelines in the national green policy framework. • Limited interaction of the PA and administrators at the municipal and regional level.
Valencia	• Multiple green regulative demands from EU, national and regional level. • The emergence of the national SD policy supported the Spanish ports with sector specific environmental indicators and monitoring guidelines. • Environmental Action plan and model for port-city coordination to confront multiplicity and conflict.
Rotterdam	• Highly diversified requirements from all kinds of environmental legislation at the European, national and local level. • Indirect governance by environmental regulations and permits at regional and national level. • The PA guided by an institutionalized project-driven setting in forming environmental strategy. • Since 2004 the PA endorsed the Dutch Corporate Governance Code. • Ongoing port-city interaction. Multiple actors' engagement in port-city sustainability focus projects to confront negative image and sustain license to operate and develop.

5.1.2 Dependence

The degree of dependence, which characterizes the relationship an organization has with the source of the institutional demands, is another important factor that predicts the potential process of strategic choice. Oliver (1991) argues that the level of the organization's dependency on these constituents affects its strategic response. The organization will tend to manipulate in case of low dependency, and on the other hand to acquiesce or compromise in case of high dependency on the external constituent.

- **ESPO/EPF power managing the accessibility and distribution of important resources**

The concept of port environmental management (PEM) has developed and spread in Europe during the last two decades. The milestones of the sector's self-regulation approach towards greening were the ESPO "Environmental Code of Practice" in 1994 and the sector's collaborative response to the Code's recommendations. Until that time many ports had developed environmental plans and had found solutions, mainly technical in nature. The ECO-Information project in 1999 was the first survey indicating that ports had started to tackle environmental issues from a management perspective, although EU PAs were still focused on an issue-based approach to confront their environmental responsibilities. The ECO-Information project observed differences among EU ports in the implementation of green objectives as much as in the application of green actions: *"The solutions received from the ports are rich in variety"* (ECO-Information project, Final Report, 1999:37).
The accessibility to integrated PEM knowledge and experience was poor. Progress in that direction was driven by mutual collaboration between the port sector, port professionals, academics, research institutions and specialist organizations. The framework for this mutual collaboration was developed through joint activities primarily initiated and funded by port partners and partly by EC R&D Programs such as Eco-Information (1997-1999) and ECOPORTS (2002-2005). According to Mr. Megalidis' statement representing the EC/DG TREN in the EcoPorts Conference in Barcelona (2003) the ECOPORTS project contributed to a:

> *"new environmental awareness in ports through fully incorporating and benefiting from practical environmental management tools, while the Commission considered this particular project as a very good example of money well spent."*

European legislation has been considered the main driver behind ESPO/EPF tools (Dabra, et.al., 2009). Already in 2004, there were no less than 30 EU environmental legislative texts applicable to port operations, mostly in the form of Directives. Since 2004, a library of environmental legislation has been available on the ESPO website and it has provided detailed and up-dated information on the international as well as EU rules and guidelines which affected the activities and developments carried out in EU ports (ESPO news, Vol:10.05, May 2004). ESPO suggested that the information provided should be used in conjunction with the ESPO Code. Thus, the ESPO Library-Code combined effort, summarized legal requirements and connected them to the highlighted practical implications for ports and managerial recommendations for their implementation. In addition, from its establishment the ESPO/EPF close collaboration was aiming to improve synergies between port environmental policy developments, technical knowhow and research (ESPO Annual Report, 2007). As a reminder to the reader it is emphasized that all the examined ports have endorsed the ESPO Code and are members of the EcoPorts network.
In the 1990's, a number of ports were leading the way and by confronting EU and national environmental regulations and spatial planning restrictions they accomplished *'learning by doing'* experiences. By the end of the decade, there were few that persisted on employing the ESPO/EPF tools aiming to put PEM in practice and in 2003 the first EU ports were PERS certified, after having successfully implemented the requirements of the EMS standard promoted by ESPO/EPF. ESPO highly suggested that the leading green ports knowledge can help other ports learn how to cope with current environmental challenges. (ESPO Annual Report, 2006). Therefore, the EcoPorts Foundation (EPF) was introduced and promoted as a network to exchange experience on port environmental solutions and port EMS standards implementation (Wooldridge, 2004; Journee and Wooldridge, 2005; EPF, 2006; Journee, 2008). The EcoPorts network indeed managed the accessibility and distribution of important green port organizational resources for those ports that did not have an alternative

provider. Since 2002, it has provided professional cooperation and specialized consultancy services to the network members and it has made PEM solutions broadly available with the main scope to create a level playing field in greening among ports in Europe.

- **Individual port efforts on alternative resources or resource providers**

Almost from the beginning of the 1990's, the *port of Dover* (DHB) interacted with various institutional actors within the UK national context, aiming to integrate environmental issues in its managerial plans. It has been an active ESPO affiliated port since 1993, when it initiated its first environmental plans (see annex1 p:38-41). Since 1998, it has been an active member of the EcoPorts and the first EU port accredited with the PERS standard certification, in 2003 (see annex1 p:43). The port's long record in building its EMS credentials was initially supported by a variety of UK scientific research institutes that enhanced in-house capabilities in environmental monitoring. Furthermore, DHB was actively involved in the EU Eco-information project (1997-1999) and frontier in implementing the SDM'98 tool by formulating its EM in a more systematic approach. The port's environmental manager verified that:
"*DHB has long recognized the value of monitoring and reporting its environmental performance as an effective approach to EM and stakeholder relations and thus effectively enhanced monitoring practices*"
"We recognized the need for a structured approach that could fit in the port's own needs and environment and this was the key reason that the port got involved in the trial of the ECOPORTS tools in cooperation with the University of Cardiff".
To the reader's information an important point, which should be emphasized, is that the University of Cardiff has been the main scientific coordinator in the EcoPorts network. Dover was the pier port in PERS implementation. This was feasible mainly because of the port's previously established monitoring system that followed a long record of legislative requirements and a national policy which requested scientific validity in environmental performance. UK ports were extensively involved in the sector's collaborative projects by promoting and enhancing port environmental protection. The PERS standard implementation for the DHB was its stepping stone to the following ISO 14001certification (2008) (see annex1 p:45).

The *port of Thessaloniki* (ThPA) was not involved in any kind of environmental management plan until 2002, excluding its management practices on health and safety for employees' safety conditions (see annex2 p:26). Evolving legislative demands and the lack of knowledge in how to implement the EU Directive on port waste reception facilities, forced the port's management to benchmark European and international experience in environmental protection. The top management commissioned consultancy services by the local academics and through these constituents it was introduced to the EcoPorts network.
Back in 2002, the ThPA management initially aimed at capacity building in terms of legislation compliance. However, within limited time the top management was convinced that is was equally urgent to identify the best way available for introducing green managerial practices into the port's evolving corporate policy. According to the port's environmental manager:
"Prior to that time our concern and knowledge of environmental protection was limited. We had to benchmark port environmental best practices in Europe and internationally. We considered the potential to adopt the internationally recognized ISO 14001, but we concluded that the port could not confirm activities or processes according to the standard and that the possibility to introduce this kind of environmental practices in our daily activity would entail substantive investment in time and money by the PA."
Considering the low priority given by the Greek port sector in integrated environmental initiatives (see annex2 p:5), within the national context the related experience was poor. Palantzas et.al., (2005) while introducing the port's PERS application, advocate that ThPA likewise many other EU ports integrated environmental protection practices into daily operation and sought to timely correspond to the *"new global trend"*. The port commissioned consultancy services by local academics and through these constituents it was introduced to the EcoPorts network (see annex2, p:44-45). ThPA was among the first group of the EU PAs accredited with the PERS certification. It was the fifth port to receive the certification (in 2003) and the first one in the Mediterranean. This outcome was based on a harsh structural guidance by EcoPorts specialists on how the PERS standard had to be implemented. By implementing the EcoPorts/PERS standard the port advanced its first environmental policy

declaration, while the PA was provided with its Environmental Management Department. The environmental manager explained that:

"The port's top management supported a research project undertaken by the local university, aiming to set up an environmental policy framework and face specific environment related issues. At the same time, the port joined the EcoPorts network and the EPF tools were introduced to us."

"Using the EcoPorts tools (SDM and PERS) we had been able to recognize the actual environmental situation in the port area and to identify legislation relevant to the port's environmental aspects. Consequently, we were capable to rank our environmental priorities and formulate the port's environmental policy".

Until 2010, the port continued to receive external consultancy (from local academics) that provided the port's Environmental Department with specialized advice and carried out specific tasks on environmental monitoring, aiming to further enhance its EMS.

The ECOPORT I project (see annex3, p:22) was the ***Valencia port's*** successful individual effort in EMS implementation. The main result was the development of a unique methodology that assisted the port in identifying environmental aspects related to its own operational activities and thus in simplifying the subsequent EMS implementation. During the ECOPORT's first phase, the PA managed to initiate its Environmental Policy (2000) and set its green targets for the upcoming decade. The environmental manager made clear that:

"The PA managed to detect a series of unsolved needs and benefited from the analysis provided by the ECOPORT project."

The port was strongly committed to EMS implementation towards being a green port, while the top management plainly considered that EMAS provided the framework and structures that could promote environmental protection in the port's cluster port community (see annex3, p:36). This decision was following the managerial perception that:

"EMAS registration is the best tool to prevent or reduce the possibility of pollution. The standard is based on principles of continued improvement and besides the essential advantage of this fact, it is totally in line with the accepted culture at the top management level that we have to advance in quality."

In fact, beyond this managerial objective, the VPA management has managed to finance its EMS implementation through EU funding. The LIFE EU's financial instrument was directly and indirectly supporting the EMAS implementation and thus it was instrumental and of vital importance to the VPA's EMS introduction. The indirect support was in the dissemination scale of the project at the European level. Ultimately, the port of Valencia was the one of the few ports that favored EMAS standard for their EMS implementation. Initiating EMAS in EU ports, LIFE supporting projects has been a managerial preference that was followed by PAs in the southern part of Europe, as there were two port cases in Spain (Valenciaport and Coruna) and two others in Italy (Livorno and Venice). The VAP's environmental manager explained:

"The ECOPORT Model was based on the EMAS/EC Regulation 1836/93. This tool provides ports with a framework designed to give a corporate image to the port area, mainly based on the regulation's validity and its applicability in all member states. In this sense, it was not the 'what' but the 'how'. Yes, we applied PERS a very port friendly standard, but it was the adoption of ISO 14001 that worked for us as the management system element of the EMAS registration, and consequently allowed progressing to our final target, the EMAS certification."

Until the time that the EU collaborative EcoPorts project (2002) was initiated, VPA had already established its own methodology for port EMS application and it had been involved in the INDAPORT project (see annex3 p:29) in order to establish a system of indicators that supported its EMS implementation. However, the port was an active member of the EcoPorts network and confronted the difficulties of the EMAS application using all the suggested stepping stones to the benefit of the final scope. VPA had been successively PERS and ISO14001 certified before its EMAS validation. PERS is a port specific standard that primarily helps ports identify problems, set up green objectives and finally form an Environmental Policy. In the case of VPA, all of them were already in place, allowing the port to be among the first PERS certified ports and the first in Spain. The ISO14001 certification emphasized the will for further improvement and was instrumental in the port's EMAS application. In this respect, the VPA's ECOPORT project may be considered the precursor of port EMS in Europe, which yet explicitly promoted the VPA's EMAS standard application.

In the case of the *port of Rotterdam* (PoR), the PA has both power and responsibilities- regarding environmental protection- closely working with various governmental entities and DCMR -namely the regional environmental protection agency responsible for granting licenses and environmental regulations enforcement in the port area. Both the municipal and corporate management (since 2004) of the port have been strategically positioned towards environmental protection.

In the 1990's the municipal management of the port clearly drew its attention to cautious and accurate environmental performance complying with strict national and EU legislation and following the national policy suggestions. The port has implemented many environmental actions or activities under the *"clean port"* strategy (see annex4 p:50). Knowledge of environmental issues has been progressively built mainly based on research initiatives and problem-solving approach. The port's environmental manager illustrated the PA's efforts:

"Working on environmental issues allowed us to discover the fact that investing in sustainability and environmental protection also delivers a return to the port. Building in sustainability has been an ongoing process for the past two decades. For the last 20 years, we are implementing the Rhine Research Project. In the last 15 years, we focused on soil and noise problems in the port area. For more than a decade we have been persistent enhancing an integrated environmental policy in the port.
In the last 5 years, we have been putting into practice area-focused ecological plans. Since 2007 we have incorporated CSR in our strategic planning.
We consider CSR as a working method that is sustainable, committed and transparent."

Since 2000's, Dutch seaports have been strategically oriented to improve infrastructure and spatial bottlenecks aiming to enhance their economic function. Despite considering the environment both as an opportunity and a threat, the Dutch port sector- characterized the Dutch ports as capable of quality and risk management and, notwithstanding its difficulty, it suggested that they should be pioneers in sustainability. Sustainability was considered as increasingly important to the port's competitiveness (see annex4 p:7) and thus, the SD concept was the PoR's priority. SD concerns were definitely elaborated by the PoR's Port Vision 2020, which aims to create a *"quality port".* It still focuses on the *"clean port"* targets –of the previous Port Vision 2010-, while it promotes the realization of the ambitious *"energy port"* (see annex, p:33). From 2004 onwards the PA continued planning long-term initiatives or innovative actions under the broad *'quality port'* strategic goal (see annex4 p:51). According to the port's interviewees both goals have been supporting quality and sustainability in the port area. The Port's Vision 2020 objectives have been translated into six goal scenarios (versatile, sustainable, knowledgeable, fast and safe, attractive, and clean port) and a comprehensive quality map. All these elements were initially developed in the PoR's Business Plan 2006-2010. For the coming years, the port has been strategically focused on accessibility and the environment (in particular air-quality) by developing policy and related targets in continuing to work on a joint authorities' approach. According to the interviewed port's experts:

"Our ambition is to improve both our own performance and that of the port, when it comes to sustainability. The Port Vision 2020 means the further development of existing strong points of the port and solves bottlenecks on some environmental issues and infrastructure.
This requires collaborative efforts on the part of the municipality of Rotterdam, which is responsible for spatial planning and for public tasks related to safety and the environment, and the Port of Rotterdam as manager and developer of the port area."

The following Table 5.2 comparatively summarizes the individual port perception regarding the likelihood of their dependence to form their individual green strategic response to constituents that exert pressures.

Table 5.2: Dependence as predictive dimension of individual port strategic response

Dependence	
Who is exerting institutional pressures on ports?	
Dover	• Strong pressures from national policy requesting scientific validity in port environmental protection, required collaboration mainly with UK academics and research institutions enhancing the validity of EM practices, particularly in monitoring. • Pioneer use of SDM and PERS EPF/EcoPorts tools.
Thessaloniki	• Lack of knowledge in port environmental protection led to the port's EcoPorts membership. • Cooperation in environmental protection with local academics. • Extensive use of the EPF/EcoPorts tools.
Valencia	• Own methodology (analogous to EPF/SDM) for port environmental aspects identification supported EMS implementation. • Cooperative and individual research for identification of a system of indicators that enhanced EMS implementation. • Own research on EMAS application financed by LIFE EU program. • Towards EMAS certification consecutively PERS and ISO 14001 certified.
Rotterdam	• Long record on research initiatives progressively building knowledge in port environmental issues. • Cautious and accurate environmental performance complying with national and EU legislation. • Strategic goals are driven by national and regional policy implementation and action. • Working with various entities in joint authorities' approach in green planning and implementation.

5.2 Perceptions of context: uncertainty and inter-connectedness

(What is the environmental context within which institutional pressures are being exerted?)

The individual port's institutional context can also determine its strategic response. According to Oliver (1991) in an *uncertain* business environment an organization will exert greater effort to re-establish its perception of reality in terms of control and stability over future organizational outcomes. Consequently, port organizations experiencing uncertainty would be more willing to comply with institutional demands imposed upon them by field constituents, and they tend to mimic other alike affected actors, which preferably are the field's peers. The factor of *interconnectedness* is mainly referred to the likelihood of the port organization interconnected environments that provide relations through which institutional norms and values can be diffused and coordinated. In most field cases interconnectedness makes possible the voluntary diffusion of institutional norms and values through information sharing.

5.2.1 Uncertainty

- **Influence of the general business environment on individual port's green strategy**

Nowadays, among their multiple and complex challenges, (Verhoeven, 2007) European seaports are confronted primarily with governance implications, which call for strong and sufficiently autonomous PAs as business entities. In recent years, the alignment of public and private interests has resulted in a diminishing role for governments in the EU port industry (PPIAF, 2006). European ports today act more as commercially independent units, with the consequent outcome of facing increased competitive pressures in today's global business environment.

Competition evolves not only among single PAs but also among entire supply chains (Harrison & Van Hoek, 2002; Notteboom, et.al, 2013). Notteboom et al (2013) point that mayor clients concentrate on quality and reliability of the entire transport chain and consider ports merely as sub-systems suggesting that the port choice becomes more a networks costs function. Researchers identified factors such as hinterland connections, terminal productivity, and port's reputation as of key importance for port performance which is not any more directly connected with the port's geographical position (Notteboom 1997; Notteboom & Winkelmans, 2001). In consequence, along regulatory and community pressures for greening, ports as major node in the transport chain have to build their ability to comply with the evolved legislation and take action towards quality like corporate organizations do (Wooldridge & Stojanovic, 2004; Journee & Wooldridge, 2010). In terms of greening, they have to secure themselves as green legitimated entities and build their green reputation without jeopardizing their competitive position. All four examined ports were among those European ports that confronted the new needs from their business environment, although they faced different types and different levels of uncertainty towards their greening.

Furthermore, to confront competition (among others), most of the European ports had to improve their infrastructure and accessibility (van de Sluijs, 2007) and thus went through more or less extensive expansion projects or projects improving their hinterland connections. All four port case studies, by improving scarcity of land problems, have planned and operationalized (or are still in progress) port development projects (see annexes – specific sections) and confronted different levels and types of uncertainties. Table 5.3 presents the environmental demands that the PAs confronted in the individual port development planning and implementation.

In the case of the *PoR's Maasvlakte2* development project what was overall expected from the project's implementation was not just a port expansion aimed to strengthen the PA's business position *but* also an improvement of the environmental situation in the region and the creation of new opportunities for the city. The project's agreement also included intensification and optimization of the use of the existing space and the project's implementation enabled new business opportunities such as biomass, and renewable energy. The Maasvlakte2 development was a project that faced most of the involved uncertainties in an interactive problem-solving way and in a joint approach with mutual gains orientation that successfully served sustainability demands (see annex4 p:23; p:45). According to the PoR's Corporate Development manager, who introduced the Maasvlakte2 experience in the ESPO seminar in Genoa (2002) the PA learnt through the process that:

> *"The port and the city live apart but together and if you separate the functions of both you create distances, physically and mentally. We have realized that traditional environmental solutions create new problems."*

Table 5.3: Individual port development projects and related environmental demands

Port development projects	*Environmental demands in planning and implementation*
DHB – Terminal 2 **Dover Western Docks**	• EIA process according to EC Directive and corresponding EIA statement. • Extensive consultation with various stakeholders. • Specification of a set of environmental parameters assessing the environmental impact. • Mitigation and Compensation measures. • Monitoring during the implementation phase.
ThPA - Pier 6 expansion	• Seabed excavation and the replacement for the protection of sea environment - (technical solution) planning and implementation considered as best practice.
Valencia port N. Expansion **Expansion Port Gandia** **Expansion Port Sagunto**	• Extensive EIA studies according to EC Directive and corresponding EIA statements. • Elaboration of corrective measures requested by the national DG of Coastal and Marine Sustainability.
PoR -Maasvlakte II	• Project planned in Natura 2000 designated area with implications on (3) designated sites. • Extensive consultation with various stakeholders. • Legal uncertainty with respect to Article 6.4 of the EC Birds and Habitat Directive – EC was asked for advice. • (2) distinct EIA reports on the effects of: 1) construction & 2) zoning – land use. • Habitat baseline commissioned to assist monitoring. • Final Agreement on (3) distinct projects-part of the initial Main Port Development Project (PMR) PoR: Land reclamation – Construction Maasvlakte PMR: Compensation of nature – 1) Dunes Delfland, 2) Marine Protection Area Province of South Holland: 750ha Nature and Recreation Area Municipality of Rotterdam: Existing Area project. • Monitoring during the implementation phase.

- **Uncertainty due to the lack of knowledge**

Among the four case studies the *port of Thessaloniki* (ThPA) was lacking -at most- knowledge of the port environmental protection. This is understandable considering that in the 1990's the Greek port sector was generally lacking information about the issue of environmental protection and it seemed that the Greek ports had difficulties in obtaining related information, due to the lack of necessary resources and trained personnel, as well as the absence of connections to a related information network (see annex2 p:5). Yet, ThPA has applied an innovative best practice in terms of a technical solution protecting the environment (see annex2 p:18), but the port management confronted lack of knowledge on how to manage environmental protection. The main concerns were about *what* and *how* exactly the port management should act and how it would relate to legislative demands. The port's environmental manger explained:

> *"Dealing with the environmental legislation was the most difficult task.*
> *We were very uncertain what our priority issues were,*
> *mainly because we could not understand the existing environmental situation of the port."*

The trigger of getting involved was the urgent legislative requirements, but the time factor was crucial. The port was significantly delayed in dealing with its particular environmental aspects compared to the other three ports.

In complete contrast are the conditions and the perception of uncertainty in the ports of Dover and Valencia. UK ports have been innovative in terms of EM implementation (Wooldridge, et.al,1998; Paipai,1999). In the case of the *port of Dover* (DHB) the reason behind that lies in the critically early (already in the 1990s) identification of environmental issues and constraints. The port commissioned various research projects and collaboratively worked with experts from different institutions within its national context (see annex1, p:47). The environmental management rather proudly described:

"Our activities attracted even the interest of 'English Nature' that provided assistance in the preparation of interpretative aspects and provided advice, where necessary, in achieving environmental objectives and targets set by the port."

Significant steps were achieved in terms of environmental planning and environmental indicators identification and the port progressively built in-house capabilities in monitoring and reporting (see annex1, p:47). Integrating early evaluation of environmental issues in environmental planning had enhanced the port's environmental management. At the time that the SDM/PERS tools were provided to the EU ports, DHB was capable of responding quickly and successfully in terms of implementation and certification (see annex1 p:41-45).

The *port of Valencia* (VPA) had already implemented a series of environmental programs before incorporating environmental considerations into strategic planning. The VPA ECOPORT I-II projects (see annex3 p:22-23) were both proactive in terms of port EMS implementation. The VPA's top management decided that the port should cope with environmental protection on a process basis and that the best way to deliver results was through comprehensive EMS implementation according to the EMAS standard. It is not clear if this particular decision was favored because of EU LIFE program support or because the EMAS standard selection was considered most suitable to confront greening at the port's community level. What was clear involves the perception that monitoring along with reporting procedures should follow a standardized approach in line with the VPA's quality culture (see annex3 p:11; p:24; p:32; p:33).

"We believed from the start that EMAS is a plus in our corporate quality image. Perhaps the most distinguished aspect of EMAS in comparison with other EMS standards lies in the communication of port environmental information to the public along with the promotion of continuous improvement in the environmental performance which then again is constantly triggered by the circulation of environmental information."

In the port of Valencia, EMS implementation was initiated with the ambitious goal of the EMAS certification. Within a decade, all the uncertainties involved -*from* establishing a system that can identify environmental aspects in the port area *to* a system of indicators that enable monitoring and reporting- were progressively confronted through research projects (see annex3 p:24). VPA made extensive use of funds from various EU and Spanish programs to conduct individual or cooperative projects in order to enhance the port's EMS.

In the case of the *port of Rotterdam* (PoR) both the municipal and the corporate management of the port have gradually confronted almost all challenges ports are facing. The actions have covered: environmental quality (water, soil, air, dredged material, noise etc.); climate change (mitigation and adaptation); nature, biodiversity, landscape and quality of life. Even spatial planning in the port and its surrounding area and transport modalities were involved in the port's environmental planning.
PoR's *"clean port"* strategy dealt with issue based environmental problems within the port area, in a problem-solving approach and by means of various individual and collaborative research projects. The *"sustainable port"* strategy confronted broader environmental aspects at the local and regional level, and planning actions were process-oriented involving participatory decision-making processes. Thus, the PA faced up complexity and uncertainty that eventually forced stakeholder management capacity building.

An illustrative example is the Maasvlakte2 project that dealt with remarkable environmental uncertainties, especially of ecology issues in the coastal ecosystem. The PA confronted the negative approach based on the argument that the decision on whether or not to build Maasvlakte II was ultimately not going to be founded on scientific reasoning but political, due to inherent uncertainty of certain scientific studies. The PA dealt with those uncertainties by negotiating on the different approaches and opinions. Thus, the presumption of uncertainty actually triggered stakeholder negotiation about how environmental risk could be minimized. The involved legal uncertainty is part of the analysis presented in the next section.

- **Legal uncertainty affecting environmental issues and port strategies**

Environmental issues are having an ever-larger impact on port development and port operations. Ports have often underlined the existing uncertainties regarding the responsibility of public authorities and highlighted the need for better coordination and application of the existing legislation (Verhoeven, 2007). Journee, presenting the 'EcoPorts Approach' in the GREENPORT and EcoPorts Conference in Amsterdam (2008), noted that the EU policy level task on port greening involved different rules and even different definitions for the same environmental issues.

"The vague rules let much room for interpretation with unwanted effects of legal uncertainty and uncertainty about who is liable", (Journee, 2008).

A clear example of that is dredging and dredge disposal, which were the port matters mostly confronted with legal uncertainty during the last decade. Dredging in Europe has been one of the most challenging aspects of port interactions with nature conservation. EU ports need to satisfy two separate pieces of critical legislation: The Habitats Directive and the Water Framework Directive (WFD), together with the Priority Substances Directive (PSD), which has set the quality standards for contaminant loads within sediments. Differing interpretations were given to the application of Article 6(3) of the Habitats Directive to maintenance dredging. There was misinterpretation and misapplication in many cases and *thus* uncertainty. Variations in national approaches illustrated the perception of an uneven playing field, although the EC has sought to harmonize the approach to site designations. This establishes a challenging legislative framework for port managers and potentially an even more challenging environment for regulators.

Then in this sense, the role of regulators at the national and regional level is important. In the case of Dover, national policy guidelines provided a clear framework that suggested how action should be undertaken. In Greece, the lack of guidance -in terms of national policy- increased the uncertainty related to their environmental obligations that the Greek ports had to confront. In Spain, the State Ports Agency is responsible for putting national policy guidelines into practice and *thus*, confront legal uncertainties, on behalf of the PAs. In the case of Rotterdam, the role of the regional environmental agency (DCMR) as the responsible authority for enforcing national policy and regulations, is vital to compliance and assurance responsibilities on behalf of the port and the city of Rotterdam, significantly improving the efficiency and effectiveness of their environmental activities and decreasing legal uncertainty. However, for PoR the central role of the EC was also crucial, when legal uncertainty under the Article 6(4) of the Birds and Habitats Directive called for an EC level advice about the proposal of PoR's Maasvlakte2 project. With the EC having no interest in the project as a stakeholder, and after the exchange of documents on alternative plans and reports on the national public consultation, the project received the Commission's approval. Although in the end the project was granted approval, the PA considered that legal uncertainty affected the planning procedure, in terms of time and efforts dealing with negotiations uncertainties. One of the port's interviewees explained:

"We learned the hard way to work with the provisions of directives such as the Water Framework and Habitats Directives. Uncertainties- due to lack of information and scientific data- made it very difficult to assess the impact of the maritime sector on the natural environment. With the European Marine Strategy (EMS) in mind, ports needed to anticipate early on new directives and at the same time rely on their know-how in order to make directives feasible and realistic."

Almost the same conditions occurred in many other port development plans in Europe. ESPO expressed its willingness to assist and co-operate with the EC in legal processes. The Code of Practice on the Birds and Habitats Directive, based on the experience of its members, was the sector's collective response to this particular matter. It gathered together the EU ports good practices, as well as a list of questions which the Commission had to resolve through guidelines.

- **Ports being aware of the values and norms of the green port**

The "spin-offs" from the first as well as the updated ESPO Environmental Code of Practice encouraged heightened environmental awareness and the need for green practices implementation. The sector's collaborative research projects provided a major forum for specialized green port research and -along with the Ecoports network activities-EPF promoted voluntary self-regulation and EMS standards implementation.

The Code in general suggested standardized approaches in environmental monitoring and reporting while ports encouraged intensifying communication of their environmental improvements. The updated ESPO Code in 2003 endorsed the integration of SD and CSR concepts in port policies and PAs were advised to prepare publicly available environmental policies setting out a related plan and methods. The ESPO Code of Practice on the Birds and Habitats Directives (2007) recommended PAs to build long-lasting and sustainable relationships with local, regional and even national administrations, NGOs and other stakeholders, even when no specific expansion plans are foreseen. In 2010, the ESPO Code of Practice on Societal integration of ports introduced societal integration and initiated the *'soft values'* (1) of ports.

In the last 15 years, the seaport sector in Europe constantly updated its environmental ambitions. All versions of the Code defined the sector's green port common vision, while the ESPO/EPF synergy provided guidance to ports for establishing and developing their environmental management thus promoting the norms of the green port. If one considers the variety of aspects and concepts promoted by the ESPO Code, as well as the time frame from 1994 to 2010 within which all of them were initially introduced, he can easily understand the puzzle of uncertainty that the 'green port' illustrated for many European PAs. Some of them were proactive enough to follow, but the majority of them were avoiding the challenge until 2010. According to the ESPO/EPF survey in 2009, many European PAs struggled with a negative perception of applying EMS standards and still experienced difficulties in implementing EM, due to both internal and external factors. The percentage change in EMS implementation between 2004 to 2009 was only 2% (see Table 4.4, chapter4 p:72). But there were also ports fully aware of the values and norms of the green port. All four investigated ports have endorsed the values of the ESPO Code and all of them followed norms in implementing various EMS standards.

In the UK, ports were already introduced to the precursor of the ESPO Code (see chapter3 p:58). The UK port sector was the first to state the need for port environmental protection. However, in short, it was the ESPO Code that introduced the truly green credentials and many UK ports endorsed its values by incorporating them in their strategic planning and EM development. The ESPO values within this particular national context were filtered through national policy guidelines, experts and academics actions in various research projects and were adapted from UK PAs, aiming to: *"secure not only sustainability in its broadest sense, but also a move towards nature conservation friendly port policies",* (English Nature representative, Greens/EFA Natura 2000 Conference, 2002).

The port of Dover was the pioneer port considering the norms and values described above. The ESPO Code established the blueprint of the sector's green vision. Ports like the port of Thessaloniki with limited or no experience in environmental protection were easy to endorse the Code's values and *thus*, they would be recognized as highly credible at least according to their statement. Furthermore, endorsing norms is a secure starting point for action taken aiming to be acknowledged as credible.

The port of Rotterdam, beyond endorsing values and norms, was rather interested in ESPO's actions regarding its role as EU institutions' counterpart. ESPO is part of the port's influencing network along with IMO and IAPH (see chapter3 p:52). The relation among them is close considering that employees of PoR have been appointed as ESPO experts.

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[1] The soft values concept was developed in 2006 by Prof. Eric Van Hooydonk of the University of Antwerp.

'Soft values' are defined as the non-socioeconomic assets of ports. Among the tangible soft values of seaports are their qualities as sensory stimulants, as collections of immoveable heritage, as unique man-made landscapes, as laboratories for experimentation by urban planners and architects, as tourist attractions and as recreation resorts. Management, promotion and development of soft values are the necessary tools to achieve societal integration. This conceptual approach consisted of 250 recommendations resting on four pillars: the rebuilding of the port-city, the telling of the port story, breaking through the port boundaries and broadening of the port community's perspective to raise the port icon status of cities.

"The Port Management now possesses an extensive network for exercising influence on the establishment of international and Dutch legislation. This takes place both globally via IMO, IAPH and on a European level via ESPO",(PoR Annual Report, 2001:31).

The port of Valencia has been an active ESPO member and a rare case that applied all possible EMS standards. Through time, VPA has also acquired international commitments such as the signing of the Sydney declaration in 2006 for sustainability in port cities, sponsored by the International Association of Cities and Ports, as well as the 'World Ports Climate Declaration' in Rotterdam in July 2008. In 2012, it was one of the best practices presented in ESPO's latest Code in port societal integration.
The following Table 5.4 comparatively summarizes the ports' perceptions of their individual context within which institutional pressures are being exerted and which affected their strategic response.

Table 5.4: Uncertainty as predictive dimension of individual port strategic response

Uncertainty	
What is the environmental context within which institutional pressures are being exerted?	
Dover	• Succeeded in dealing with lack of knowledge through cooperative research with academics, research institutions and experts. • Port development plans successfully confronted environmental and societal concerns. • Engagement in stakeholder dialogue utilizing thorough scientifically based environmental studies. • National policy guidelines decreased the level of uncertainty. • Pioneer port in being aware of the values and norms of the green port.
Thessaloniki	• Delayed confrontation of port environmental issues. • Lack of knowledge in individual port environmental aspects and related mandatory obligations, urged the port to EcoPorts membership. • Port development implemented in environmental friendly technical terms did not incorporate local regional green aspects. • Lack of authoritative guidance and frustration from legal uncertainty.
Valencia	• R&D projects progressively supported the lack of knowledge and implementation process of EMS according to various standards. • Legitimated EIA procedures in port development without any claims from stakeholders. • The Spanish state port agency confronted legal uncertainties supporting the autonomous PAs. • Pioneer port in being aware of the values and norms of the green port.
Rotterdam	• Gradually built knowledge on almost all port environmental challenges by means of individual and collaborative research projects. • Environmental planning based both on problem solving approach and incorporation of local regional green concerns through process-oriented actions. • Ecological and legal uncertainty crucial in port development was overcome with extensive scientific research, stakeholder dialogue and EC level approval. • The role of the regional environmental agency decreased legal uncertainty in enforcement.

5.2.2 Interconnectedness

- **Advancing network cooperation on port environmental issues**

In the 1990's European ports were lacking knowledge of actual environmental rules and responsibilities. In 1999, the Eco-Information Final Report identified that knowledge was necessary for ports to be able to proactively anticipate green problems. A plan to activate this knowledge within ports seemed to be necessary and it was initiated under the ESPO umbrella and EC funding. ESPO launched several initiatives to help PAs better understand the environmental legal framework in which they were operating. ESPO members advanced network cooperation to deal with various port environmental aspects (see Table 4.5 chapter4 p:73). The EPF and its EcoPorts network played a crucial role from 1999 to 2010 offering support for PEM best practices implementation. The network provided services based on the mutual collaboration of port professionals who worked together sharing knowledge and experience and aiming at the port's environmental protection as well as at continuous improvement through effective management- in terms of practicable tools and methodologies specifically designed to deliver a harmonized approach of port environmental management- (Wooldridge & Puig, 2011).

After the finalization of the ECOPORTS project in 2004, the networks members (port environmental management and researchers), through their meetings in conferences (see Table 4.5 chapter4 p:73), projects' plenary sessions and national/regional workgroups, regularly looked at the current and forthcoming legal context and discussed how their work can respond to the EU environmental policy trends. It was clear that ports will become increasingly involved in coastal management and management of designated areas for special protection, and that port managers have to accept the necessity to cooperate with a range of agencies and organizations (ESPO Environmental Review, 2004).

In 2008, during the first Greenport-EcoPorts Conference in Amsterdam, the network initiated mutual collaboration with the Environmental Protection Agency (EPA) of USA and USA ports aimed at an international scale collaboration on finding common solutions. By the end of 2010 the network had appointed new tasks on societal port issues. It was acknowledged that future developments like spatial scarcity for logistic needs, energy transition towards bio-based industries and renewable energy impact of climate change as well as the needs of the next generations of consumers will have their unpredictable impact on how ports will develop (ESPO, Code on societal integration in ports, 2010). Societal integration was identified as the key task of the 21st century for the EU PAs and therefore it is expected to be fully integrated within their strategic management. Thus, according to ESPO, Corporate Social Responsibility (CSR) is the 'future green' management task for EU ports.

The ports of *Valencia* and *Rotterdam* were the most active EcoPorts network members participating in the majority of the network's issue-based research projects. VPA commissioned further collaborative projects with a special focus on the Mediterranean basin area (see annex3 p:26-28). The port of *Dover* was more national oriented -in terms of collaborative research- in knowledge gain. The port of *Thessaloniki* was primarily locally oriented in confronting green incapacity. Local academics were the key green resource providers for the PA and they initiated the PA's interrelation to the EcoPorts network.

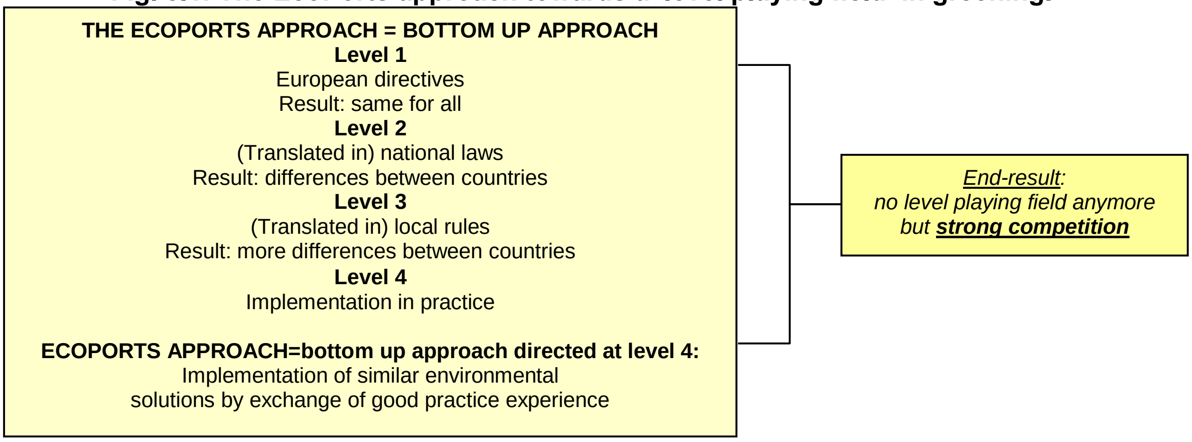
- **Greening affecting port competition - Unconstructive "level playing field"**

"Both the distinctive characteristics of EU ports and their complementary nature define the competition between EU ports", (Notteboom, ESPO Conference Algeciras, 2007).

In ESPO's point of view there has been a fundamental discrepancy between Europe's transport and environmental policy. On the one hand, Europe was trying to achieve a sustainable transport system by promoting maritime and intermodal transport as the prospect environmental friendly modes, and on the other hand, the application of EC environmental legislation -such as Natura2000 or the Water Framework Directive- was often seriously hampering essential port and port-related development projects (ESPO, Annual report 2003). Complexity also occurs from the diversity of environmental aspects that ports face, and the number of inter-jurisdictional bodies that provide guidance on how these should be managed- including IAPH, PIANC and CEDA (see chapter3 p:52). Guidance and information provided by these organizations is voluntary and occurs on a regional or on an individual country basis. Above all, it was the lack of a harmonized environmental policy in the entire European Union to prevent unfair competition among ports that urgently asked for the sector's unitary response in order to construct a level playing field in port environmental protection.

According to the port's point of view, non-constructed integration of the EU environmental legislation, transport policy, as much as wider environmental considerations, have been a matter of potential conflict among ports embedded within different national context. Therefore, although EU ports constitute a highly competitive commercial sector, they did combine forces for environmental protection to avoid greening as a competitive factor among them and they agreed that they *"should not compete on the basis of the provision of environmental safeguards."* (Wooldridge et al., 1999). Journee (2005) illustrated the coercive consequences of the EU law and particularly of the EC Directives for PAs by analytically explaining why the competition between ports became more severe, more unequal and more unfair. The following Fig.5.1 highlights the ESPO/EFP point of view in terms of unconstructive 'level playing field' among different national contexts (Journee, 2005).

Fig. 5.1: The EcoPorts approach towards a 'level playing field' in greening.



Source: Journee, 2005

An important point to the reader is the fact that the UK port industry is based on a different model (a deregulatory, private sector see annex1 p:5) from the majority of Europe and therefore the mindset across Europe differs. The UK government without intervening in commercial activities seeks to promote high environmental standards and support sustainable port development (DfT, 2000). The British Ports Association Code was the first to promote port environmental behavior (BPA, 2009). Environmental standards for port operations were advised to UK PAs and consequently, port environmental management was initiated by the country's port industry. The *port of Dover* was the first port in Europe to obtain an accredited EMS through the PERS standard in 2003 and thus, it did advance green competitiveness in terms of EMS implementation within the EcoPort network. Obviously, the interviewee for the port claimed the need for harmonization at EU level:

"In terms of the environment, the aim to introduce common environmental standards is very important in terms of fair competition given that all EU Member States are required to achieve the same standards."

In contrast, in Greece the absence of private sector participation has not been favored until recently. EU legislation (2001/96/EC) has been the main force for port quality and (safety) diffusion. The overall port quality assurance culture and practices were limited mainly due to the lack of a national policy on port quality, port authority understaffed or unqualified personnel and lack of funding (Chlomudis, et.al., 2011). Even more, Greek ports were not familiar with environmental practices. Until the beginning of the 2000's only health and safety concerns (see annex2, p:26)were at the center of attention regarding the *port of Thessaloniki* management efforts. Port environmental management procedures were initiated by the need for conformity to legislative requirements. In 2000's, the port, aiming to comply with the EU Directive on port waste reception facilities (see annex2, p:23) and the requirements to set up proper waste management procedures, confronted, for the first time, the necessity to combine green behavior, while sustaining the port's competitiveness. ThPA operational manager pointed out:

"We confronted the need to develop a plan on ship generated waste management and to prepare the related reception facilities. We used consultancy from the local university to resolve the lack of adequate scientific knowledge and most important to come up with a tariff policy for the ships that will deliver their waste. The result was an effective ships' waste management plan and cost recovery system, in full compliance with the objectives of the Directive 2000/59/EK. This was essential because our competitive ports in the region were not members of the European Union and had no obligation to apply the Directive. After the plan's implementation, we fully understood the strong trade-off between the port's environmental performance and business competitiveness."

The *port of Valencia* is strategically oriented towards 'quality' (see annex3 p:11). What is clear according to the port's top manager is that VPA encountered greening in managerial processes to confront competition in the supply chain. The port's environmental self-regulation strategy has been progressively relevant to corporate policies and capable of engaging the port community in complying and surpassing environmental regulations. VPA promoted information exchange to enhance environmental protection and led several initiatives for implementing environmental management systems in firms among the port community. According to the interviewees:

"Valenciaport has taken on the challenge of creating a cleaner port environment, and to contribute to a sustained transport chain by making a joint commitment with companies which form part of the port community."

"The PA has a key leadership role to play in the port Community and sustainable development must be a primary objective in its strategy. You can see the results of the port's ECOPORT-EMS implementation in VPA's port community:
- VPA's EMS certifications: PERS (2003), ISO 14001 (2006), EMAS (2007)
- 42 companies engaged; 22 ISO 14001 certified up to 2010."

The most illustrative answer in terms of the need for green playing field comes from the *port of Rotterdam* (PoR). The port's environmental manager stressed the need for greater legal certainty for businesses when they have *"done enough"* to comply.

"In the competition with surrounding ports in terms of environmental protection, there must be a level playing field. The EU plays an important role in this respect. Not only by establishing rules, but by ensuring that rules are introduced and enforced in the same manner everywhere."

In fact, the port besides its green efforts was very active in lobbying. Lobbying was not new for the PA and it has been rather useful to strengthen its competitive position. In the 1990's, PoR successfully lobbied for the improvement of its hinterland connections and the further expansion of the port-industrial complex. Jacobs (2004) reveals that PoR increasingly focused its lobby activities on 'Brussels' instead of 'The Hague' to tackle -among others- the increase of regulations for environmental protection, especially when it was formulated at the European level. A clear example of the above provides the 2007 EC call for consulting the port sector's different actors on an integrated seaport policy for environmental protection. The result was a document announcing more stringent environmental requirements and measures so as to create a more level playing field on which seaports can compete each other. PoR was directly involved in the document's preparation for air-quality issues, the new soil directive and marine strategy among others (PoR Annual Report, 2007).

The following Table 5.5 comparatively summarizes the port perceptions of their individual context within which institutional pressures are being exerted and which affected their strategic response.

Table 5.5: Interconnectedness as predictive dimension of individual port strategic response

Interconnectedness	
What is the environmental context within which institutional pressures are being exerted?	
Dover	• Extensive network within the port's national context supporting research in port environmental protection. • Active member of the EcoPorts network. • Green competitiveness in terms of PERS implementation among EcoPorts network members. • EU level playing field in port environmental protection strongly requested.
Thessaloniki	• Extensive cooperation with local academics supporting research in port environmental protection. • EcoPorts network member advancing information exchange and consultancy in EMS implementation. • No level playing field in port environmental protection with ports located in no EU neighbor countries.
Valencia	• Individual projects supporting EMAS implementation. • National entities supporting research in port environmental protection. • Highly active EcoPorts network member advancing issue based research on port environmental protection. • Collaborative initiatives at EU regional level in the Mediterranean basin. • Willingness to confront competition in supply chain in terms of green competitiveness. • Capable of engaging the port community and coordinating self-regulation.
Rotterdam	• Active EcoPorts network member advancing issue based research on port environmental protection. • Collaborative initiative among ports in the national context. • EU level playing field in port environmental protection strongly requested. • Lobbying at EU level trying to sort out increase of green regulations.

5.3 Perceptions of cause: legitimacy and efficiency

(Why are ports being forced to confront institutional expectations?)

Cause refers to the question why green institutional pressures are exerted on ports and why PAs are forced to confront the green-port institutional expectations. *Legitimacy* refers to the level of the green institutional anticipations that are incorporated as legitimated within the port organization. The higher the legitimacy is, the higher the likelihood ports choose to acquiesce. The *efficiency* factor explains the way ports perceive their green port policy implementation as of importance in terms of efficiency, while it involves subsequently expected efficiency gains. The higher the perceived legitimacy and efficiency of port EMS implementation with the PA, the higher the chance for compliant strategies is.

5.3.1 Legitimacy

- **Individual port organization perception on legitimacy**

Organizational research has identified greening as a result of legitimacy issues. Organizations turn green in order to comply or stay ahead of *legislation*, or regain *reputation* lost (Shrivastava 1995; Bansal & Roth 2000; Clemens & Douglas 2006). Although ports primarily like to follow the law, some of them choose to implement greening processes and they do so for both reasons (Wooldridge, 2004; Naniopoulos, et.al.,2006; Acciaro, 2013). Ports' environmental liability has grown immensely over the last twenty years and is directly related to the adoption of (EU, state, regional) regulations. In the last decade, this may also refer to port green self-regulation or even as a part of a PA's CSR program (Acciaro, 2013).

Port related research has illustrated interpretations of what legitimates greening within port organizations beyond compliance to legislation. A lot of conference presentations and related articles within the ESPO-EcoPorts realm revealed that ports aiming to turn green did go beyond regulation. It was suggested that port interest in environmental management addresses the growing need for sustainability (Journee, 2005; Antoniou & Stamatiou, 2007), and the need to consider the value of the green port image (Acciaro, 2013). Port organizations seek legitimacy for their public image as well as for their customers and users, by appearing environmentally aware and sustainable. In the same vein, publicly available green port policy and reporting on tangible green results reveals the PA's liability, while it builds confidence and trust between the PA and the port's users (Acciaro, 2013). EMS standards implementation is an effective way to produce those results.

Although since the 1990's complying with a vast amount of legislation has provided the primary impetus for green advancements in ports, in the 2000's this was changed and it was the conformity with standards that yielded green port legitimacy. A constantly upgraded number of EU PAs maintained compliance with regulations and sought the benefits to develop strategic environmental management systems. Consequently, in their quest for green legitimacy, EU ports have made considerable progress improving environmental management and several went through certification procedures (ESPO, 2012). However, the degree of green practices adoption varies among ports and thus, it is easily understandable that *how* greening is legitimated within a port organization is a unique case. As any other managerial action, green legitimacy falls within the dynamic of aligning the port organization with its institutional environment. What individual port management did to increase or maintain environmental legitimacy is illustrated by the different ports explored.

Aiming to deliver green port operations since the early 1990's, the *port of Dover* (DHB) has been active by implementing both mandatory demands and national policy recommendations. Structurally upgrading its monitoring program and integrating environmental data processing and analysis in its management system DHB managed to be the first within the EcoPorts network to implement EMS standards. It has taken a systematic approach building on the PERS/EPF standard to further develop its EMS according to ISO 14001 standard requirements within four years from 2002 to 2006, (see annex1 p:41; 45). EMS implementation was highly supported by the port's top management and was perceived to be an effective way of building the port green image:

> *"Our environmental reputation is important to us. In 2008 the port was ISO14001 certified and received recognition by the (UK) Marine Conservation Society for environmental best practice and the efforts in implementing a good environmental management and monitoring system. ISO14001 meets British, European and International Standards.*

It is more rigorous than the PERS standard and has enabled the port to become more widely acknowledged amongst its customers and competitors.

The *port of Thessaloniki* (ThPA) was the first Greek port that considered the importance of dealing effectively with the evolving EU legislation in environmental issues. In 2002, the top management initiated consultancy services from local academics aiming to understand the port's liability for its potential environmental impact and how to confront mandatory obligations. The port management was particularly concerned about how to demonstrate compliance to environmental requirements. The port's operational manager (he was among the port professional group advised by the academics in ad-hoc meetings) illustrated the port's perception at that time:

"The challenge was how our ambition to act as green port could be translated into practical reality."

The interconnection among the local and UK academics was responsible for the port's introduction to the EcoPorts network and consequently to the EcoPorts tools. In 2003, the PA applied the SDM tool and was informed about the port's particular environmental issues. Immediately afterwards the ThPA declared its Environmental Policy and preceded the port's EMS implementation according to the PERS standard. Aiming to confront specific issues and reduce environmental impact from particular or potential polluting sources, the next step for the Environmental Office was to create separate issue based policies. From 2002 to 2006, ThPA gradually confronted a project-based approach towards health and safety, waste management, energy efficiency, dust emissions, and risk management issues, (all of them) in collaboration with the local academics (see annex2 p:26-38). According to the port's environmental manager:

"We learned about best practices from other ports and experts in the network.
Being aware of the other ports' performance increased environmental awareness;
primarily at the top management which resulted in setting up the port's Environmental Department."
"Implementing the SDM we were able to register all environmental aspects in the port area
and understand the existing environmental situation of the port.";
"EMS implementation according to PERS has provided a structured framework
that helped us to identify the most significant environmental aspects and thus, to set priorities.
We initiated different policy plans and built up step by step our environmental capacity,
including the setting up of performance indicators"

In 2006 the PA considered the possibility of developing its EMS according to more comprehensive standards. Although extensively investigated, potential EMAS certification was turned down and ThPA progressed its first PERS re-certification.

The *port of Valencia* (VPA) has been committed to environmental protection since the mid 1990's. The PA encouraged necessary conditions to go beyond compliance with legal requirements as far as it was technically and economically viable (Orejas & Torres-Monfront, 2001). The top management considered that:

"EMS is a practical tool to address the environmental impact on daily port operations
and a valuable way to green self-regulation."

In 1997, in collaboration with other organizations of its port community, the PA initiated an exploratory project in order to introduce port environmental management in its cluster port area, thus hoping to establish a blueprint for the introduction of EMAS in port facilities. The Valenciaport ECOPORT project (see annex3 p:22) produced one of the two generic procedures for the identification and assessment of port environmental aspects-- the other one was provided by EU ECOPORTS project (Puig, et.al., 2015). Thus, VPA was the first PA that attempted to develop a method for port environmental aspects identification with its own efforts. The project secured the top management's decision about green self-regulation based on EMS implementation according to EMAS and provided a detailed Environmental Policy (see annex3 p:36). The PERS and ISO 14001 certifications served as immediate stepping stones to the final goal of the EMAS certification (2008). The port had already applied and maintained advanced management models aiming at quality performance.

"The EMAS choice perceived as most suitable
mainly because of the standard's validity among member states as EC regulation
and its principle of continued improvement which has been an accepted philosophy for the PA.
We are a quality oriented port"

Since its first Environmental Policy initiation in 2000, the PA has continued to demonstrate commitment to self-regulation in collaboration and joint commitment with companies of the port community and through the years the VPA played a strong leadership in encouraging port community members to apply EMS standards. The interviewees described why ISO 14001 and EMAS were promoted within the port community:

"In this way VPA possesses the ideal tools for achieving its environmental objectives and goals as specified in the port's Environmental Policy";
"Both are of significant value for companies within the port community that aim to improve their environmental management."

VPA's green self-regulation strategy was primarily based on an in-house developed methodology and the ESPO guidelines (for environmental protection), the C40 World Ports Climate Declaration (for energy efficiency), the IACP–Sydney Declaration (for societal integration). The fourth strategic axis of the 2015 VPA's Strategic Plan specifically focused on port-city integration (see annex3 p:9). This particular scope has integrated Corporate Social Responsibility (CSR) (see annex3 p:28) while the port's Environmental action plan implemented several environmental initiatives over the years especially through cooperation at EU-regional Mediterranean level (see annex3 p:26-28). Perhaps most of the action oriented from these initiatives, was the SIMPYC project (see annex3 p:26) which focused on a coordination mechanism that provides environmental management processes and monitoring, carried out in port and city environment. The VPA's representative in the project explained:

"Not always, the same administration is in charge of managing port area and urban area. A coordination mechanism is especially valid when talking about environment and this is why the SIMPYC project includes environmental variables (indicators) in the so called environmental port city interface."

The *port of Rotterdam* (PoR) is a unique European port in terms of clustering and concentration of various activities, managed by a former municipal department that changed to a public corporation in 2004. It was a significant institutional change. The PoR organization changed considerably after the corporatization. The port became more market-oriented, there was an increasing commercial approach to port development and investments grew very rapidly in scale (from 150million€ in 2005 to 500million€ in 2011, mainly because of the Masvlakte II expansion project).
The highly improved -in terms of performance- corporate management (De Langen & Heij, 2013), affected and upgraded the already clearly established by the port's municipal management green awareness and commitment to environmental protection during the 1990's. At that time, the Rotterdam Municipal Port Authority (RMPA) used *'the polluter needs to pay'* principle as its starting point aiming at environmental protection. It was a well-established organizational belief concurred with pollution prevention practices based on licensing and monitoring. Since 1992, the role of DCMR has been central serving national policy and providing license, enforcement and environmental quality monitoring at Rotterdam regional level (see annex4 p:5). The agency's most important activities of license and enforcement have been constantly aimed at environmental protection not only by issuing licenses for new initiatives but also by emphasizing the shifting to greener outcomes through modifying existing licenses in line with developments in policy, regulations and/or techniques (Paipai, 1999). In this way, indirect governance was performed in the port area by regional and national government with the means of environmental regulation and permits (De Langen, 2007).
Responsibilities of environmental management were clearly defined and well interrelated in terms of internal and external communication. Environmental protection was considered a part of the port's policy as well as of the daily operational management aiming at a *"clean port"* (see annex4 p50). RMPA, following a project based approach, developed its environmental management by focusing on knowledge gain in environmental issues, by actively participating in national and EU environmental R&D projects. The port representative explained:

"The polluter pay's principle was the core element in the port's policy aimed at tackling problems at the source, as we strongly believe that only a clean and sustainable port has a future. No company wants to set up operations in a polluted environment. This, by the way, also benefits those who live near the port area".

After the port's corporatization in 2004 the strategic Port Vision 2020, that was collaboratively created with the Rotterdam Municipality, introduced the "*green quality port".* The realization of the "quality port" was based on the elaboration of six targets; the *"clean port"* continues to be one of them, while the policy declaration initiated the *sustainable, knowledge and attractive port targets,* which were direct or indirect focused on sustainability aspects (see annex4 p:51). Port Vision 2020 itself has no specific implementation program; it depends on collaborative projects and plans and aims to apply sustainability projects at three different levels: the PA as business entity, the port and industrial complex and the chain level. *"Our coordinating role means we take responsibility for the total quality of the port. We wish together to strengthen Rotterdam's quality in terms of sustainability. On the one hand because it will make the port more attractive for customers, and on the other hand because it is rightfully a part of our social responsibility. We wish to establish a profile as the 'Green Quality Port",* (PoR, Business Plan 2006-2010).

The *"sustainable port"* took advantage of targeted port sustainability in Maasvlakte2 port area and intensive space utilization of the existing port as well as of the industrial area and initiated R&D projects in more environmental forms of industry and energy. A high-profile and ambitious energy, air quality and climate change program was elaborated (see annex4 p:31-41) and concepts of cleaner technology and industrial symbiosis were discussed. Thus, the corporate management of the port has been policy and innovation oriented, focusing both on the port's sustainable future and on research for the port's contribution to low carbon economy.

"The goal of creating a sustainable living and working environment is an integral component of our management role. For us sustainability means improving our own individual performances and encouraging sustainable enterprise in the port and industrial complex." The "clean port" target continues implementing national regulations for improving the environment and confronting nuisance and risks at source in the port area."

"The integration of sustainability into the construction and use of Maasvlakte2 will be partly safeguarded by an extensive monitoring program. Since the beginning of the construction in 2008, we have been measuring the effects of the construction on protected nature, while decisions on nature compensation were made."

"In the transition from the current way of producing energy towards a new way the port could play a key role using the industrial clusters already in place as they will efficiently participate in this transition."

The interviewees of the port were more enthusiastic to introduce plans related to the port's sustainable strategy. They considered that all of them -and particularly the results of the clean port strategy in the previous years- were much more important for the port's environmental management implementation and the PA's new corporate image, than the port's PERS implementation and certification. One of them strongly highlighted that since 2008 -along with the PERS certification- PoR has developed its Sustainability Index and produced its annual CSR report.

- **Green port legitimacy as strategic value for the PA**

Ports are primarily business oriented organizations and thus, whatever promotes and maintains their licenses to operate is of strategic value. Since the 1990's, EU PAs dealing with mandatory, market and social demand on environmental protection or with strategic planning involving expansion projects, have regarded environmental considerations as of great importance. Indeed, EU ports were triggered by environmental dynamics and increased their focus on value creation by greening. They did that mainly for legitimacy reasons. However, was their green legitimate behavior of strategic value to them?

Since the early 1990's the *port of Dover* (DHB) has been active and innovative in the field of port environmental management. Greening has been essentially considered part of the daily business management. To be able to confront such a demand, the port regarded EMS implementation as the appropriate tool to build its environmental efforts. The PA decision to adopt a formally accredited system was a top management decision and of strategic importance. The ISO14001 standard's accomplishment to be a worldwide well-known system was considered as the most valuable choice. In addition, the port was successful in implementing the core aspects of its environmental policy and it was capable of providing high-quality environmental analysis and documentation, using the ISO14001 certification as formal credential for building up its environmental management capacity. The port's environmental management claimed that:

"The Board was dedicated to pro-actively managing and delivering a sustainable port operation. We managed to minimize environmental impacts and promote good environmental practice We monitor, analyze, act and report on reliable evidence. The ISO14001 certification for the port's EMS implementation was a plus to the core value of our environmental policy."

In 2002, _the port of Thessaloniki_ (ThPA) was the first PA in Greece that challenged EM efforts to minimize its environmental impact. This was a pioneer (top management) decision considering that port environmental management was not promoted by any means in the national port policy (Palantzas, el.al., 2014) and port environmental protection in Greece was lacking an adequate enforcement system (Palantzas, 2008). The port incorporated the EcoPorts network and immediately deployed the PERS standard. Until 2010 ThPA was twice recognized for its commitment to greening according to PERS standard implementation (see annex2, p:42-45). The port's Environmental Policy has defined greening as high value priority that should be integrated in the port's daily management. This approach resulted in an on-going learning experience. The port's environmental manager identified that the PERS implementation was the trigger for:

"environmental awareness resulting in the setting up of the ThPA Environmental Department"

and that the main benefit gained by the EMS application was:

"the creation of on-going experience, knowledge and awareness".

In practice, environmental issues connected to the port's activities were identified and prioritized by the port's Environmental Policy in line with regulatory obligations, while they were progressively managed effectively. Therefore, primarily the PERS certification was accelerating results towards the port's environmental liability.

"The PERS certification constitutes an explicit proof that the port's EMS implementation has succeeded implementing legislative requirements".

The _Valenciaport_ (VPA) sought quality in performance as part of business development already in the 1990's. The port has been self -orientated as a potential green port since the end of the 1990's, and one of the first ports in Europe implementing EMS, which had been awarded different certifications until the 2008. EMS implementation was proved to be the decisive tool for the port in building environmental credentials. Even from the very first project that initiated EMS application, VPA was always targeting towards the EMAS certification. Organizational targets, such as ensuring commercial sustainability and development with a special focus on quality issues, have led the PA to be confident that EMS implementation was worth doing and thus encompassed its merit among the organization's core business values. The environmental manager pointed that:

"By being ISO14001 and EMAS certified, the port possesses the ideal tools for achieving its environmental objectives and goals as stipulated in the Environmental Policy. EMS certification adds value to the port's services. Valenciaport is an internationally recognized PA for its environmental management, that has been certified by different standards."

Perhaps the words that mostly express the green mission and strategy of the _port of Rotterdam_ (PoR) are outlined in the following: *"We invest with our partners in obtaining broad support in society and optimum preconditions for a port that has the ambition to develop. Sustainability, dialogue, work and innovation are important elements in this aim",* (PoR Annual Report, 2009:18).

EM implementation in PoR was initiated based on consistent regulations compliance as well as issue-based planning and research that gradually upgraded the port's environmental knowledge. The environmental management department worked closely with the strategy and development department. Strategy for environmental protection settled on target approach and was implemented with plans and programs that incorporated stakeholder dialogue whenever required. Many of these actions built the port's green qualifications and were an essential part of the port's PERS application.

The following Table 5.6 comparatively summarizes the port perceptions with regard to the level green institutional anticipations that are integrated as legitimated in the PA.

Table 5.6: Legitimacy as predictive dimension of individual port strategic response

Legitimacy	
Why are ports being forced to confront institutional expectations?	
Dover	• Adoption of environmental legislation. • Implementation of national policy recommendations on scientific validity in monitoring and reporting, securing reliability for port environmental plans and policies. • EMS standards considered as suitable legitimate tools for building the port's green image and gaining reputation as green port. • EM implementation system oriented – standardization/certification of strategic value. • EMS according to ISO14001 and PERS immediate step.
Thessaloniki	• Mandatory requirements and networking provoked environmental awareness. • EcoPorts tools application advancing the port's Environmental Policy. • EMS on the basis of the PERS standard. • Issue based policy plans enhanced the port's environmental capacity (performance indicators). • Upgrading to ISO14001 and particularly EMAS was turned down. • PERS standard a practical tool to accelerate the port's green liability.
Valencia	• Corporate culture supporting quality and standardization. • Top management commitment in greening through standardization. • EMS on the basis of EMAS standard – PERS and ISO14001 standards immediate steps. • EMS toward green self-regulation for as many as possible different organizations in the port community and not just for the PA – leading and coordinating role. • EM implementation system oriented – standardization/certification of strategic value. • Social integration – synergies in the port-city interface supported by coordinating mechanism.
Rotterdam	• Strict and effective pollution prevention practices, aiming at environmental protection. • Indirect regulation enforcement related to the national environmental policy. • EM implementation on project based and pragmatic approach. • high profile sustainability strategy focusing on research and innovation. • Greening based on strategic targets and project realization built the port's green legitimacy. • EMS on the basis of the PERS standard / own procedures perceived more valuable. • Social integration - CSR annual report and Sustainability Index (since 2008).

5.3.2 Efficiency

Environmental management research proposes that important profits are earned in case organizations become green. Pollution prevention has been identified as providing improvement in environmental performance and financial benefits (Hart, 1997). The 'green and competitive' likelihood was argued by some researches (Porter, 1991; Porter & Linde, 1995; Reinhardt, 1999) suggesting that it can lead to efficiency, lower costs of compliance and market opportunities. However, linking environmental and economic performance has been a research area with controversial results.

The competitive position of a port is very much related to cost and efficiency (OECD, 2011). Within a port organizational context, 'efficiency' is usually a word associated with operational rather than environmental management, while environmental expenditure is only seen as increasing operating costs and giving little improvement in the overall efficiency of the port. Environmental requirements have been typically considered as added costs for the majority of the European ports and thus the related costs can be considered as the main reason behind a PA's decision to support or not approve green practices (Adams, et.al., 2009). Ports generally try to minimize their environmental expenditure, although this practice may work only in the short-term and it is likely to cost more in the long-run (PEC, 1999). Many ports negatively estimated the EMS preparation, considering it as a bureaucratic approach to manage port environmental impact and did not see a positive balance between the costs of assigning personnel for these preparations, the costs of investments in environmental measures and their income from port activities.

Since 2000, EMS application in EU ports has had positive environmental effect in port environmental management (ESPO Review, 2009), but the impact on the profit side is still unknown. Within the EcoPorts network, academics and port professionals have increasingly suggested that in order to increase efficiency of PEM, the establishment of an EMS emerges as a necessity (GreenPort Conference, 2009). Green port policy targets, like emissions reduction, reduction of the overall energy consumption, optimization in energy and waste management are issues that when properly managed may provide cost reduction, avoidance of latent liability costs or even bring potential revenues. Hence, PAs gains from being environmental conscious, depend on the kind as well as on the effectiveness of the environmental management established in the port.

- **Perceiving green port efficiency as of organizational importance, cost reduction and economic gain**

In the broadest terms, it is suggested that, a 'green port' is one that achieves an acceptable balance between environmental costs and economic benefits. But how much environmentally friendly a port must be to be considered 'green' is a strategic issue which each port organization addresses differently. Efficiency in terms of environmental protection is not a one-off project but an organizational continuous process which aims to balance the conflict between achieving an acceptable environmental impact and maximizing port efficiency. In addition, a logical argument could point that environmental efficiency in a port is strongly conditioned by the total of the various companies that operate in it and thus, the link between greening and economic success could be materialized by maximizing the number of the cost efficient individual companies or even by potential market gains from green synergies in the port community.
Voluntarily available EMS standards (PERS, ISO, EMAS) are introduced in ports as able to recognize and manage their environmental effects and therefore enhance their environmental efficiency. But do all environmental aspects -even when effectively managed- cope to provide green efficiency and how is this traceable? The answer was unclear for the majority of the interviewees.
Perhaps the most influential argument in EMS standards promotion, is that by implementing them pollution reduction is ensured in an effective and economically efficient way. The argument follows the supporting assumption that it is more cost-effective to prevent pollution than manage it after it was generated. All four ports examined in this research, considered of significant organizational importance the- *although unclear*- indirect gains in terms of reduced liability costs, which are understood as directly related to EMS implementation. What was common among all was that their EMS efficiency gain was almost automatically introduced as related to eco-efficiency.

"The Eco-efficiency concept means to add more and more value to products and services, consuming less raw materials, reducing waste and generating increasingly less pollution through environmental, economically efficient procedures."
(Federico Torres Monfort, VPA – Director General Port Service, Safety & Environment)

Until 2010, most EU ports perceived green port efficiency in terms of eco-efficiency programs' integration in their environmental policy. The main focus was on resource efficiency and waste minimization. Both aspects were of significant organizational importance and the PAs integrated specialized energy and waste management policies and plans into their EMS and extensively communicated their successful results in environmental reports and newsletters, mainly because these particular aspects provide pragmatic and traceable green managerial results. It is no exaggeration for one to speak about the newly evolved *green port energy efficiency* realm (Wiegmans & Geerlings, 2010; Acciaro, et.al., 2014). Although significant environmental impacts are generated by the immense use of diesel oil for developing port activities, until the 2000's little -if any- had been done by PAs to address energy consumption issues, but within a decade PAs have been proactive enough even to the point that some ports have been using standardized tools of reporting on their energy efficiency efforts.
All four ports examined in this research implemented managerial actions and gained relative benefits in terms of resource efficiency (mainly energy efficiency) and waste minimization with a direct result in costs reduction. Although a limitation, considering the extent of the Oliver's efficiency factor which refers to the efficiency or economic fitness of all aspects in a firm's environmental performance, the next section proceeds analyzing efficiency as it was perceived by the examined ports. However, there are several aspects of operational port activities that affect resource efficiency -and especially energy efficiency plans- and thus the matter of *to what extent* energy efficient is perceived as of organizational importance differs among ports.

The *port of Dover* (DHB) persistently worked out cost effective resource efficiency measures. DHB integrated specialized programs in its EMS in order to maintain and encourage waste reduction, waste recycling, energy and water efficiency. The port's organizational interest in waste reduction can be traced back in 1998, while since 2007 a waste minimization policy has been part of the port's waste management plan (see annex1 p:29). Recycling plan and practices in the port were successful in effectively reducing the amount of waste sent to landfill due to waste hierarchy integration into operational decisions. Until 2010 the port's waste was separated into 22 different waste streams, 19 of which were sent for recycling. The port's environmental manager explained:

"EMS implementation helped us in maintaining our commitment as environmentally alert in efficient way. We managed wherever possible to minimize costs, wastage and consumption. We were even more successful in recycling when recycling practices were structured and integrated in our management system. Employee involvement was also important. They played an active role in reducing the amount of waste which was generated for landfill."

In 2006, DHB set up its energy and water policy (see annex1 p:33-37). The policy was a set of goals in energy and water efficiency, partially in compliance with the national regulation like energy efficient building regulations. A supportive web-based advanced monitoring system allowed good coverage of detailed energy data that led to a better understanding of the port's energy consumption issues. According to the environmental manager:

"The plan was developed based on specialized monitoring that provided a better understanding of the port's energy consumption issues. The data allows the management team to clearly identify inefficiencies and therefore focus on the development of solutions to give the best results in most cost-effective ways."

In 2007, the port updated its Environmental Policy aiming to ISO14001 certification and set the priority to reduce its carbon footprint (see annex1 p:36). DHB has had a carbon footprint data since 2006 and in 2010 it was awarded the Carbon Trust standard. Since 2007, the port has been exploring the possibility of renewable energy use, while collaboration with port tenants contributed to delivering the most effective results and innovative installation of a Combined Heat and Power plant in the port area (see annex1 p:37).

Until 2002, the *port of Thessaloniki* (ThPA) experience in environmental protection was narrow. Among the range of management response choices available for voluntary self-regulation, the EMAS standard was not considered as an option, while an EMS implementation based on the ISO 14001 required considerable costs following that the standard's application required the total and all of the port's operational segments (container terminal, management of bulk, passenger terminal, etc.), (Palantzas, et.al, 2005). The top management aiming at cost-effective and practicable process to demonstrate compliance with legislation decided:

"allocation of funds for greening according to the port's capacity and need."

Following up green port developments at a European level, ThPA incorporated the EcoPorts network and advanced the use of the SDM/EcoPorts tool so as to overcome the gap of knowledge in a fast and 'cost efficient' way. According to the interviewees:

"Joining the EcoPorts and implementing the SDM and PERS standard helped us to set up step-by-step procedures for achieving short and long-term environmental targets by monitoring their implementation, effectiveness and the related costs. This whole process changed the way the port functions."

"We considered as vital the gradual implementation of green practices according to the port's environmental priorities and efficient distribution of costs."

The port's first Environmental Policy in 2003 declared the application of efficient green practices which were classified as natural resources protection and conservation practices. In fact, ThPA has applied practices to minimize waste production and improve recycling efficiency since 2003 (see annex2 p:32). The management considered the port's waste management plan as functional and effective, especially for its waste reception and handling of ship generated waste and cargo residues. However, the results of the port's recycling program were positive but not extensive. What was mainly perceived as of organizational importance was reduction in energy costs (see annex2 p:37). Energy efficiency projects were prioritized and the PA accomplished positive results in fuel oil, heating oil and electricity consumption from 2006 to 2010. Beyond the environmental benefits from the aforementioned taken actions, the port's environmental manager considered that they were:

"significantly contributing to operating cost reduction."

Until 2010, the *port of Valencia* (VPA) applied a comprehensive and multitask Eco-efficiency policy and action plan focusing both on organizational and port community level. A series of different aspects improving energy efficiency and climate change mitigation have been addressed (see annex3 p:29). Following the same way, by building up various issue-based policies that were finally integrated in its EMS implementation, VPA comprehensively initiated various eco-efficiency operational plans, implementing several inter-organizational, national and European level collaborative R&D projects. The port's eco-efficiency projects extensively focused on electric energy and material consumption, renewable energies, waste management, sustainable mobility, port facilities efficiency, Green House Gas Emissions (GhG). Since 2008, the port has been particularly active in energy consumption as the interviewee explains:

"We aim to improve consumption efficiencies through monitoring and measuring water and electricity consumption in the supply networks of our cluster port.
A project is underway in relation to energy efficiency aiming to improve the efficiency of the VPA's buildings located in port areas and achieve certification. We are also reassessing the vehicles we use and their possible substitution for more eco-friendly models.
There are so many aspects that should be placed in the puzzle but there is no other way to do it than continuously integrating in the EMS implementation new practices which enhance efficiency."

With special focus on energy efficiency at container terminals, VPA's port facilities efficiency efforts may be considered as the most appealing to any other EU port active in container transshipment. The related national R&D project (see annex3 p:29) provided a tool for achieving targets and objectives related to the overall competitiveness through a system of monitoring and evaluating energy efficiency and environmental performance. Furthermore, the port can be considered as particularly successful in securing EC funding for R&D port research; one clear example for that comes from its efforts in climate change mitigation. VPA has been active in the fight against GHG emissions through collaboration with ports located around the Mediterranean Sea (see annex3 p:30). The collaboration initiated a port specific methodology and on-line tool to control energy consumption and carbon footprint calculator especially for ports. This method is distinguished between 4 levels; the port as a whole, port activities, services, and port equipment and machinery.

"We like to employ a proactive attitude that promotes respect for natural resources and their rational exploitation. We think the environment as a business opportunity, a source for saving and, on many occasions, for benefits too."

If it is difficult to accurately estimate the actual outcomes of eco-efficiency policies –integrated in EMS processes- in small-sized ports how is it possible to estimate it in the tremendously large scale of the *port of Rotterdam* (PoR). PoR has grown thanks to fossil fuels and became a global scale petrochemical complex.

Since the mid-2000s, the port's strategic vision has been aiming at an absolute decoupling of economic growth and CO_2 emissions towards the future sustainable port. The target is a long- term port strategy that, taking advantage of the size of the port area as well as the density and the scale of emissions, serves three actual opportunities for innovative large scale efficient solutions. The Rotterdam Climate Initiative (RCI) (see annex4 p:32), with the ambitious target to halve CO_2 emissions in 2025 compared to 1990 action plan, is based on 5 cornerstones. PoR is responsible for two cornerstones of 'Rotterdam Energy Port' and 'Sustainable Mobility'. The introduction of the term 'Rotterdam Energy Port' -at least as a marketing tool- marks a new leap forward for Rotterdam's promotion to this role. However, the scale and the ambition of the 'Rotterdam Energy Port' objectives, the uncertainty involved, as well as the fact that it is a long-term plan, make it extremely difficult to estimate results regarding efficiency and economic gain. In respect of the 'energy port' (see annex4 p:33-40), the port has focused on three strategic- almost missionary- objectives to reduce CO_2 emissions: energy efficiency; renewable energy; and CO_2 capture and storage. Since 2007, PoR has published a yearly *footprint report* (see annex4 p:39), on CO_2 emissions from its own operational activities, addressing CO_2 emissions derived from the energy use of buildings and transportation needed for the daily operational activities. In 2010 the port authority published a business plan (2011-2015) concerning actions to reduce its CO_2 footprint.

The following Table 5.7 comparatively summarizes, the way ports perceive their green policy implementation as important in terms of efficiency and subsequently anticipated efficiency gains.

Table 5.7: Efficiency as predictive dimension of individual port strategic response

Efficiency	
Why are ports being forced to confront institutional expectations?	
Dover	• Indirect gains by potential reduced liability costs through EMS implementation are perceived as of organizational importance. • Unclear efficiency gains of EMS implementation relate to the total of the environmental aspects. • EMS implementation efficiency gains demonstrated in terms of eco-efficiency. • Operational cost reduction through specific eco-efficiency policies integrated in EMS implementation: o Waste minimization policy focused on waste reduction and recycling integrated in EMS (2007). o Energy and Water efficiency policy supported by specialized monitoring system integrated in EMS (2006). o Carbon Footprint Policy as organizational priority (2007). o Collaboration with port tenants for Carbon Footprint reduction at the port community level (2009). o Carbon Trust standard certified (2010). o Feasibility research projects in renewable energy use (2007).
Thessaloniki	• Indirect gains by potential reduced liability costs through EMS implementation are perceived as of organizational importance. • Port greening was integrated within organizational goals after effective and efficient cost distribution for the port's EMS implementation. • EMS implementation efficiency gains demonstrated in terms of eco-efficiency. • Cost reduction from green practices: waste minimization, recycling and energy efficiency projects.
Valencia	• Indirect gains by potential reduced liability costs through EMS implementation are perceived as of organizational importance. • Implementation of several inter-organizational, national and European level collaborative R&D projects focused on issue based eco-efficiency operational plans integration in the port's EMS, like: o electric energy and material consumption o renewable energies o sustainable mobility o port facilities efficiency o Green House Gas (GhG) Emissions • Initiation of port specific operational tools through national/European level collaborative R&D projects for: o energy efficiency at container terminals o GHG emissions mitigation o Carbon footprint calculator especially for ports.
Rotterdam	• Unclear efficiency gains of EMS implementation relate to the total of the environmental aspects. • Unclear efficiency gains for the Rotterdam Energy Port strategic vision aiming at decoupling economic growth and CO_2 emissions through: energy efficiency; renewable energy; and CO2 capture and storage. • Since 2007, yearly Carbon Footprint reports regarding own operational activities indicated positive but not significant cost reductions.

5.4 Perceptions of content: consistency and constraint
(To what norms or requirements are the ports pressured to conform?)

There are two other distinct factors, *consistency* and *(discretionary) constraint,* that are shaping another institutional constituent suggested by Oliver. The Oliver's *Content* institutional factor is about the norms or requirements ports were obliged to conform to. In the case that green norms and requirements exerted by institutional pressures are consistent with the port's organizational goals then it is more likely that there are no doubts about the institutional expectations' validity or legitimacy and *thus*, the PA will choose a conforming strategy. However, it is exactly the opposite in case those institutional pressures constrain the port to choose freely, and thus more resistance should be expected. Organizations will more eagerly acquiesce to pressures that do not constrain substantive organizational decisions, such as resource allocation and acquisition, or organizational administration (Oliver, 1991: 166).

5.4.1 Consistency

- **The way green port legitimacy is acknowledged within the field**

The lack of a coherent EU environmental policy, as well as the absence of a level playing field in port environmental issues which mainly derived from legal uncertainty, shaped the dynamics that influenced the way green practices were introduced to ports. The ESPO Code towards self -regulation addressed the need of a green policy framework that was absent. The Code guided PAs to design green projects by improving the port area environmental quality and to build cooperative synergies with cities by building up a positive public image. The EC supported ESPO and co-financed research-led collaboration among the PAs willing to act. The evolved EcoPorts network provided its members with methodological managerial tools capable to deliver regulatory compliance and risk reduction through independent certification standards.

"ESPO and EPF/EcoPorts were active in the field of port environmental protection using a dual approach by setting policy targets and promoting the creation and use of EM tools that assist ports in implementing the policy targets",
(1st EcoPorts Conference Barcelona, 2003)

Thus, the main approach towards assisting European ports with environmental management was predominately focused on the mitigation of environmental impact through EMS standards' use. Certified ports are considered as the legitimate green ports in the field. Consequently, EMS standards implementation was favored by PAs as the systematic approach to manage their environmental plans for pollution prevention, protection and control (Lam & Notteboom, 2014).

- **Individual port's organizational goals consistency to field demands**

The ports of Dover and Valencia were the most consistent to the field's demands towards greening. In the UK, a science-based approach of port environmental policy progressively enhanced PEM implementation. Already in the 1990's, a policy framework promoting the concept of environmental management in ports was also in place (see chapter3 p:57). Located in this particular national context, the *port of Dover* (DHB) has been proactively involved in building up environmental plans since the early 1990's (see annex1 p:38). The port was vigorously involved in collaborative research programs at a national as well as European level and it was most active in the use of the EPF/EcoPorts tools already from their initiation. It is the EU port with the longest SDM records (see annex1 p:41). The port's environmental manager highlighted the organizational value of the SDM tool. The PA perceived SDM as a valuable performance indicator, internally and externally.

"The SDM tool stresses priorities and identifies the areas that require attention. It helps us to have a clear picture of where the port stands in comparison with other European ports. For the management, it is a long-standing proof of environmental commitment and and a proof of our proactive membership in the EcoPorts network"

DHB was a pioneer in using the EPF/EcoPorts tools. They initiated the port's first Environmental Policy Statement and its first EMS certification according to PERS. In line with the ESPO/EPF recommendations and in terms of continuous improvement in greening, its EMS standard was also certified according to ISO14001.

"Finally, after almost 15 years of efforts our EMS was ISO14001 certified. We consider that this certification ensures legislative compliance in all activities undertaken on the Board's estate and continuous improvement in our green efforts."

The *Valencia Port Authority* (VPA) is a PA managing a cluster port. Since the 1980's, VPA's business planning has been focused on infrastructure development and has related milestone building to match capacity and trade growth. The Valenciaport's South extension (1985-2015) and North Extension (2002-2030) as much as extension projects in Sagunto and Gandia (see annex3 p:15) were planned and so far, executed to avoid bottlenecks for freight and passenger movements requirements, but they also had to follow national and EU law and integrate the required granting of EIA implementation in their projects' design. *Thus*, the port had to follow green mandatory rules to be able to extend, but in the 1990's according to the port's management there were also:

"market oriented internal factors towards quality assurance of our services aiming to secure commercial sustainability and development led the PA's management to act proactively and adopt sustainability principles."

The port's (1985–2000) Environmental Program facilitated environmental actions, objectives and targets (see annex3 p:31-32) enabling the PA to depart from a reactive position in greening. The port's greening process was literally set up in the port with a top management commitment to EMAS standard implementation. The path to this particular standard certification involved firstly the EPF/PERS standard application as a stepping stone to ISO14001 and the latter as a stepping stone to the final goal. This long path's commencement was supported by the national port policy encouraging quality standards implementation in port services. Quality characteristics application in Spanish ports has been mainly supported by ISO 9001, ISO 14001 and OHSAS standards.

Both Dover and Valencia ports recognized validity to institutional expectations, considering as vital to build their green credentials in a systematic approach through EMS standard implementation. Both PAs acknowledged the validity of ISO 14001 and/or EMAS as a recognized systematic approach to monitor the management and environmental performance quality; and PERS validity as a building block in their attempt to progress towards these more comprehensive EMS standards.

In contrast, the green organizational goals of the ports of Thessaloniki and Rotterdam were less compatible with the institutional expectations for EMS standard implementation compared to the other two ports. The *port of Thessaloniki* (ThPA) without having any knowledge of green managerial procedures was forced to effectively respond and adopt the least expensive approach confronting its legal responsibilities. The PA, after benchmarking the successful green port initiatives and joining the EcoPorts network, considered it valid to follow the ESPO recommendations and set up its EMS according to the EPF/EcoPorts tools. In the case of Thessaloniki, SDM initiated a process of creating awareness and identification of the port's environmental aspects and responsibilities. Subsequently, the PERS implementation established the port's EMS framework and initiated the PA's environmental policy statement (see annex2, p:44-45). PERS is primarily perceived valid as sector's specific standard. The port did not proceed following ESPO/EPF recommendations to implement a comprehensive standard like ISO14001 or EMAS. The port's representative explained:

*"The port's EMS, according to PERS, aims to assess benefits of key areas best practices implementation and a professional approach to the whole issue of EMS implementation on ports.
PERS is based on internationally recognized professional best practice.
The management considered important and very useful the fact that it is a port specific system, defining a basic standard of good practice."*

The case of the *port of Rotterdam* (PoR) follows partially the Oliver (1991) suggestion that organizational resistance to institutional pressure increases with a lack of consistency between organizational goals and institutional pressure. PoR's resistance was mainly expressed in terms of timing. Although the port was consistent with the ESPO recommendations, and while at the same time other ports were advancing certification schemes, EMS standard implementation was not considered a priority, *primarily because* the port did not perceive EMS certification as a necessity in building up its environmental strategy.

As early as the 1990's, the port's municipal management introduced concern for the environment as an absolute prerequisite. The port's management focused on a more intensive use of land and infrastructure and at the same time on increasing the port's green outcomes, collaboratively working in a series of strategic programs. For PoR it was most critical to work in partnership with various actors, developing through the years a policy framework on how to become a clean port and ever since its corporatization building a comprehensive sustainability strategy. Aiming to further bridge economic growth and environmental pressure, PoR's corporate management has constructed its vision on how to be a sustainable port by introducing potential solutions to increasingly complex challenges like climate change, energy, port development, incorporating all aspects of ESPO's recommendations, following legislation and national policy guidelines, relying on existing green knowledge and consistently working with different stakeholders at a local and regional level. Additionally, since the corporatization process, the legal obligation arising from the independent corporate status has also changed the annual reporting status (Satta et al., 2014) and the port has also moved towards the creation of a comprehensive sustainability report, in line with other world ports, such as its main competitors, Antwerp and Hamburg.

According to the port representative, PERS is valid as a sector's specific standard which did not affect the port's green strategy. It was considered as a valuable structured framework for EM in the port area and helpful as a checking reference for the port's environmental department.

"The PERS certification is in line with our ambition to be a sustainable port. We have worked and continue to work with a variety of partners aiming to support good living conditions. We strongly believe that we should address environmental issues in collaboration at regional level."

The following Table 5.8 comparatively illustrates the way ports perceive their green organizational goals to be consistent to field demands.

Table 5.8: Consistency as predictive dimension of individual port strategic response

Consistency	
To what norms or requirements are ports being pressured to conform?	
Dover	• DHB's Environmental Policy consistent to ESPO recommendations. • EMS implementation consistent to national policy guidelines. • Consistent long-lasting use of the SDM/EcoPorts benchmark tool. • Consistent to ESPO/EPF recommendation upgrading PERS to more comprehensive standard (ISO14001),
Thessaloniki	• ThPA's Environmental Policy consistent to ESPO recommendations. • Consistent to EPF/EcoPorts tools use – EMS implementation according to PERS. • PERS perceived valid for EMS implementation.
Valencia	• VPA's Environmental Policy consistent to ESPO recommendations. • EMS implementation consistent to national port policy encouraging quality standards implementation. • Consistent to EMAS Regulation for building the port's EMS. • Consistent to ESPO/EPF recommendation upgrading PERS to a more comprehensive standard (ISO14001 and EMAS).
Rotterdam	• PoR's Environmental Policy consistent to ESPO recommendations. • Strategic focus on building green credentials in partnership with various actors at local and regional level. • Since PoR's corporate status emphasis on building and communicating comprehensive sustainability strategy. • PERS perceived valid as sector specific standard.

5.4.2 Constraint

- **Individual port (discretionary) constraints towards greening**

Prior to the 1990s, the port sector was an industry that was not difficult to exert environmental unfriendly practices. Since that time, for a constantly increasing number of European city-ports, port business planning and operation has been based on the balance between their environmental impact and economic concerns aiming to meet increasing and demanding social concerns for port environmental impact. Within each port's national context, environmental protection was encouraged or compelled based on potential green national policy as well as legal obligations and enforcement. Even though EU PAs had a wide range of reasons to react to the newly evolved demands of greening (Wooldridge, 2004), the 2009 "ESPO/EcoPorts Port Environmental Review" revealed that although EU PAs had been dealing with green enforcement for more than twenty years they still faced difficulties in the environmental legislation implementation - difficulties which are predominantly caused for political and economic reasons (ESPO, 2009). They were aware of the costs raised from both financial penalties and negative publicity when they do not address their environmental responsibilities and liabilities properly, but also that complying with regulations comes with cost as well as allocation of time and human resources. Furthermore, the cost estimation is even more unpredictable when it comes to PAs obligations to reduce their environmental impact derived from the evolved national environmental policies which took into account overarching European sustainability objectives and requirements.

All four port case studies confirmed that, dealing with green institutional pressures and mainly conforming to their legal obligations and liability imposed strict demands which limited their organizational decisions. In fact, they did not have any other option than deal with environmental issues and classify them in their business agenda. Yet, the diverse individual constraints that hindered the building up of their greening processes were different from the ports themselves. An important point that posed constraints to organizational decisions was the lack of adequate knowledge able to tackle the majority of port environmental concerns and issues. The way each individual port dealt with insufficiencies was also related to the extent of organizational constraints. For those ports that aimed to establish environmental procedures, by particularly emphasizing environmental management, a database of the port's environmental status was primarily required. The establishment of the individual port environmental issues index system and its interrelation with the appropriate indicators was vital to environmental planning, as well as, to the integration of greening into daily port management. Putting up a comprehensive green port strategy is a complex process that involves *from* strategic top management decisions *to* coordination activities of employees by applying various practical green procedures at different port services. Coordination of green practices among diverse tenants of the

port community is another issue and the way ports decide to handle it depends on their green strategic goals. Therefore, the way organizational choices for environmental protection were constrained is directly related with the way each individual port has decided to approach environmental management.
Based on the above reasons, EU ports did not have the option to decide whether to be green ports or not. The only possible way they could control their affirmative decision to become green ports had to do with the ways in which they could apply this decision. PEM implementation among PAs in the 1990's was varied to an immense extent having controversial results. The choice of EMS standards application reflects the strong need for a 'level playing' in port environmental protection processes. Individual port's discretionary constraints, opposite in this regard, may support arguments of inadequate implementation and unfair competition. All four port case studies supported their strategic decision to become green ports by applying EMS standards in order to put their environmental policy into effect. Both the ports of Dover and Valencia proceeded different standards certification as their management felt that their choices should not be limited by *either* the cost *or* the allocation of time and human resources.

In the case of the *port of Dover* (DHB) it seems that the management had only to overcome planning and operational constraints towards the clearly defined goal to put environmental protection into practice. The path to PERS (2003) and ISO14001 (2008) certifications included advancing specialized knowledge, through collaborative research programs at a national and European level which especially focused on environmental quality issues and EMS implementation. After the successful first ever PERS certification, the port was proclaimed a pioneer port within the EcoPorts network. In this respect, the port's environmental manager argued that the port made available more than a decade of required efforts building its EMS implementation:

"We had, through the years, to overcome planning and operational constraints on how to identify and minimize the impacts of our operations on the environment. This also involved constantly extending our knowledge. We worked a lot with research institutes. We worked collaboratively to build up a systematic structure. At some point PERS enabled us to demonstrate our progress."

The *port of Thessaloniki* (ThPA) followed the same path by initiating its PERS standard certification in 2003 -the same year as Dover and three other UK trust ports- but ThPA had to overcome the lack of experience in environmental management that the other case study ports had acquired over a decade before. Additional to the extremely deferred awakening for the need to implement green practices -again, compared to the three other ports-, the limited financial and specialized human resources did not burden the decision for the PERS standard application. The time of the decision was also favored by the availability of the standard in the field and it 'just' happened that the standard proved beneficial or effectively implemented by some minor number of ports. The ThPA's top management explains the relevance of this particular organizational choice:

"How much the port could afford as well as to what extent was it capable to move towards green plans has affected our decision. The PERS implementation turned out to be a valuable and effective choice and having gone through even the certification process we can strongly support what we had been told that PERS can be adopted by each port authority on a time scale that it will define and adjust to the specific characteristics and requirements of each port."

Ports are quite conscious that by adopting ISO14001 or EMAS standards or even by implementing EMS, the operating costs are directly increased (Puig, et.al., 2013; Palantzas, et.al., 2014). EMAS in particular, goes beyond the international ISO14001 standard requirements (far more beyond the port specific EPF/PERS standard) by adding four pillars: *compliance with environmental legislation* ensured by government supervision; initial *environmental review*; public *information* through annual reporting; and *employee involvement*. It is also acknowledged that the adoption of the ISO 14001 as the management system element of EMAS allows organizations to progress more easily from ISO 14001 to EMAS.

The *port of Valencia* (VPA) EMS implementation has been consistently shaped by both the EMAS EU environmental regulation and national policy pressures on quality standards application. Although

constrained by its own preference on the type of the EMS standard application, the PA managed to control individual organizational decisions and proceeded with the most proactive response in EMS implementation, being certified by PERS, ISO14001, and EMAS, within the relatively limited timeframe from 2003 to 2008. To emphasize the success, it is no exaggeration to say that the port developed an exceedingly successful 'personalized EMS work plan' towards EMS application which from the very beginning aimed at EMAS certification.
The port's management was also committed to enhance environmental protection at port community level. This decision was strongly supported by the port's ECOPORT initiative which was inspired and launched earlier than the European EcoPorts project that produced the PERS standard. It is also important to emphasize here that the PERS standard is exclusively concerned with EMS application at the individual organization level and precisely the PA. VPA was a rare port case, which perceived *as of strategic value* leading and urging EMS application at the port community level. The port's efforts in this respect started with producing a methodology of EMS application though its ECOPORT II project (2006-2008) that could have two levels of performance: any facility located inside the port area, and the port area as a whole (see annex3 p:23).

"Valenciaport considers that EMAS registration is the best tool to prevent or reduce the possibility of pollution. Furthermore, EMAS provided the framework and structures for Valenciaport to improve the motivation of staff and the organization of the company with better internal and external communication, staff training and greater involvement of the top management."

"The PA has a key leadership role to play in the port community and sustainable development was a primary objective in our strategy. For us sustainable development requires a firm commitment of the management, employees and all members of the port community."

The challenges of a major hub, such as the *port of Rotterdam* (PoR), differ from those of a relatively small port that operates in a niche market (Dekker, et.al.,2010). In terms of environmental protection, the challenges are first of all related with the amount and the complexity of the port activities and the size of the port area, as well as the port's need to expand while maintaining its 'license to operate'. PoR was increasingly confronted with the output of European directives to protect the environment. The port development plans (see annex4 p:23) were hampered or impacted when particular Directives came into force. The integration of sustainability into the planning and construction of Maasvlakte2 was safeguarded by environmental knowledge enhancement that had also served the extensive stakeholder dialogue during the approval procedures (see annex4 p:46). The PA was particularly concerned and tried to ensure that environment regulations in European ports did not have a competitive effect. The produced knowledge supported the PA's reaction to controversial effects of legal requirements and actively reinforced ESPO efforts to address insufficiencies of legal requirements while confronting EC policy makers and legislators.
The port of Rotterdam was among the PAs that initiated the EU ECOPORTS project and it was also one of the funding members of EPF. The PA has been actively involved in various collaborative research projects of the EcoPorts network. In 2008, PoR used the EcoPorts tools; implemented the SDM in its port area and obtained the PERS certification. Reflecting on the EcoPorts network membership, the port's environmental manager explained that the port valued positively the information sharing. Ports are extremely different and exchange knowledge within the network and network collaboration in common problems was useful, but the EcoPorts tools did not add to the port's environmental performance. The PA had already in place effective procedures to identify risks and deliver compliance to environmental obligations. The PERS certification was mainly the recognition of efforts and certainly not a valuable tool for long-term planning.

"The exchange of information in port environmental solutions and knowledge has been valuable, especially knowledge linking to practice. However, we did not rely on the EcoPorts tools neither to implement nor to measure our environmental performance. We did have in place the proper procedures to identify environmental risk and related obligations and priorities, which is an approach very close to PERS environmental aspects classification. Without doubt PERS did not add to our long-term planning, although it is a practical tool creating a structure internal overview of the PA."

The following Table 5.9 comparatively illustrates the way ports perceive their green organizational goals to be constraint by field demands.

Table 5.9: Constraint as predictive dimension of individual port strategic response

Constraint	
To what norms or requirements are ports being pressured to conform?	
Dover	• Discretionary constraints putting emphasis on environmental quality supported by national policy guidelines. • Strong commitment to EMS process performance and integration of environmental aspects. • Planning and operational constraints were effectively overcome, gradually upgrading the port's EMS
Thessaloniki	• Knowledge constraints imposed the EcoPorts network membership. • EMS implementation according to PERS standard was perceived appropriate option.
Valencia	• Strong top management commitment to EMAS standard implementation. • Commitment to engage individual firms in the port community in EMS standards implementation.
Rotterdam	• Ensuring a level playing field in port greening at European level vital to secure own interests. • Cooperation in the EcoPorts network for knowledge gain. • Use of the EcoPort tools though perceiving them as unnecessary for policy development. • Discretionary constraints delayed the decision of EMS standards application.

5.5 Perceptions of control: coercion and diffusion
(How or by what means are green institutional pressures being exerted to ports?)

Control refers to the means through which institutional pressures are imposed on organizations. The enforcement mechanisms in the field may vary between two distinct processes that exert pressures: *legal coercion* and *voluntary diffusion*. In case that legal *coercion* is high and non-conformity leads to consequences and penalties the strategic response of acquiescence is more likely to best serve organizational interests (Oliver, 1991:168). In less coercive situations, when sanctions for non-compliance are limited, organizations can be expected to seek compromises for their conformance. *Diffusion* denotes voluntary adoption of practices. Oliver (1991) remarks the likelihood of conformity to institutional expectations or practices to the extent that these have been already diffused or voluntarily spread through an organizational field. Organizations are easier persuaded to acquiesce in an institutional behavior, if it is observed as successful elsewhere.

1.5.1 Coercion

- **Legal coercion demands, enforcement and consequences affecting individual ports**

Pressures for port environmental performance have been many and varied, but ports were prompted to go green, primarily through mandatory requirements. Environmental legislation and regulations - not always specific for port operations, but in many ways affecting them- have obliged PAs to consider the practical implementation of international agreements, EU Directives, national and regional legislation aiming at environmental protection (Wooldridge, 2004; Chlomudis & Pallis, 2002; Beresford, et.al., 2004; Verhoeven, 2010; Acciaro, 2013).
The complexity of requirements, related to both coastal and marine environmental protection, has inflicted a complicated task on port managers. Regulations decided at higher levels (European as well as international) -which is indeed evidence of the international character of the sector-, are particularly significant for port environmental performance and influence national decision-making. Particularly EU legislation- that does not specifically deal directly with the port activities' management and their effects on the environment- has a number of Community instruments for environmental protection, which affect and regulate port activities. Such operations include Regulations, Directives, Decisions and Recommendations, which have brought to the fore port environmental protection. Already in 2004, there were no less than 30 EU environmental legislative texts applicable to port operations, mostly in the form of Directives. However, based on the peculiarities of the EU legislation (particularly Directives) -that obliges member states to achieve a specified result but allows the country to determine the method and form of law by which this result is achieved-, the legal issues applicable to each individual port differ depending on the national context within which the port is embedded.

Sustainability oriented national policies have also ignited various port responsibilities. In 2001 the EC adopted its sixth environmental action program to underpin the European SD strategy. New proposals for integrated coastal zone management, promotion of renewable energy resources, air quality, bathing water quality, noise and civil liability for environmental damage have been adopted. The EU green policy is directed towards the integration of environmental considerations into all aspects of commercial and social activity, a theme which strongly runs through ESPO's Code (ESPO, Environmental Review, 2001). In addition, the Aarhus Convention (1998) on public access to environmental information, public participation in decision-making and access to justice for environmental matters, represented a major new initiative. Ports as organizations with statutory responsibilities were required, when requested, to make the information about their environmental plans and general environmental status available, (ESPO, Environmental Review, 2001).

All four case studies ports identified that the main reason for driving the decision to manage their environmental effects was the need to comply with relevant environmental legislation, while they confirmed that they are willing to comply in order to avoid potential fines and liability costs. For all of them environmental legislation was the main driver in the decision on environmental management practices adoption, while all four case studies' representatives confirmed that the legislative framework for environmental protection became more severe through the years.

The *port of Dover* (DHB) as a trust port (see annex1 p:6) is primarily subject to national legislation, and thus, it must comply with numerous pieces of environmental legislation and government policy objectives which have driven the port's own green policy initiatives. Local governmental authorities, and particularly environmental health departments, are responsible for dealing with any complaints related to the environmental effects caused by the port's activities. According to various British Standards, and in line with environmental regulations, the local environmental health officer has the power to serve an enforcement order where a statutory nuisance has occurred. At a regional level, since its establishment in 1996, the UK Environment Agency has been the main executive public body that supports SD policies implementation by providing advice and regulating activities.
DHB has persistently sought to meet the requirements of all applicable environmental legislation. Therefore, the port was obliged to constantly increase its capacity so as to meet legislative demands and standards. Its efforts were supported by research projects that have scientifically enriched specialized knowledge and built up in-house competences. The port's Environmental office regularly reviewed and upgraded its register of environmental legislation, while an Environmental Legislation Database has been accessible to all Board employees, in order to increase their awareness regarding their environmental responsibilities. The port's environmental manager considered that EMS implementation was useful and effective in tracking down the port's environmental legal requirements.

"The port's environmental office applies systematically all legislative requirements to prevent risk in the port area and ensure the protection of the surrounded ecosystem,
while it undertakes a minimum of two internal audits to monitor compliance with legislation.
We also managed to create an environmental legislation guidance document for DHB staff."

In implementing its environmental policy, prior to endorsing the principles of the ESPO Code, the port followed the guidelines of the national SD policy (see annex1 p:2) and particularly the UK marine environment policy (see annex1 p:3). It was engaged in various research projects in order to develop distinctive environmental management practices and their related performance indicators, and it was advised by academics, research institutes and the UK Environment Agency. The next lines present a clear example of this kind of efforts:

"DHB's green responsibilities don't just cover the port operations;
they take stewardship of the harbour and environs seriously.
For example, although Dover Beach is not a designated bathing water beach, due to the nature of activities which take place there, we are keen that the water quality meets bathing water standards.
We even invited the Environment Agency –which consults us when it is deemed necessary-
to monitor water quality at Dover Beach on a weekly basis throughout the summer season and the port is delighted to be included in the Marine Conservation Society's Good Beach Guide."

For the Greek PAs compliance with legislation was the main driver that forced them to minimize their environmental impact compared to social pressures, while pressures coming from their business customers and environmental organizations were almost insignificant (see annex2 p:2). The *port of Thessaloniki* (ThPA) had to comply with the national environmental legal framework -a key part of which was in the process of the national legislation harmonization with EU Directives and international

treaties (see annex2 p:2)- which however was not directly addressing its activities. Legislative demands were mainly regulating general environmental issues from any economic activity or issues that arise from different operations of the shipping sector.
The national environmental policy has been dominantly influenced by EU directives and EU funding subtended national objectives, while its operational program was insufficient in building up effective enforcement mechanisms (see annex2 p:3-4). Still in the late 2000s, the lack of any strategic perspective to move the country's environmental policy *from* remediation *to* prevention and management was evident, while national environmental guidance was deficient in coordinating the various administrative units that were ineffective in implementing environmental policies or legislation. Implemented by governmental ministerial entity, the national port policy aimed to improve productivity, efficiency and quality of port services. The national policy implementation was obligatory for the Greek ports -they had to change by becoming environmentally friendly ports- but it was not followed by sufficient implementation guidelines (see annex2 p:6). Both the country's two largest ports (Piraeus and Thessaloniki PAs), as well as the smaller ones, have been generally recommended to exploit prospects to become green ports. To overcome the lack of adequate guidance ThPA endorsed the principles of the ESPO Code and proceeded to use the EPF/EcoPorts tools. The EcoPorts/ SDM application was particularly catalytic and supported the port to follow up legislative requirements, by structuring and classifying them based on the port's particular environmental aspects. The interviewees of the port explained that:

"Pressures on the port from the local community for environmentally friendly behavior were less important than compliance with environmental legislative requirements.Because there was not guidance following the national policy suggestions
on how we could operate as a green port or on how to provide evidence of our green behavior, we had to define our duties and responsibilities regarding all types of legislative requirements."
"There are several competent authorities that operate as inspection bodies scrutinizing the application of existing legislation rather than as policy makers for port environmental protection."
"Our goal is fully compliant with the national and international environmental regulations."

Most Spanish environmental laws have derived from the transposition of EU legislation and enforcement is carried out at state, regional and local authority level. The country's local Autonomous Regions are able to develop and enforce their own environmental legislation -having their own regulations with regard to the powers of inspection and control- and the local authorities also have environmental protection responsibilities. The *port of Valencia* (VPA) beyond complying with national and EU environmental regulations -mainly in the form of Directives- had to adopt state and regional regulations towards strengthening environmental sustainability. Although fragmented, these regulations finally merged with the Royal Legislative Decree 2/2011- along with principles of transparency and disclosure of environmental data as well as public involvement in decisions affecting the environment -which the Spanish companies ought to comply with-, made up the regulatory and policy framework for environmental and sustainability management for the cluster port of Valencia.
Through time the Spanish Port System has been committed to sustainability. Since 2000, the legislation -that had been progressively applied to Spanish ports- required that their economic management was carried out in a framework of sustainable development to ensure the environmental protection and conservation, as well as the social integration of ports with nearby cities. Finally, the 33/2010 law -which requests Spanish PAs to disclose environmental sustainability objectives and indicators and prepare sustainability reports- was based on former research initiatives of the National port administrator that produced the required indicators for port environmental aspects monitoring and reporting (see annex3 p:3). Based on this framework, the Spanish port system laid out strategic guidelines concerning the management of particular port environmental protection aspects, like noise and water quality. The goal was to track the main strategic and operating objectives that each individual port authority had to identify and set. The result was that some Spanish PAs took an early advantage using the appropriate guidelines on how to incorporate sustainability criteria in relevant port policies. The port of Valencia has been a clear example. Since 2008, the port has been quite active ensuring legal compliance -where applicable at the port community level- by making use of mechanisms -like the Ecoport-Lex (see annex3 p:23)- that enforce good environmental behavior by port users. The port's interviewees provided the related information:

"VPA's Environmental Policy targets stimulate all the measures required to prevent environmental contamination and implement good environmental practices complying with the variety of legislation."
"The port has a system to regularly identify and assess legal and other environmental requirements and our in-house environmental team worked closely to the National Port State Agency with the guidelines provided for port environmental good practices.
We target on zero for liability costs by keeping environmental authorizations up to date, and complying with environmental obligations on regular basis."
"In 2006, we re-released our Good Practice Guide in Ports with special emphasis placed on environmental legislation aiming to inform all players involved in the port community, while in 2008, we launched a port environmental legislation system called Ecoport-Lex and we are offering a consultancy service on environmental legislation to port community companies of our cluster port."

As in most other European countries, the *port of Rotterdam* (PoR) has the responsibility of environmental matters in its huge industrial port area and *therefore*, it is accountable for implementing European and national environmental legislation and regulations. Particularly, in terms of the significant number of vessels using the port's services, effective implementation of shipping regulations has also been of key importance. International regulations issued by international organizations like IMO (such as the SOLAS and its amendments); recommendations of EC; national regulations, like the Dutch Inland Waterways Policy regulations; and local laws, like port management Bye-Laws that specify the port's 'house rules' for ships carrying dangerous cargoes, are applied. The role of the Harbour Master -PoR's distinguished division- includes inspections that secure related to vessels' national and international safety, security and environmental regulations enforcement and the supervision of a cluster of ports (Rotterdam, Schiedam, Vlaardingen, Dordrecht, Zwijndrecht and Papendrecht).
The Dutch national environmental policy has been drawn around national environmental objectives in different sectors and it recommends priority environmental actions (see annex4 p:3). An important focus of the policy is related to spatial planning, directing the attention to provinces and regions as geographical units of sustainability. In this framework, the PoR's sustainability policy had to be embedded in the regional development framework. Consequently, the PoR's Port Plan 2010 should be considered as located in the regional development scheme of the ROM-Rijnmond plan (see annex4 p:11-13). The framework created by the ROM-Rijnmond plan focused on sub-targeting objectives to produce an integrated environmental plan (Giebels & Teisman, 2015), with the dual target to expand the Rotterdam Mainport and improve the living and social climate of the wider area. In this respect, for the port administration to keep up consistency of the PoR's policy at a regional level, one should consider the importance of collaboration and the compulsory efforts. Additionally, the national policy level aiming to contribute to an integrated approach for sustainable port development, proposed that Dutch PAs should focus on the following themes: air quality; energy; CO2 and residual flows; use of space; preservation and development of nature; as well as water quality and management (Dekker, et.al, 2010).
Until the first National Environmental Policy Plan (NEPP), which was focused on remedial measures for urgent environmental problems, the environmental law enforcement had not been very strong. Since 1992 and the first National Enforcement Program (NEP), environmental infringements have been successfully addressed. After four NEPPs, in 2001 the Dutch National Strategy for SD (see annex4 p:4;), based on quantitative standards towards a sector-oriented environmental policy, moved from a governmental policy to a regional and locally applied and controlled one, emphasizing preventive measures (Carley & Christie, 2000). In the new national policy approach, the establishment of the regional environmental agency (DCMR) was vital for environmental legislation enforcement. The main tasks of the agency include regulation and licensing of the industries and facilities in the port area as well as monitoring and assisting the PA in developing environmental policy (see annex4 p:5). Finally, the role of the individual company established in the port area is very clearly distinguished. They should apply for environmental permits (issued by DCMR) and they should operate and report in accordance with the conditions set in the permits. The PA is clearly not responsible for their environmental issues and aspects connected to their use of the port and the industrial area. The port's interviewees put the aforementioned in plain words:

"We have to implement a plethora of international, European and national legislation that form a variety of areas of environmental law. PoR would benefit from more consistent and clear-cut environmental regulations. Yet, our vision for the sustainable port was definitely not inspired by the numerous, and in some cases contradicting each other, environmental regulations that we have to apply to our operation."

"To maintain a sustainable port, we work beyond our efforts to follow our environmental responsibilities, a clear example of that is the Harbour Master unit. Apart from actively monitor compliance with environmental laws by the port user, together with the VROM Inspectorate and the Transport, Public Works and Water Management Inspectorate, we developed the 'Enforcement Strategy for Shipping Waste' in 2007, containing legislation to prevent pollution of the sea from ships."

"There is a clear understanding of the respective roles of both the port administration and DCMR which is the formal environmental authority. Management at senior level in both authorities is committed to close levels of co-operation. Our focus is also on developing an international quality port from an economic perspective, whereby regional interests such as health, quality of life and nature weigh heavily, in this respect we work structuring collaborating endeavors."

The following Table 5.10 comparatively illustrates the ways ports were forced to comply with institutional coercive demands.

Table 5.10: Coercion as predictive dimension of individual port strategic response

Coercion	
How or by what means are green institutional pressures being exerted to ports?	
Dover	• DHB is a Trust port and thus, primarily is subject to national legislation. • Obliged to conform mainly to EU and national environmental legislation. • Local governmental authorities and particular environmental health departments are responsible to enforce environmental regulations and various British standards for environmental protection. • National SD policy objectives are advised and supported at regional level by the UK Environment Agency.
Thessaloniki	• National law regulating general environmental issues and in harmonization process with EU legislation. • Insufficient implementation of environmental legislation due to the large number of government agencies with environmental responsibilities and the dysfunction of the country's inspectorate system. • Lack of integration mechanisms in the Greek public administration made it difficult to formulate and implement integrated environmental policies. • National port policy obliged ports to become 'quality' ports with insufficient implementation guidelines. • Lack of familiarity with the concept of SD constituted a handicap for Greek ports.
Valencia	• Mandatory obligations derived by EU legislation have been applied at national law and enforcement is carried out at state, regional and local authority level. • National and regional regulatory framework aiming at sustainability objectives has progressively incorporated recommendations focused on transparency and disclosure of environmental data. • The National port Agency provided PAs with strategic guidelines for the management of specific port environmental aspects and recommended scientifically based indicators for various port environmental aspects monitoring and reporting. • At port community level VPA initiated mechanisms to ensure legal environmental compliance by port users.
Rotterdam	• In terms of environmental protection, the PA's operation is subject to national policy and legal requirements. • Environmental responsibility within and/or related to the port area is plainly defined. • National and regional spatial planning and the resulted policy memorandums were shaping the long-term scenarios or perspectives for the sustainable development of the port. • The most recent national policy recommends an integrated approach for the Dutch sustainable port based on five subjects thematic action. • Licensing and enforcement of environmental law focused on long term targets of emissions reduction. • The PoR's Harbour Master departmental entity carries responsibility for environmental enforcement of complex shipping regulations. • Significant role of the regional environmental agency DCMR in permitting and enforcing in the port area, as well as, reporting about environmental quality in the region. • Individual companies in the port area apply for environmental permits (issued by DCMR) and thus, operate and report in accordance with them.

5.5.2 Diffusion

- **Conformity to EMS standards as green port strategy that brings legitimacy - Green values, practices and expectations diffused in the field**

In the 1990s, the unavailability of specific legal procedures to regulate environmental quality in port areas (Goulielmos, 2000) generated problem-solving efforts by individual ports and the sector's collective response, which both aimed to initiate port activities' greening. EU seaports were engaged in a collective industry action through their association (ESPO), so as to make the difference. The environmental values that guided the ports' actions towards change were introduced with the first version of ESPO's Environmental Code of Practice in 1993. The core value expressed the EU port commitment to environmental protection (Hoenders, 2007). The Code set priorities and challenges towards the identification of various environmental issues related to all aspects of port operation (see ch3 p:54).

The Code was welcomed by the sector and the EC, as a groundbreaking initiative that put in the agenda the close relationship between ports and environmental protection, admitting that ports must, like all industries, commit to obedience and respect of environmental laws and regulations. Some individual port experiences and best practice solutions that were already in place, but they were not easily accessible, keened the requirement for the existing know-how of ports to be shared. PAs communicated the need to create a 'common language', to understand each other's situation, problems and the value of found solutions. More importantly port environmental managers expressed the urgency to have tools to demonstrate good work in the field of environmental protection, especially to third parties -industrial clients, local and national governments, pressure groups, etc. (Eco-information project, 1999). Port administrations also expressed the need of systems and structures incorporation within the PA regular operation that could assure the requirements of environmentally friendly practices, while the ports could remain focused on business targets.

Greening was perceived as added cost but it was also considered as of strategic value -at least for a constantly increasing number of EU ports (ESPO, 2004). The possibility to minimize costs of greening sounded beneficial as well. Thus, the EU ports worked towards 'a level playing field' in terms of standards and approaches to their environmental responsibilities (Stavrakouli & Wooldridge, 2004). Following the same path as other industrial sectors, the European PAs were advised and supervised for environmental protection by *self-regulation* and EMS implementation through standards. Standards like ISO14001 and the former established EMAS, as well as British BS7750, were already embraced by other industrial sectors and their associations enhancing self-regulation. Although governments are involved in varying degrees in promoting self-regulation (Delmas, 2002), in the case of industry associations' stewardship programs of self-regulation this may be quasi-mandatory (Moutchnik, 2002). Standards mostly come with a verification mechanism and organizations undergo scheduled third-party audits in order to become certified.

In the case of EU ports, since the mid 1990's ESPO, the seaports' association, and by the beginning of the 2000's the ESPO/EPF synergy, initiated certain tools aiming to put port environmental management (PEM) in practice: SDM/Port Environmental Self-Diagnosis Method, PERS/Port Environmental Review System, and EcoPorts Environmental Certificate of validation; while it provided national training workshops and organized yearly international conferences (Journee, 2008). Since 2002, the PERS certification scheme has been available to PAs. It was the main outcome of the sector's collaborative ECOPORTS project (see ch3 p:61) and it was introduced as the sector's specific EMS application. According to Mr. Megalidis' statement representing the EC/DG TREN in the EcoPorts Conference in Barcelona (2003) the ECOPORTS project contributed to a:

> *"new environmental awareness in ports for fully incorporating and benefiting from practical environmental management tools. The Commission considers theproject, as a very good example of money well spent."*

To avoid liability costs, EU PAs had to ensure compliance with different types of strict environmental regulations for their port activities, and indeed, this was the primary aim of greening, but in the early 2000s the ports realized that:

> *"The work that ECOPORTS partners have pioneered will soon be viewed as an industry, standard requirement" (Jordi Vila, Port of Barcelona / EcoPorts Conference Barcelona, 2003).*

Under ESPO, the EcoPort network was created as a way to set the basis for cooperation amongst ports to share information and best practice, as well as to make the use of the aforementioned tools available. Linked to this was a more 'political' aim, which was to demonstrate to legislators that the port sector could look after itself, could self-regulate, and that new legislation would be unnecessary.

> *"Ports should get a better knowledge of the environmental effects of their activities.*
> *To do so, they should use environmental management and monitoring tools.*
> *By adopting such a pro-active approach, they will be in a stronger position to negotiate."*
> *(David Whitehead, Chairman of ESPO / ESPO Conference in Genoa, 2002)*

Since their inauguration, the SDM and PERS standard have been valuable for helping managers to identify goals and set up priorities, but they are accessible only by joining the EcoPort network. Both

EPF tools are sector specific and particularly effective in dealing with individual port insufficiencies when confronting environmental legislation scrutiny, but another reason that makes them quite attractive to ports is that they are promoted as a promising starting point towards meeting the market's demand for EMS standards.
Voluntary schemes around the world, like EMAS in Europe and especially the ISO14001 standard, are considered more comprehensive or internationally oriented EMS standards, but still during the 2000s port managers rarely supported EMS standards implementation for their environmental plans. They considered the standards implementation 'unrealistic', in terms of costs and human resources. However, port customers, as well as different kinds of stakeholders, who are aware and have the knowledge of these EMS schemes, might feel assured by the standard on the basis that obtaining certification means that the port has already established an environmental quality control customized to its port activities. EPF tools aimed to harmonize PEM in Europe, while the EPF/PERS standard offered PAs a green certification scheme which was also promoted as a stepping stone to ISO14001 or EMAS (see Fig.4.1 ch4 p:54). In this respect, the use of the EPF tools had a dual value for EU ports. First, they established a 'level playing field' in environmental regulations implementation. Ports had finally tools –especially by using SDM- to evaluate their environmental strengths and weakness and thus, update their green goals. Secondly, by encouraging PAs to further plan ISO14001 and EMAS certification, the sector appraised the green port not as an isolated and sector specific issue. Greening should be part of their overall business identity which makes them possible to compete.
Especially in the case of ports hosting primarily container terminals, their competitiveness is directly related to their presence in value driven chain systems (Robinson 2002, Adams, et.al., 2009) and being part of this kind of reality these ports are necessitated to endorse greening and green management practices, (Lun 2011). Market driven green integration in port management has been as well upgraded since the end of 1980's, due to the gradual deregulation and privatization of PAs in different parts in Europe (Baird 2000), which in turn forced port administrations to obtain characteristics of private organizations towards greening (Brooks 2004). Finally, there is also the potential that some PAs become more conscious of their obligation to future generations (Balbaa, 2010), or the fact that some of them implement environmental regulations purely aiming to be efficient.

The *port of Dover* (DHB) was the very first EcoPort that issued the PERS certification. Before that, DHB had been a member of the British Ports Association (BPA) -the first port association that got engaged in environmental performance (see ch3 p:61). The DHB environmental staff have been active members both of BPA and the UK major Ports Group (UKMPG) Environmental Policy Group since 1993. The BPA was an active participant in every EU environmental projects –starting with the Eco-information project in 1997.The Group examined the updated national and upcoming European legislation and shared experience of environmental matters and best practices. More importantly it was regularly engaged with statutory bodies to help raise awareness of port environmental issues and worked with them to find implementable solutions.
Securing collaborations with academics and research institutes the port has implemented environmental plans and procedures since 1992. The port management was aware and determined to meet the legislative requirements and focused on planning and implementation of different environmental objectives. The port's environmental manager argued that in order to overcome the related planning and operational constraints the port managed to gradually accomplish the required efforts; yet, within a reasonable time span.

"In terms of mandatory obligations: Knowing was Half the Battle, to maintain our commitment to environmental protection, we had -through the years- to overcome planning and operational constraints on how to identify and minimize the impacts of port operations. It was an ongoing process that took into account wildlife, government legislation and best practice guidance for the terrestrial, coastal and marine environment. A high level of environmental management was therefore required to ensure that all these factors are taken into account in order for our business to be sustainable."

In 1997, DHB was one of the ports that initiated EcoPorts and until 2010 it was an active member of the network, but most importantly it was the first ever EU port that implemented the EPF tools, both SDM and the PERS standard. The EcoPorts membership and the tools that collaborative efforts within the network produced, was the right set of circumstances for the port of Dover. The PERS standard especially provided the opportunity to integrate the work done, in a systematic way that was especially designed for ports. The port's environmental manager explained:

“There is no legal requirement for an organization to adopt an EMS, but its use helps an organization respond to government legislation and work towards improved environmental performance. We had worked with academics and research institutes since the early 1990s aiming to understand our environmental impact. PERS gave us the means to organize this work into a systematic structure and ensuring that the most significant impacts were tackled.
It was our first green certificate that demonstrated to regulators, stakeholders and the community that the port is taking environmental protection seriously.
Being an EcoPort allows to demonstrate that the port is being proactive on environmental issues.”

As part of its environmental commitment, DHB focused on devising and constantly reviewing environmental performance objectives by setting a comprehensive monitoring system (see annex1 p:40), as well as by adopting proper performance indicators (see annex1 p:44). After the PERS certification in 2002, the port developed and extended its EMS to meet the ISO14001 requirements. It obtained ISO14001 certification in 2008. Progressively the focus was on actual green performance results.

“The port’s EMS was progressively upgraded. This was managed by providing the Board with relevant environmental information based on proposed projects and opportunities for improvement. In addition, we had to ensure that a sufficient response was available at all times with regard to information, equipment, training and staff for all types of environmental occurrences.”

As for any business environment, greening for ports is based on the idea of qualitative growth. Within the national context, sustainability policies particularly aim to reconcile quantitative objectives of growth with environmental protection, but in Greece -still in the 2000s-, governmental and regional authorities did not provide sufficient guidance to the ports to implement procedures that will improve the environmental status. For the Greek PAs, it was also particularly difficult to follow updated legislative demands due to the lack of specialized information. Self-regulation through EMS certification is an entirely voluntary option and perhaps it may sound at least extremely ambitious for a port organization like the Greek *port of Thessaloniki* (ThPA) which, until the moment of the PERS implementation decision in 2003, had been facing environmental issues mainly through environmental friendly technical solutions (see annex2 p:17). Yet, it might happen that at the particular point in time the organization was committed to take the challenge, since there were already available sources in the field having the adequate knowledge to make it possible for the organization to set up actions in that direction. When ThPA expressed interest –that came directly from the top management- in exploring options for EMS implementation benchmarking within the European context, the PERS standard had already occurred and the EcoPorts membership sounded beneficial to that direction. Palantzas et.al., (2005), exploring the PERS application in the ports of Piraeus and Thessaloniki, implies that like many other European ports seeking to timely correspond to the “new global trend” of integrating environmental protection and sustainable principles into the port’s daily operation, both PAs took advantage of PERS. The PERS standard as port specific EMS provided them with a “structured framework” for environmental improvement and assisted them to incorporate green procedures in daily activities (ibid). The ThPA environmental manager, though, pointed out that the PERS standard was mainly selected based on the expectation that the process might secure regulatory compliance. In fact, the PERS implementation assisted the port to prepare its first environmental policy; take account of updated legal requirements based on their own environmental aspects (ThPA overcame this basic requirement mainly by successfully completing the SDM); consider what monitoring is required to assess progress in environmental aspects and identify the related indicators. The port was extremely fast and effective in producing the aforementioned amount of work without having related experience and therefore, the consultancy services from local academics and experts from the EcoPorts network was vital. In 2003, ThPA was among the first PERS certified EU ports and the first in the Mediterranean region.

“Our main benefit gained so far by applying the EMS has been the recognition of the port’s actual environmental situation and that we have identified the relevant legislation to our activities.”
“Environmental policy implementation in ports is inappropriate to be done in a direct and restrictive way, but in the context of a gradual integration of environmental principles across the range of port activities and operations in an economically and operationally viable manner.”
“The port’s decision to join the EcoPorts Network in 2003 was a strategic move towards the port’s sustainable future. Networking plays a major role in reaching sustainable development goals.”

The *port of Valencia* (VPA) has been committed to environmental protection since the early 1990's. VPA's ECOPORT project (1998-2000) (see annex3 p:22) was a vital milestone in the port's sustainability strategy. The EMAS standard is promoted by the CEE regulation 1836/93 as the European EMS standard. VPA's ECOPORT project -slightly earlier than the EU EcoPorts project (1999-2002)- aimed to develop a methodology which would enable different port facilities to adopt EMS and meet the new EU requirements. It involved actions of raising awareness and publicizing the advantages of implementing EMAS in a port area context, as well as, disseminating the results of the project -particularly in the Mediterranean region. The project set the basic priorities of the port's self-regulation and produced the first VPA's environmental statement. According to the interviewees it made *a constructed EMS methodology of its own* possible for the port:

"We strategically selected this type of approach for environmental protection and we focused on establishing an EMS methodology to encourage companies in the port community to remain committed to environmentally respectful activities."

"We implemented the project motivated by a possible change in terms of environmental quality and we aimed to approach port greening though EMS application. These systems have proven to be very effective management tools for ensuring understanding and monitoring of the port's environmental protection requirements".

VPA's EMS went through all possible stepping stones towards EMAS certification, obtaining PERS, ISO14001 and EMAS certifications from 2003 to 2008. This experience involved a strong commitment to developing EMS practices through a series of collaborative initiatives on related environmental aspects. Valenciaport participated in many national and international projects to improve both its EMS process and actual environmental performance (see annex3 p:23-28). These efforts upgraded the ports EMS implementation by adoption of plans and programs to evaluate, prevent, control or correct environmental effects of port activities, as well as, to integrate environmental quality monitoring (air, acoustic, water quality, etc.). One interviewee confirmed that the organizational goals were more than compatible with the field demands in EMS implementation and that the VPA environmental self-regulation has been increasingly relevant to corporate policies.

"We have voluntarily opted to broaden our environmental commitments. Environmental compliance is required not only in order to ensure community support for port development but also to attract customers."

VPA's ECOPORT II project (2006-2008) (see annex3 p:23) emphasized the strong leadership of the PA in enhancing environmental protection at the port community level. The principal milestones for fulfilling this objective included technical assistance to the involved companies, training (EMS, energy efficiency and waste management) and awareness actions for the companies' staff, as well as a coordination mechanism.

Environmental issues have been particularly significant for the *port of Rotterdam* (PoR) and they have been added in the ports agenda since the mid-1980s, when it was a municipal governed port (RMPM). Already, in 1984, agreements were successfully reached with companies on the Rhine and Maas about discharges (Rhine Research Project see annex4 p:26).

In the 1990s, the PA participated in various research programs building up knowledge on environmental issues. A clear example was ECEPA (see ch3 p:59). Through the years of the port's municipal administration, the port's environmental management was determined by issue-based green processes and licensing as well as monitoring protocols that served pollution prevention in the port area and the *polluter pays* principle, while the DCMR involvement ensured the validity of the process. On account of desirable environmental pollution reduction (noise, odour etc.), permits for trade and industry -located or relocated in the port area- complied with strict regulations, while -where possible- the PA made harsh environment agreements with private companies. The municipal management of the port (RMPM) deemed environment protection as very important for the port's future. The 'clean port' of the Port Vision 2010 (see annex4 p:11) was the flagship through the PA actions and in collaboration with the port business community, dust and noise emission levels likewise the pollution of water and soil were substantially reduced. After almost 15 years of efforts, the sludge dredged up in the port was not polluted and there was no need to be stored at the Slufter depot, as only a minor percentage qualified for storage. Regarding the port's development, with the Maasvlakte2 expansion in planning, RMPM began to bear in mind the quality of life in the neighboring residential areas.

The ‘clean port’ remained one of the six targets in Port Vision 2020 but there was a shift on ‘quality port’ (see annex4 p:51). It has been already pointed that in the late 1990s sustainability integration in a Dutch port strategy was emphasized as increasingly significant for port competitiveness (Kolk & van der Veen, 2002; Dekker et.al., 2010). After the port’s corporatization in 2004, managerial priorities changed and sustainability was accentuated as of important strategic goal. This necessity was reflected on the sustainable port axis of the Port Vision 2020, which brought up issues like organizing Maasvlakte II along sustainable lines, co-sitting, research in industrial ecology and environmentally friendly forms of industry and energy. What is particularly interesting in the case of PoR is that although since the 1990s the port has been active in implementing various environmental practices, an active ESPO member and one of the ports that initiated EcoPorts, it joined the other three ports -regarding EMS standards application- in delay -at the late 2000s. Considering the amount of environmental policies and practices already in place what was different from other ports is that the port of Rotterdam in the 2000s went through a governance change. After the port’s corporatization, the PA recognized the need to set in motion a transition towards the ‘sustainable port’. In other words, the ‘sustainable port’ was the new environmental policy target reflecting the new port governance focus on the port’s future.

When it comes to making long-terms plans, the port of Rotterdam has a tradition usually limited to a time horizon of 15 to 20 years. Almost at the same time with the new vision initiation towards 2020 and the first corporate strategy 2006-2010, the port’s corporate management expresses the ambition to advance the port's CSR program (see annex4 p:51). *“It is the ambition of the port of Rotterdam authority to develop a CSR program”*, (PoR Corporate Strategy, 2006-2010).

The RoP’s CSR program was initially based on three theme tracks: sustainable entrepreneurship, community investment in social and cultural initiatives, and transparency. In terms of sustainable entrepreneurship, the Maasvlakte2 was set as the driving force for sustainability. In addition, in order to improve PoR’s sustainable performance and to stimulate a sustainable port as well as an industry complex, the program’s focus points are: clean & safe shipping, water quality, attractive port, energy, sustainable mobility and environmental management. The CSR strategy also advanced significant sustainability projects: the Rotterdam Climate Initiative, the sustainability index and the port’s CO_2 footprint (see annex4 p:39). The new CSR mission set sustainability, commitment and transparency as priority goals. The last goal required reporting -in a systematic way- on all aspects of the proposed sustainable port. At this point, the attention of the reader should be to the vast amount of EM practices that the PA implemented through the years (see annex4 Table 4.3 p:51). All of them were relatively easy to be systematized, based on the EcoPorts tools requirements (see annex4 p:52). It was a strategic time selection. In 2008, the port of Rotterdam (PoR) made use of the EPF tools, conducted SDM and obtained the PERS certification. The port’s interviewees explained:

“We strongly believe that managing an effective system of enforcement and licensing based on all possible legal requirements we had worked fairly good in preventing and controlling pollution which would have been enough, but nowadays we are convinced that attention should be given to sustainability and the living environment around the port.
For the Port of Rotterdam Authority, sustainability means both improving our own performance as well as encouraging sustainable enterprise in the port and industrial complex.
Creating sustainability affects product chains and transport around the world.”
“Public corporation demands transparency and PoR has both public duty and commercial goals.
The complexity of regulations required a pro-active policy. To improve the sustainable performance of PoR and to stimulate a sustainable port we focused on:
clean shipping, water quality, attractive port, energy, sustainable mobility and environment management.
“PERS offers a structural way for classifying risk and environmental aspects in the port area, still we had in place our own procedures to identify the problem when it occurs.”

The following Table 5.11 comparatively illustrates the ways ports were required to comply with institutional normative demands.

Table 5.11: Diffusion as predictive dimension of individual port strategic response

Diffusion	
How or by what means are green institutional pressures being exerted to ports?	
Dover	• Active member of the British Ports Association (BPA), the first port association in Europe engaged in port environmental protection in the early 1990s. • Involved in the main mechanism of BPA for sharing knowledge and best practice in port environmental issues. • EM planning and implementation ensured by collaboration projects with academics and research institutes. • Strong commitment to integration of environmental quality aspects and particular monitoring in the EMS. • Through BPA the Eco-information project that provided the platform for collaboration in PEM participated in the first EU port initiative. • EcoPorts membership provided the opportunity for PERS implementation in the port. • Pioneer EcoPort member extensively demonstrated its EMS implementation according to PERS standard. • Used PERS as stepping stone to ISO14001:2004 certification.
Thessaloniki	• Top management commitment in following trends in EMS standards in the early 2000s. • Strategic decision for early incorporation in the EcoPort network. • Immediate exploitation of knowledge in environmental best practices and EMS implementation shared among members in the EcoPorts network. • Fast and effective EMS implementation according to PERS standard using consultancy services from local academics and experts from the EcoPorts network. • Positive attitude and fast implementation of the suggested organizational adjustments to the PERS standard. • Early adopter in PERS certification. • While exploiting the benefits of the EcoPort label, it continued as an active member of the network and re-certified according to PERS.
Valencia	• Active in developing port EM plans since the early 1990's. • Top management commitment to developing a green strategy in the late 1990's. • Own ECOPORT research project in EMS implementation according to EMAS financed by EC/LIFE program initiated the port's environmental policy. • The efforts of the ECOPORT II project in EMS implementation of various firms in the port area confirmed VPA's leadership in environmental protection in its cluster port. • Strong commitment to developing EMS practices and procedures. • Participation in various national and EU collaborative projects to improve EMS process and actual environmental performance. • Early adopter of the PERS standard. • Use of the stepping stones of PERS and ISO14001 towards EMAS certification. • VPA environmental self-regulation has been increasingly relevant to corporate policies
Rotterdam	• Active in developing port EM plans since the mid 1980's. • Since the 1990's progressively building up knowledge on environmental issues. • In the 1990's the municipal management of the port developed its EM based on green processes, licensing and monitoring protocols. • Close cooperation with the regional environmental agency DCMR responsible for licensing, enforcement of regulations and monitoring of environmental quality at the region. • Active and early participation in European collaborative efforts for port environmental protection. • The 'clean port' strategy yielded results in various port environmental issues. • The Maasvlakte II expansion projects already from its planning stage urged the port to be interested in the quality of the environment in neighboring areas and initiated the issue of sustainability. • Since 2004 and the port's corporatization, PoR's strategy has shifted towards sustainability and employed the strategy of the 'quality port', a long-term plan until 2020. • PoR's CSR strategy initiated in 2007 and focused on sustainable entrepreneurship, communication and transparency, and the Maasvlakte2 was set as the driving force for sustainability. • Both the CSR strategy and the theme targets of the 'sustainable port' required comprehensive reporting in a systematic way in all environmental aspects of port. • In 2008 used of the EcoPorts tools (SDM / PERS) and PERS certification. • Important sustainability projects: the Rotterdam Climate Initiative, the sustainability index and the port's CO2 footprint.

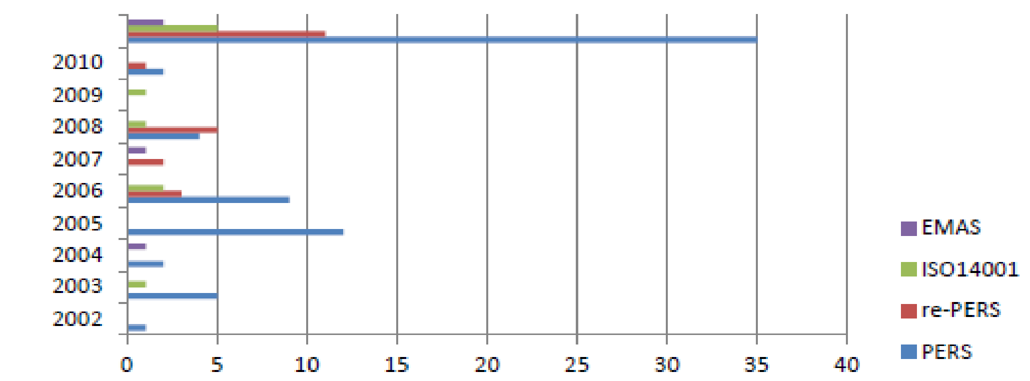
5.6 A timeline of port EMS standards adoption in Europe (1993-2010)- Early and late adopters

Like in other industrial sectors -where the mere threat of environmental regulations was the trigger for industry associations to create voluntary schemes and codes of behavior-, by the early 2000's, the EU port sector was in position to provide practical tools to PAs aiming at green self-regulation. Although the Code for proper port environmental behavior has been in place since 1993, only by the early 2000s was it possible for the EU port sector to take advantage of a port specific EMS certification scheme. In-between, research collaboration in EC financed projects between ports led to the development of effective tools- in terms of cost and time-, specifically designed to deliver compliance to environmental legislation and pollution reduction. The EcoPorts (EPF) tools were introduced as practical means developed by ports for helping fellow ports in their environmental liabilities. They are concentrating on cost efficiency, as well as on environmental effectiveness in EMS implementation by delivering a combination of 'top down and bottom up approach', in terms of commitment from the top management and improvement of environmental performance at the operational level of the PA.

In 2002, an EMS independent certification of agreed standards was presented to EU ports. The PERS standard is based on ISO 14001 elements and provides environmental information to interested parties regarding the environmental impact and performance of the port's significant environmental aspects. It was an important new development for ports in Europe as it demonstrated attainment of a benchmark standard (Journee, et.al. 2006), and a common belief that it was an attempt of the sector to formalize a 'level playing field'. The reasons why the EcoPorts membership was beneficial to PAs vary depending on the individual port abilities and their ambition. The fact is that since the mid 2000's, being an EcoPort member has been considered as hallmark of pro-activeness in PEM -at least within the sector. The PAs that applied the PERS standard and obtained the certification could provide the agreed evidence of their commitment to the environment, and beneficially use it as a valuable means in public, governmental and market relations.

From the year of issue in 2002 to 2010 -when the EPF, the formal representative of the EcoPorts network, merged into ESPO organizational structure- thirty-five (35) EU ports were PERS certified, eleven (11) of which were re-certified with the standard from 2006-2010, while the ISO14001:2004 and EMAS standards just began to acquire 'merit' in EMS standards application. Four (4) of the thirty-five (35) PERS certified ports succeeded in their next step towards ISO14001:2004 and from 2006-2009 one more- the port of Valencia- was EMAS certified in 2007. The only EcoPort member that obtained the ISO14001:2004 and EMAS standards from 2003 to 2004, without first implementing PERS, was the port of Livorno in Italy. The port of Livorno in Italy is an exceptional case within the network although a very similar case to the Valenciaport. The PA's EMASPOLI (EMAS Port of Livorno) project -a LIFE funded project- defined EMAS as the proper EMS standard, while the Livorno PA proposed itself as the EMAS reference point for the local port community. One of the reasons for the project's final success, in terms of the obtained EMAS certification especially at a very short time (2001-2004), is that the port managed to successfully face the problem the Natura 2000 designated area of tha Cinque Terre National Park situated only 20 km away. This particularly unique location circumstance makes the port a rare successful case within the network, as it does not reflect a common environmental aspect of EMS application. Yet it points the fact that the purely European Natura 2000 mandatory framework ensured the EMAS preference and that the EMAS standard choice until 2010 remained a Southern Europe selection.

Fig.5.2: Diffusion of EMS standards in the EcoPorts network (2002-2010)



	2002	2003	2004	2005	2006	2007	2008	2009	2010	
EMAS			1			1				2
ISO14001		1			2		1	1		5
re-PERS					3	2	5		1	11
PERS	1	5	2	12	9		4		2	35

Source: own elaboration

In total, they were thirty-six (36) ports and fifty-seven (57) EMS certifications within the network. The following Fig.5.2 presents the standards' diffusion within the EcoPorts network. To the reader's information, in Fig.5.1 two ports located between the North and the Baltic Sea, - that also implemented ISO14001 requirements from 2005 to 2007-, are not included. The port of Copenhagen-Malmo, a unique EU port of a transnational cooperation and the port of Gothenburg have been active members of ESPO and EcoPorts, but before applying the ISO14001:2004 standards they had not used the PERS standard, although the port of Copenhagen-Malmo particularly made use of the SDM/EPF tool. If these particular ports are adopters of the international perspective of ISO14001 standard or the choice falls within local criteria, it is not addressed within the research.

In order to map up successful green ports in terms of EMS standards implementation and their followers from 2002-2010, it is important to consider the norms-based view of why self-regulation is perceived successful when it relies on arguments of legitimacy and socialization (Graham & Woods, 2006). Ports are primarily business entities, especially due to the changes they faced within their business environment and their phenomenal growth during the last decades. Most logically they did not want to incorporate added cost practices in their daily operation without some sort of benefit, while they are always willing to maintain a good reputation. Image is vital as much as compliance, mainly because it shapes stakeholders' response and thus PA's relations with them. For these key motivation factors, ports -as normative actors- took actions at different points in time within the emerged EcoPorts network and thus, they were early and late adopters of EMS standards application in the field. The following Table 5.12 presents the different categories of adopters and their preferences in the type of the EMS standard within different time periods from 2002 to 2010, as well as, the port's country.

Table 5.12: Categories of adopters - EU ports and EMS standards preference (2002-2010)

time	adopters category	standard adoption (year)	standard	country	port / number
2002	innovator		PERS	UK	DHB
2003-2004	early adopters	2003	PERS	UK	3
				GR	ThPA
				ES	VPA
			ISO 14001	IT	Livorno
		2004	PERS	GR	Piraeus
				IT	1
			EMAS	IT	Livorno
2005-2006	followers	2005	PERS	UK	8
				NL	3
				FR	1
		2006	PERS	UK	7
				IRL	1
				ES	1
			re-PERS	UK	2
				ES	VPA
			ISO 14001	UK	London
				ES	VPA
2007-2008	late adopters	2007	re-PERS	UK	2
			EMAS		VPA
		2008	PERS	UK	1
				IRL	2
				NL	PoR
			re-PERS	IRL	1
				NL	3
				GR	ThPA
			ISO 14001	UK	DHB
2009-2010	laggards	2009	ISO 14001	IRL	1
		2010	PERS	NL	1
				FR	Calais
			re-PERS	IRL	1

Source: own elaboration

The PERS standard is the dominant preference in EMS standards certification by the European ports during the time period of the research. The port of Dover (DHB) was the first port in Europe that obtained an EMS certification according to PERS in 2000; and thus, it is the ***innovator*** in the field. It was proven successful by using a structure for building up port environmental actions into regular organizational processes as well as the first port organization that brought up a new managerial process and communicated in the field. *"Norm entrepreneurs",* the central actors during the first stage in the life cycle of a norm (Ingebritsen, 2002), play a role in influencing others to prioritize particular causes and values (ibid).

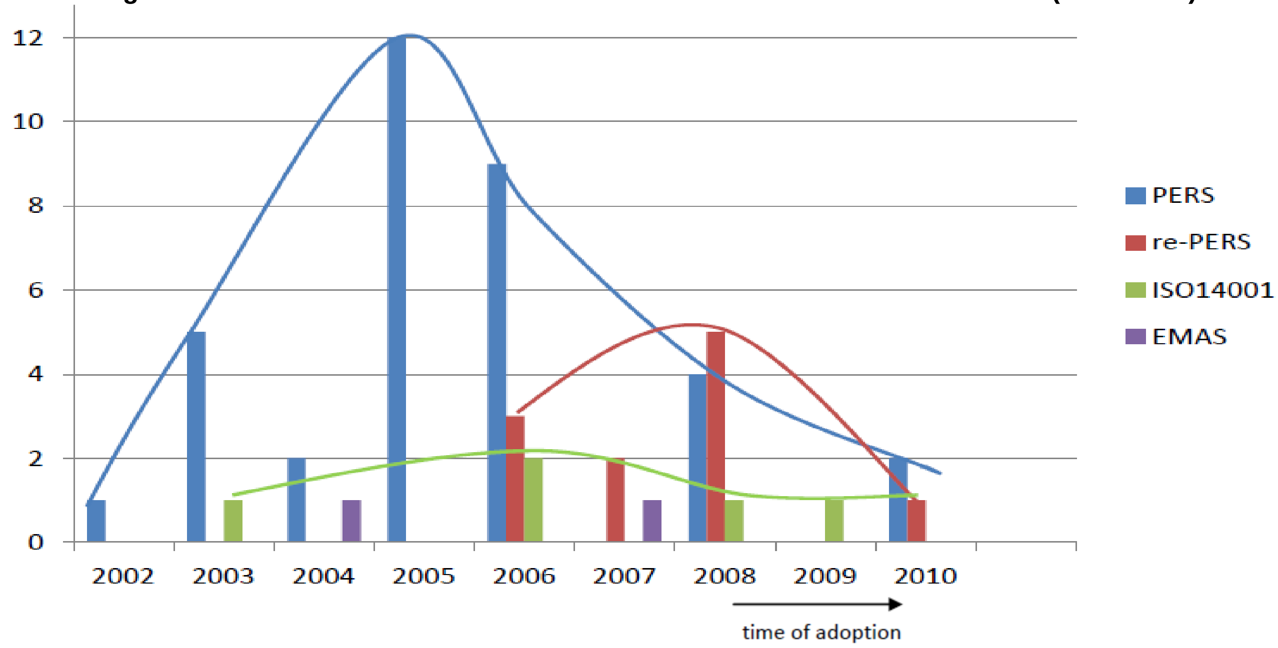
Within the limited time period of two years the ***early adopters*** appeared in the field. Their decisions to implement the standard falls into the assumption that the proposed norm guides them to embrace opportunities which are deemed legitimate (Suchman, 1995)- and to a certain degree effective

(Huisman & Beerkens, 2000). In the two first years -with the exception of the port of Livorno case, which like the Valenciaport was strategically aiming at EMAS certification- the PERS standard spread to certain directions in the continent: within the innovator's national context, the UK; Greece and Spain. At this early stage of the standards' adoption, a clear institutional perspective analysis would demonstrate that the early adopters are imitating the perceived successful port, but the already identified diffusion mechanisms in the field indicated that the problem-solving, learning and indirect transmission mechanisms are in place in Valenciaport's adoption of the standard, while the mimetic mechanism is reflected in the Greek port of Thessaloniki. Nevertheless, even in the case of Thessaloniki, a combination of mechanisms was identified, and with problem-solving expected as sovereign mechanism in most cases, ThPA was proven the role model for the port of Piraeus within a year.

The period from 2005 to 2006 is the timespan when PERS adoption reaches a critical mass, twenty-one (21) ***followers*** in total, twelve (12) in 2005 and nine (9) in 2006. The standard's spread is most flourishing in the UK –perhaps including the certification of the port of Cork in neighboring Ireland; however, it began to have a dynamic presence in the Netherlands with three (3) ports to be PERS certified within a year. The rest two (2) ports are located in different national contexts, yet in the same area at the Mediterranean Sea: The port of Marseille in France; and the port of Castellon in Spain, where the local-regional context could be a possible influence as the Spanish port is located north of Valencia in the same region. The followers were aware, which is a logical assumption that falls into the presence of the problem-solving mechanism. If the followers imitate without much thinking about their actions' consequences -again an institutional driven assumption-, the outcome of the standard's adoption would be expected to be less successful (Huisman & Beerkens, 2000). In contrast to the *innovator*, and even the *early adopters*, the standard application by *followers* would be expected to be less successful due to insufficiencies or lack of organizational competences. There is no evidence that the mimetic mechanism should be considered the dominant mechanism, on the contrary, considering the standard's spread within specific national contexts (UK, NL), individual port organizational capabilities, which might be built up addressing national environmental requirements, could ensure the successful standard application. In addition, the network connections and the related knowledge about transfer should not be underestimated *as* it was present through the identified mechanism of the indirect transmission by standard's adoption. This assumption is highly supported by the constantly increasing (after 2006) ports that were PERS re-certified. From 2006 until 2010, although the number of ports adopting the PERS standard was declining, some ports considered the PERS re-certification valuable. A total of eleven (11) ports within the network could be expected to have upgraded their EMS performance using the same standard within two to three years' time. The case studies strongly indicate this outcome, as all confirmed strong ability of knowledge transfer among members within the network. Particularly, for the ports of Valencia and Dover -as much as for the ports of London (UK) and Cork (IRL)- the PERS re-certification reassured their ISO14001 certification.

At the same time period that PERS re-certification was dominant, the ***late adopters*** appear. An obvious explanation is that competitors' success -more than once with standard certification- was the proof they need to be part of the adoption process. A total of five (5) ports were PERS certified in 2008, including the port of Rotterdam among them. For Tolbert and Zucker (1983), in contrast to early adopters who seek technical gains, the late adopters are primarily interested in the advantage of appearing legitimate. Finally, the ***laggards*** within the time span of 2009 to 2010 -although a very small group of four (4) in three different countries-, repeat patterns that were already pointed. Location does influence the standard adoption as it is indicated once more from the port of Calais PERS certification –only the second port from France- where the influence from Dover is evident. Again, the pattern PERS and re-PERS immediately before the ISO14001 -in this case within four years-, classifies the port of Cork (IRL) a successful port like Dover and Valencia. The following Fig5.3 illustrates the diffusion of standards related to the time of adoption.

Fig 5.3: An illustration of EMS standards diffusion in the EcoPorts network (2002-2010)



Source: own elaboration

The next section proceeds by summing individual port perceptions, regarding the Oliver (1991) suggested institutional factors that shape port strategic response to EMS standards application and, as outlined in the first section of the chapter, addresses the research question: which choice of response strategy is related to specific institutional factors. The chapter concludes with the adopted tactics that supported each port's strategic response.

5.7 Institutional factors and individual port strategic response

Applying the research's conceptual framework in order to explore the evolved green change in the European port industry was essential for the individual port EMS standards application to be considered and understood in the context of the supported or opposed field dynamics. For Oliver (1991) a key success factor of organizational efforts for change *is* managing their institutional environment. Based on the Oliver (1991) proposed framework, the previous sections analytically described the managerial perceptions of institutional antecedents that affected the individual port strategic response to EMS standards application.
This section proceeds in presenting a summary of this analysis and relates the findings with the Oliver (1991) suggested five strategic responses and relevant tactics: *acquiesce*, *compromise*, and *manipulate*. Both *avoid* and *defy* suggested responses are excluded as all the explored ports of this research implemented EMS standards within the time frame of the research.

5.7.1 Mapping up ports' managerial perceptions on greening

- ***multiplicity / dependence***

All four ports identified the ***multiplicity*** of constituents as crucial and restrictive. Regarding a range of environmental issues, they insisted on highly diversified requirements from different legislators. Although the national policy contexts have been adding to multiplicity, their effects on individual port environmental policy plans and implementation were different among countries. In the UK and Spain, the sustainability emergence advanced guidelines concerning what should be the ports' focus and shaped the way in which the ports of Dover (DHB) and Valencia (VPA) planned and implemented environmental management. In the Rotterdam case, especially with the Maasvlakte II expansion in progress, the national sustainability context by shifting to a green governance paradigm directed a mixed type of national, regional and local green policy framework. The latter secured the indirect governance of environmental protection in the port's industrial complex through environmental regulations and permits. With the moderate exception of the port of Thessaloniki, multiplicity derived also from the port-city interface for all the other three port case studies. The effects of multiple EU constituents' demands were the common issue in all cases. Even in the case of Thessaloniki's port (ThPA), where the degree of green expectations from local and national constituents was limited, the EU legislative requirements imposed multiple prerequisites for greening.

Grounded on mutual interest, pressures from unconstructed level playing field in port greening were confronted on a collaborative basis within the sector. The ports leading the way in that direction accomplished 'learning by doing' experiences. The outcome was that -to a large extent- the ESPO/EcoPorts network of ports' willing to turn green (and related actors), managed the accessibility and distribution of important green port organizational resources by providing specialized information, professional cooperation and training in EMS standard implementation. Network cooperation, especially in the form of collaborative projects, yielded valuable knowledge and experiences for the participated ports, but to the extent that ports like the ports of Dover (DHB) and Valencia (VPA) had already built up knowledge in environmental management –for instance in-house capabilities, monitoring or already established experience in EMS implementation- their degree of ***dependence*** was low. Yet, EcoPorts membership secured specialized knowledge distribution and consultancy services and it was vital for ports like the port of Thessaloniki (ThPA), which was lacking vital knowledge of environmental protection but it was willing to overcome the gaps towards EM implementation. Obviously, the degree of dependence in this case is high. The case of port of Rotterdam is slightly different. The port was rather late in applying an EMS standard for the first time, although it had built up a robust and long-term knowledge related to different port environmental aspects. The port's action in environmental protection evolved *from* a cautious and accurate compliance with multiple mandatory demands *to* a strategically oriented sustainability policy driven by national and regional policies implementation, including the complicated Maasvlakte II environmental planning requirements. The Dutch joint authority approach ensured- to a large extent- the effectiveness of environmental practices which were definitely in place, whilst it additionally required collaborative efforts and skills. Cooperation in the EcoPorts for knowledge gain was also part of the port's environmental agenda and turned out to be beneficial when the port's corporate administration decided that EMS standard implementation was also a necessity.

- ***uncertainty / interconnectedness***

All four ports –although in varying degree- have been influenced towards greening due to their general business environment. When they depend on supply chains sensitive in environmental protection, greening could be considered an important issue for their competitiveness. Port greening was especially influenced when planning and implementation of expansion projects was part of PAs business agenda. While incorporating these concerns in their planning and decision-making processes EU PAs were confronted with a high degree of uncertainty, especially when legal uncertainty affected environmental future development plans or regular maintenance operations like dredging and dredge disposal that disturb EM planning. In helping ports with uncertainty, the national context was vital -although the way it was utilized varies among different countries. In the UK, national policy guidelines decreased the level of uncertainty, whereas in Greece the lack of authoritative guidance intensified the level of frustration. In Spain, the state port agency confronted legal uncertainties by supporting the PAs in their environmental plans. In the Netherlands, the port of Rotterdam- especially due to the Maasvlakte II expansion planning- had to overcome ecological and legal uncertainties which demanded scientific research, extensive stakeholder dialogue and even EC level interference. The regional environmental agency also has an essential role helping the PA with legal and scientific uncertainty in enforcement and planning procedures. ***Uncertainty***, due to the lack of knowledge about the individual port's environmental aspects, was particularly crucial for the environmental policy formation. *How early* and the *way* the four PAs succeeded in dealing with it *was* part of their individual efforts and their accomplished competences towards EMS standards implementation.

By observing ***interconnectedness***, it is possible to identify the relational channels that facilitated the voluntary diffusion of values, norms and knowledge information sharing which supported individual port greening and built up institutional consensus and conformity. All four port case studies have been active members of EcoPorts network. To what extent the EcoPorts membership engaged the individual port in active collaboration research or passive gain of valuable information does not diminish the fact that the density of inter-organizational relations among actors in the field was gradually reinforced, especially since the port of Dover promoted green competitiveness among network members by being successful in obtaining the first EMS standard certification. National networks supporting research in port environmental protection, both in the UK and Spain, local cooperation with academics in the case of Thessaloniki, collaborative initiatives among ports in the Netherlands and the Valenciaport, collaborative initiatives at EU regional level in the Mediterranean basin; all the aforementioned -through information dissemination- further improved the network's capacity and ability to support a common approach to building up a level playing field in port greening. In the Port of Rotterdam, political relations outside the national framework, like lobbying attempts at the EU level, confirm the significance to secure fair competition. Finally, an active EcoPorts member, the Valenciaport, was also a dynamic counterpart in cooperative activities especially oriented in the Mediterranean region and it is a rare port case that -earlier than other ports- became engaged in promoting information exchange and enhancing EMS implementation in firms at the port community level. VPA was strategically oriented towards leadership in environmental protection at the port community level. The PA introduced to fellow ports the importance of this type of network-relation in port greening.

- ***legitimacy / efficiency***

Legitimacy refers to the extent that the pressure for EMS standards application in ports is legitimated within the individual port organization. In the case of EU ports, it is more appropriate to take into consideration what preceded the EMS standard application in order to understand why and how it was finally legitimated. Beyond coercive demands, the case studies revealed that the greening pressures confronted by the individual port were unique for each one. Both the ports of Dover and Valencia developed a good record for environmental stewardship, persistently legitimating their green efforts through EMS standards. For the port of Dover, it was important to secure reliability of port environmental plans and policies following national policy recommendations on scientific validity in monitoring and reporting; thus, EM implementation was system oriented and standardization and certification were perceived as of strategic value. Eventually, EMS standards were considered as suitable legitimate tools for building the port's green image and gaining reputation. In the Valenciaport case EM implementation was also system oriented and was highly supported by the quest for quality and standardization as a result of the port's corporate culture and top management commitment to greening through standardization. The EMAS standard was a strategic choice, as well as the leading and coordinating role in green self-regulation at the port community level and synergies in the port-city interface aiming at social integration. In the case of Rotterdam EM implementation was initially based on a pragmatic approach. Environmental plans applied strict and effective pollution prevention practices and the regional environmental agency ensured an indirect enforcement of regulations related to the national policy. Through the years, strategic targets and projects realization forwarded the port's greening approach, yet it was the port's corporatization that triggered a high-profile sustainability strategy focusing on research and innovation. Although its own green procedures were perceived effective and valuable, the port advanced the PERS standard certification and, aiming at social integration, immediately afterwards, the port formed its first CSR strategy and started reporting according to the Sustainability Index. Finally, the port of Thessaloniki could form an environmental policy only after incorporating the EcoPorts network and thus, it immediately considered the PERS standard as a practical tool to accelerate the port's green liability. It was only after the first PERS implementation that gradually the same -as the other three ports at earlier stages- issue based policy plans enhanced the port's environmental capacity.

Ports today in most cases consider themselves corporate organizations seeking profitability and potential economic gain that may keep their business alive. It is then evident that potential cost reduction, especially connected with green efforts, may provide optimal value added to any port greening likelihood. In fact, port managers *do* consider their green policies efficient when cost reduction is involved. However, the case studies revealed that although indirect gains by potential reduced liability costs through EMS implementation are perceived as of organizational importance, the managerial perceptions in the ports of Dover, Valencia and Rotterdam deemed ***efficiency*** gains related to the total of the port environmental aspects as unclear. The exception comes from the port of Thessaloniki. Legislation was the driver, but costs were obviously the determinant to the final decision of port greening to be introduced within organizational goals -following an optimum cost distribution among the available financial resources and the expected effectiveness of the standard's implementation. Directly related to operational cost reduction, minor positive results are delivered mainly by eco-efficiency programs, however it should be noted that these programs were mainly in effect for a relatively short time or were research oriented within the time frame of the research.

- ***consistency / constraint***

In view of the differences between ports and the changing nature of the environmental challenges that ports faced in the 1990s, ESPO highly recommended to all ports within its membership to work towards establishing and maintaining a systematic approach to EM. Established EMS standards such as ISO 14001 and EMAS were available in the market and, since the early 2000s the sector's port specific approach, the EPF/EcoPorts tools and the PERS standard have been also accessible to the EcoPorts network members. All environmental policies of the explored case studies were ***consistent*** with ESPO recommendations and the use of the EcoPorts tools (PERS/SDM). Upgrading their EMS implementation to more comprehensive standards, the ports of Dover and Valencia were consistent with ESPO advice and they were both particularly consistent to national policies suggestions concerning EMS and quality standards application respectively. The Valenciaport was strategically oriented and effectively consistent towards EMAS implementation for its own business entity and the dissemination of EMS standard implementation among the different firms within the port community. The port of Thessaloniki perceived the PERS certification valid and was fast and effective in fulfilling this commitment. The port of Rotterdam was more dedicated to building its green credentials in partnership with various actors at local and regional level, since the PoR's corporate status emphasis was put on building and communicating a comprehensive and visionary port sustainability strategy. Within this new status, the PERS standard should be perceived valid as sector specific standard.

With the exception of the port of Rotterdam, where ***discretionary constraints*** delayed the decision of EMS standards application, the rest of the investigated ports were effectively committed to EMS standards implementation. Mainly, the PoR municipal administration was confident with its own environmental procedures and had no strategic or operational preference in using EMS application so as to deliver environmental outcomes. Although the port demonstrated strong willingness of a level playing field in port greening at EU level to secure its own interests, PoR's resistance to institutional pressures was only surmounted after the establishment of the port's corporate character and the final decision to use the EcoPorts membership not only for knowledge gain but also for advancing green credential through PERS certification. The port of Dover was discretionarily constrained by putting emphasis on environmental quality and EMS process performance, however planning and operational constraints were effectively surpassed and gradually the port EMS implementation was upgraded. In the case of Valenciaport, discretionary constraints of strong top management commitment and emphasis on quality standards implementation secured the final goal of the EMAS standard strategic choice. Meanwhile, the PERS and ISO14001 standards ensured an almost predesigned one-way path to the final goal. In the port of Thessaloniki case, discretionary constraints imposed by the lack of environmental knowledge pointed out the EcoPorts network incorporation. Consequently, the port's administration perceived appropriate to apply norms and to follow the leader's behaviour in the field.

- *coercion / diffusion*

Although all four ports were obliged to comply with mandatory obligations by EU legislation, divergence occurred regarding the ***coercive means*** that exerted pressures on ports because of differences in the methods and forms of law, which were employed to achieve the requested results in the country that each port case study is located. In the case of Dover, enforcement was applied at the local level based on environmental regulations and various British standards for environmental protection, while the port was advised and supported about national sustainability policy objectives at a regional level by the UK Environment Agency. The Valenciaport case had to fulfill sustainability objectives which were put into force at a regional level and progressively incorporated recommendations focused on transparency and disclosure of environmental data. The role of the National port Agency was catalytic to the efforts needed by providing PAs with strategic guidelines for the management of specific port environmental aspects and by recommending scientifically based indicators for monitoring and reporting. *Being successful* in incorporating an in-house built framework for EMS implementation for different port facilities within a port community helped the VPA administration to effectively initiate mechanisms, in order to ensure legal environmental compliance by the port users. As any other EU port, the port of Thessaloniki had to oblige coercion demands and at the same time to overcome the governmental mechanisms insufficiency in order to formulate and implement environmental policies: the national port policy obligations asking Greek ports to become 'quality' ports based on insufficient implementation guidelines along with the large number of governmental agencies responsible for environmental enforcement and the dysfunction of the country's inspectorate system. In this respect, it is easy to understand why the lack of familiarity with the concept of SD constituted a handicap for Greek ports. In contrast, in the port of Rotterdam case the PA's operation in terms of environmental protection was subject to national policy and legal requirements, while environmental responsibilities -within or related to the port area- were plainly defined. In line with the Dutch national and regional spatial planning and the resulted policy memorandums that shaped the long-term scenarios, the regional policy recommendation suggested an integrated approach for the Dutch sustainable port based on thematic action, while licensing and enforcement of environmental law in the port area focused on long-term targets concerning emissions' reduction at a regional level. Enforcement was secured *both* at the PA *operational level* by PoR's Harbour Master departmental entity that secured the environmental protection of complex shipping activities *and* at the *regional level* by the environmental agency DCMR which was responsible for reporting about environmental quality in the region. Particularly, environmental protection in the port area was ensured by environmental permits (issued by DCMR) according to which the individual companies had to operate and report.

In the UK, the BS 7750 was the first national standard created for an EMS in the 1990s (Morrow & Rondinelli, 2002). The port of Dover was an active member of the British Ports Association (BPA), the first port association in Europe that was engaged in port environmental protection in the early 1990s and highly benefited its involvement in the main BPA's mechanism for sharing knowledge and best practice in port environmental issues. The PA elaborated EM planning and implementation through collaboration projects with academics and research institutes and gradually integrated environmental quality aspects and monitoring procedures in its EM framework. The EcoPorts membership provided the opportunity for the PERS implementation in the port and, after the successful certification the port extensively demonstrated its EMS implementation according to PERS standard by initiating the ***standard's dissemination*** in the field. It used PERS as a stepping stone to ISO14001:2004 certification. The Valenciaport's own ECOPORT research project in EMS implementation according to EMAS which was directly financed by the EC/LIFE program, initiated the port's first environmental policy and was a milestone for building the PA's EMS application credential. The project results enforced the PA's strong commitment to develop EMS practices and procedures which in turn made it highly achievable for the port to be an early adopter of the PERS standard. Participation in various national and EU collaborative projects improve the effectiveness of EMS process by constantly integrating new aspects and therefore, the PA managed to successfully use the stepping stones of PERS and ISO14001 towards EMAS certification. VPA environmental self-regulation has been increasingly relevant to corporate policies. The port of Thessaloniki was one of the few early adopters of PERS standard. This was a result of top management commitment to follow trends in EMS standards implementation in the early 2000s and its strategic decision for early incorporation in the EcoPort network. To be fast and effective in EMS application -according to PERS standard- the port used consultancy services from local academics and experts from the EcoPorts network. The PERS certification increased internal organizational awareness in environmental protection and in the next years the PA was able to enhance its EMS. The perceived benefits of the awarded EcoPort label encourage further efforts and the port was re-certified according to PERS. Since the 1990s, environmental protection in the port of Rotterdam has been formulated on the basis of building up knowledge on environmental issues. The municipal management of the port developed its EM based on green processes, licensing and monitoring protocols in close cooperation with regional authorities and especially the regional environmental agency DCMR. The port was an active and early participant in European collaborative efforts in port environmental protection. By the end of 1990s, the 'clean port' strategy yielded results in various port environmental issues, while through the years the Maasvlakte II expansion project- already from its planning stage- urged the port to be interested in the quality of the environment in the neighboring areas. Since 2004 and the port's corporatization, PoR's strategy has shifted towards sustainability and employed the strategy of the 'quality port' through a long-term plan until 2020. PoR's CSR strategy initiated in 2007 and focused on sustainable entrepreneurship, community and transparency, while the Maasvlakte II was set as the driving force for sustainability. Both the port's CSR strategy and the theme targets of the 'sustainable port' required comprehensive reporting in a systematic way in all environmental aspects of the port and to a certain extent the PERS standard could guarantee it. Nevertheless, it put forward the structural way that the port needed for classifying risk and environmental aspects in its huge port area. Being certified in 2008, PoR was a late adopter of PERS.

5.7.2 Individual port strategic response (related tactics) - Concluding remarks

The following Table 5.13 illustrates the characterization of the individual port perceptions of the Oliver (1991) institutional antecedents, as well as the resulted individual port strategic response and the related tactics.

Table 5.13: Individual port strategic response (and tactics) according Oliver (1991) predictive factors

Institutional factor	Predictive dimension	DOVER (DHB)	THESSALONIKI (ThPA)	VALENCIA (VPA)	ROTTERDAM (PoR)
Constituents	multiplicity	high	high	high	high
	dependence	low	high	low	moderate
Context	uncertainty	low	high	low	moderate
	interconnectedness	high	high	moderate	high
Cause	legitimacy	high	high	high	low
	efficiency	low	high	low	low
Content	consistency	high	moderate	high	moderate
	constraint	low	low	low	moderate
Control	coercion	high	moderate	high	high
	diffusion	-	high	high	high
Strategic response *tactics*		**Acquiesce** *comply*	**Acquiesce** *imitate comply*	**Acquiesce** *comply*	**Acquiesce** *comply habit*
		Manipulate *co-opt influence*		**Manipulate** *co-opt*	**Compromise** *balance bargain.*

With respect to the Oliver (1991) institutional factors, in a scale *from* low up *to* high, the depicted results of the observations indicate a mixture of strategic responses at least for the three port cases. The mixed response strategy occurs from specific values of each institutional factor predictive dimension. *Acquiesce* is the predominant response for three of the four case studies (DHB, ThPA, VPA) even when the individual overall strategic response is a mixed one of the Oliver's proposed strategic responses.

The *port of the Thessaloniki* (ThPA) is the only port where this predominant strategy, which fits the overall impressions of the case, occurs. All the predictive dimensions with the expeption of the content antecedents matched *acquiescence* as response strategy. Especially, uncertainty and unpredictability of coercive demands exerted pressures on the organization that triggered the management commitment to overcome the primary obstacle of the limited environmental protection experience and apply greening objectives. The port was initially engaged in EMS implementation and certification adoption for legitimacy purpose and for reducing uncertainty rather than reasons of promoting actual performance. At this point it was not in position to produce actual results in environmental protection with just having its first environmental policy in place. Although an early adopter of the PERS standard, the core values of the supporting Code of practice were already diffused within the Ecoports network, where a high degree of interconnection among organizations had already occurred. In addition, being part of the network involves norms with which the network members must comply. In this sense, the membership is automatically related to normative pressures, with the likelihood that compliance to them will convert organization uncertainty into trust and confidence. Thus, lacking any national policy framework to support the port’s efforts in confronting severe coercive demands, ThPA grasped the opportunity to participate in the Ecoports network and under normative pressures got engaged in EMS implementation primarily aiming at legitimacy gains. This port case highly confirms that when there is environmental uncertainty, organizations tend to imitate successful peer organizations and the port of Dover happened to be just recently successfully PERS certified. ThPA strategy of response to EMS implementation was to consciously imitate the peer organization by accepting network consultancy towards its first PERS certification. However, as an organization could take another step to redesign its efforts in order to comply or fit to institutional expectations (Oliver 1991:154), the port proceeded by building up specific environmental capabilities that enhanced its EMS process, and until its second successful PERS certification ThPA managed to produce actual environmental results.

Fig. 5.4: The main institutional factors that explicate ThPA’s strategic response

	THESSALONIKI (ThPA) - Strategic response (early adopter-**reactor)**	
Institutional factors	***Acquiesce***	*tactics*
	Mandatory requirements derived from EU and national level.	
coercion	National port policy requested ‘quality’ ports with insufficient implementation guidelines. Lack of integration mechanisms in the Greek public administration, and dysfunction of the country’s inspectorate system.	*comply*
diffusion	Early adopter in PERS certification. Positive attitude and fast implementation of the suggested organizational adjustments to the standard.	
multiplicity	Uncertainty and unpredictability of different agencies demands derived both from EU and national legislation and unconstructed and diverse regional agencies	
dependence	Lack of knowledge in port environmental protection led to EcoPorts membership	
uncertainty	Uncertainty due lack of knowledge in individual port environmental aspects and related mandatory obligations and lack of authoritative guidance at national level.	
interconnectedness	EcoPorts network consultancy in EMS implementation, while working with local academics supporting research in port environmental protection.	*imitate*
legitimacy	Networking that provoked environmental awareness and indicated the PERS standard as a practical tool to accelerate the port’s green liability.	
efficiency	Indirect gains by potential reduced liability costs through EMS application are perceived as of organizational importance.	
	EMS implementation efficiency gains demonstrated in terms of eco-efficiency and cost reduction from green practices.	

Both the *ports of Dover* (DHB) and *Valencia* (VPA) deployed a mixed strategic response in EMS implementation. The predictive dimensions of the content and control antecedents matched *acquiescence* as a response strategy. Before strategically positioning themselves in EMS standard implementation, the ports had already established a status of compliance regarding coercive and normative demands. They were both active in identifying their specific port-environmental aspects and the related liabilities and they were involved in self-regulation procedures. The high and low degree in the multiplicity and dependence predictive dimensions of the constituents’ antecedent indicates that the ports deployed the manipulation strategy. Both were able to act in this way as they had a long record of efforts in problem-solving on port environmental aspects, while they were also both engaged in research projects focused on port EMS implementation.

Fig. 5.5: The main institutional factors that explicate DHB's strategic response

	DOVER (DHB) - Strategic response	(innovator)
Institutional factors	***Acquiesce***	*tactics*
consistency	EMS implementation consistent to national policy guidelines and consistent in the use of the EcoPorts tools and to ESPO/EPF recommendation upgrading PERS to ISO14001.	
coercion	DHB as a Trust port is primarily subject to national legislation. National SD policy objectives are advised and supported at regional level by the UK Environment Agency. Local authorities are responsible to enforce environmental regulations and various British standards for environmental protection	*comply*
legitimacy	EMS standards considered as suitable legitimate tools for building the port's green image and gaining reputation as green port. EMS according to ISO14001 and PERS immediate step.	
	Manipulation	
multiplicity	Multiple and diverse agencies' coercive demands from national and EU regulators, the national sustainability program and the port-city interface	*influence*
dependence	Strong pressures from national policy requesting scientific validity in port environmental protection and EM practices, particularly in monitoring	
uncertainty	Pioneer port in being aware of the values of the EcoPorts, that succeeded in dealing within the natiobal policy guidelines and an extensive national reaesrch network	*co-opt*
interconnectedness	Highly active member of the EcoPorts network and an extensive network within the national context supporting research in port environmental protection.	

Especially the *port of Dover* had the advantage to be the first port that applied the PERS standard and therefore, it was capable to form its *manipulation* strategy by co-opting and influencing the standard. Being supported by the national proactive framework and a national research network, that had already made it possible for the port to incorporate environmental quality aspects and accurate monitoring procedure in its EM framework, allowed DHB to import influential constituents and shaping values as well as criteria of accuracy and reliability in the PERS standard implementation.

Fig. 5.6: The main institutional factors that explicate VPA's strategic response

	Valencia (VPA) - Strategic response	(early adopter)
Institutional factors	***Acquiesce***	*tactics*
consistency	EMS implementation consistent to national port policy encouraging quality standards implementation. Consistent to EMAS Regulation for building the port's EMS and to ESPO/EPF recommendation upgrading PERS to ISO14001 and EMAS.	
coercion	EU and national legislation enforcement is carried out at state, regional and local authority level. The National port Agency provided PAs with strategic guidelines for the management of specific port environmental aspects and recommended scientifically based indicators for monitoring and reporting.	
diffusion	Self-regulation has been increasingly relevant to corporate policies with a strong commitment to developing EMS practices and procedures. Own ECOPORT research project in EMS implementation according to EMAS financed by EC/LIFE program initiated the port's environmental policy. Early adopter of the PERS standard. Use of the stepping stones of PERS and ISO14001 towards EMAS certification.	*comply*
legitimacy	Corporate culture supporting quality and standardization. Top management commitment in greening through standardization and EMS toward green self-regulation for as many as possible different organizations in the port community.	
	Manipulation	
multiplicity	Multiple agencies' demands from EU, national and regional level, the national SD policy's guidelines for the Spanish ports and the port-city interface.	
dependence	Own methodology (analogous to EPF/SDM) for port environmental aspects identification supported EMS implementation. Cooperative and individual research for identification of a system of indicators that enhanced EMS implementation. Own research on EMAS application financed by LIFE EU program.	*co-opt*
uncertainty	R&D projects supported the lack of knowledge and EMS implementation. The Spanish state port agency confronted legal uncertainties supporting the	
interconnectedness	Individual projects supporting EMAS implementation, collaborative initiatives at the national and EU regional level in the Mediterranean basin and willingness to confront competition in supply chain in terms of green competitiveness moderated the level of interconnectedness in the EcoPorts network.	

The *port of Valencia* was not the innovator of the norm. Yet, it was among the early adopters with a moderate level of interconnectedness in the network and low-level dependence on it -mainly because it pursued its own research in port EMS implementation. VPA pioneered a self-designed EMS framework based on EMS implementation according to EMAS standard and thus, it was also capable to co-opt the norms proposed in the field.

The *port of Rotterdam* (PoR) is the only one where *acquiescence* was not the predominant strategy, although the port had to follow taken for granted norms, obey rules and confront both high coercive and normative pressures, -especially when it needed to secure its expansion plans and after the change in the institutional status of the PA. PoR is a unique example of a port which although initiated advanced objectives towards sustainability it was the last among the four ports to apply for PERS standard, with a significant delay. This made the port an exceptional late-adopter regarding EMS implementation. Additionally, PoR's innovative and visionary green policy, which was part of the regional policy framework, places the port in a unique place within the Ecoports members. The port's acquiescence strategy was based on complying and habit tactics. However, the moderate level of consistency and discretionary constraint as well as the low level of the perceived legitimacy and efficiency gains in EMS implementation are the main predictive dimensions that explain the port's prime *compromise* strategy. PoR employed mainly bargain efforts, negotiating with different types of institutional stakeholders, but also chose the compromise tactic so as to balance various expectations of diverse and multiple constituents between innovation policies and EMS implementation challenges.

Fig. 5.7: The main institutional factors that explicate PoR's strategic response

Institutional factors	**Rotterdam (PoR) - Strategic response (late adopter)**	*tactics*
	Acquiesce	
coercion	Environmental protection was subject to national policy and legal requirements. National and regional spatial planning shaped long-term perspectives for the SD of the port and licensing and enforcement of environmental law focused on long term targets of emissions reduction. Both PoR's Harbour and the regional environmental agency DCMR secured the enforcement in the port area.	*comply*
diffusion	PoR's municipal management developed EM based on green processes, licensing and monitoring protocols. Since the port's corporatization, PoR's CSR strategy and the theme targets required comprehensive reporting in a systematic way in all environmental aspects of the port. In 2008 PoR used of the EcoPorts tools (SDM / PERS) re-establishing the PA's approach for classifying risk and environmental aspects and was PERS certified as a late adopter of PERS	*comply habit*
	Compromise	
multiplicity	Diversified requirements from all kinds of environmental legislation at the European, national and local level. Indirect governance by environmental regulations and permits at regional and national level. Ongoing port-city interaction with multiple actors' engaged in sustainability focus projects.	
dependence	Cautious and accurate environmental performance complying with national and EU legislation, as well as, regional policy implementation and action. The Dutch joint authority approach ensured the effectiveness of environmental practices.	
uncertainty	Environmental planning based on problem solving approach and incorporation of local regional green concerns through process-oriented actions. Ecological and legal uncertainty crucial in port development was overcome with extensive scientific research, stakeholder dialogue and EC level approval	*balance*
legitimacy	Indirect regulation enforcement related to the national environmental policy. EM implementation on pragmatic approach. Strategic targets and project realization built the port's EM legitimacy. Although, own procedures perceived valuable, PoR implemented EMS based on the PERS standard as a late adopter.	
interconnectedness	Active EcoPorts network member strongly requesting at the EU level playing field in port environmental protection. Collaborative initiative among ports in the national context and lobbying at EU level trying to sort out increase of environmental protection regulations.	
consistency	Since PoR's corporate status emphasis on building and communicating sustainability goals. PERS perceived valid as sector specific standard.	*bargain*
constraint	EcoPort tools were perceived as unnecessary for policy development, delaying the decision of EMS standards application.	

CHAPTER 6: Analyzing green *port capabilities* as constructs of environmental pro-activeness

6.0 Introduction

The analysis of the previous chapter used the Oliver's (1991) framework typology and confirmed the variety of individual port responsiveness in the European green port organizational field. Different port leaders-laggards' strategies, and their related tactics in the emergence of port environmental management from 1993 to 2010, were identified and highlighted.
Scholars suggest that, analyzing issues of environmental management and sustainability so as to understand green organizational responsiveness is useful, in order to explore its connection to organizational resources and capabilities, (Hart, 1995; Teece, et.al., 1997; Sharma and Vredenburg, 1998). Ports that are strategically proactive, develop capabilities which correspond to their individual path towards greening. To create a more thorough understanding of *how* the divergence of individual port strategic responses into EMS implementation occurred in the field, in this chapter the research goes further by asking*:*

- *Is it possible that certain strategies and tactics are driven from the existing situation within the organizational field, while others evolved from specific organizational capabilities?*

This part of the study aims to explore the way that each port developed core port capabilities towards greening, and to what extent the resource requirements are significant for a successful green-port strategy adoption through EMS implementation. The primary focus is on how individual organizational characteristics influence strategic responses, and therefore, the interest is different from the Oliver's approach whose centre of attention is on relational characteristics (like power). In addition, this chapter's analysis concentrates on the role of port capabilities in enhancing EMS implementation by providing a competitive advantage. The findings aim to add to port environmental management (PEM) knowledge.
Aiming to explore *how* each port's response strategy interrelates with distinct capabilities that enhance EMS implementation and *to what extent* these organizational competences provide competitive advantage, this part of the research addresses the following sub-questions:

- *How has individual port pro-activeness occurred?*
- *To what extent can ports differentially gain competitive advantage from their individual environmental management approach?*

This kind of analysis expands the existing research, in an attempt to investigate environmental pro-activity related to organizational capabilities. Moreover, it reveals what determines a pro-active green port strategy and enhances a PA's ability to generate competitive advantage. The findings, reflecting the significance of building-up internal capabilities for port greening, aim to add to the port management knowledge.
The next sections, once more, compare the four selected case studies in the way EMS implementation was built upon organizational capabilities and upon explicit competences that the individual port organization possessed prior to EMS adoption. Subsequently, the chapter discusses the potential value of port differentiated capabilities, in terms of the individual 'green port' competitive advantage. The selection of the multiple case study approach, once again, properly addresses the exploratory nature of this part of the research.

6.1 Pollution Prevention (Hart, 1995)

Firms adopting a pollution prevention strategy, are basically seeking to minimize or eliminate their environmental effects. The natural resource-based view (NRBV) indicates that pollution prevention is a crucial starting point in environmental performance advancement, through environmental management practices (Hart, 1995). This kind of strategy facilitates the implementation of new practices, that enable organizations to generate further improvements in environmental performance. In the case of ports, actions of pollution prevention greatly depend on the specific location and the characteristics of the port area. It is about deeply knowing the complexity of the environmental effects caused in the port area by different kinds of activities of both the PA and the multiple tenants. The extent of *what* and *how* the PA manages to prevent them, is also crucially related. In the bottom line, pollution prevention capabilities provide the PA with the adequate means to show actual green results at a scale up to environmental excellence, as well as to communicate them to societal groups and stakeholders in their business environment. The more information available for pollution prevention strategies, the more ports may be considered as transparent and able to communicate their actual environmental performance results. The aforementioned were highly supported at the International Transport Forum in 2014:

"*When the focus is on pollution prevention much depends on the local situation e.g. river ports need to be dredged which can have impacts; some ports have a strong industrial character with the related impacts; some ports are close to urban areas so need to pay more attention; some ports have ship types that are much more polluting."* (Merk, 2014)

It is the business reality of ports that intensifies the complexity of pollution, mainly because ports are made up of various enterprises and operations. Merk (2014) pointed that it is difficult to generalize about the environmental impacts of ports, because:

"the port does not exist; it is rather a variety of ports with different environmental challenges."

However, in most cases, it is the particular pollution-prevention capabilities which enable ports to demonstrate environmental excellence to the variety of stakeholders that applaud or provide them with the licence to operate. Bailey and Solomon (2004) addressing health effects of air pollutants in ports outlined that pollution prevention represents a proactive, -beyond compliance-, approach whereby emissions are reduced, prevented or altered through changes to the port organization's processes. They pointed out that, if ports are to move toward a sustainable model which serves a local region without damaging the health and integrity of local communities and ecosystems, numerous approaches will be necessary to reduce pollution. Therefore, the perspective for developing and implementing an environmental policy, that would be effectively supported by an integrated EMS into the port's corporate policy, sounds like a long-term plan. Although, uncertified environmental management systems may considerably vary between different port organizations, there are some common elements that the self-regulation through EMS requires, (certified or non-certified). A PA should identify targets and develop an environmental policy (Jiang & Bansal, 2003), while specific conditions of transparency and monitoring are also required (Graham & Woods, 2006). Furthermore, the port's environmental disclosure was upgraded in the 2000s, -although in delay compared to other business sectors *where* the increased demand for information was related to actual environmental performance and the prospect that green results are connected to improve financial performance was crucial (Porter and van der Linde, 1995), particularly because disclosure of green actual outcomes is a potential source of legitimacy that substantially enhances a company's performance (Oliver, 1991). The management system of an organization can also satisfy requirements others than environmental ones, and the quality and safety standards respectively can be certified according to ISO9001 or OHSAS 18001. There is a conceptual similarity in *pollution prevention strategies* supported by EMS standards to quality assurance standards, as they offer similar organizational processes that make it possible to accumulate resources in the former by integrating them into the latter (Roome, 1992). Well-developed quality management or health and safety processes can be effective precursors of pollution prevention practices. Especially because pollution prevention strategies are people intensive rather than technology intensive, and beside strong top management commitment they necessitate voluntary and extensive involvement of large numbers of people especially line employees (Hart, 1995).

It has been suggested that a pollution prevention strategy has the characteristics of a dynamic capability (Hart and Dowell, 2011). In this perspective, it would be interesting in this study to consider *to what* extent, specific organizational processes of different port organizations support its implementation. This is particularly important, as it is directly related to the individual port's actual environmental results. It would provide a thorough indication to what extent the individual port self-regulation was efficient for improving environmental performance. In its essence, the EMS application by all four explored ports should provide results beyond ensuring that the PAs have identified and prioritized their activities which could impact on the environment. A strong correlation between EMS implementation and the reduction of environmental effects should be expected, which would weaken the possibility that this particular organizational structure serves symbols of compliance without affecting the actual environmental performance.

o *Port of Dover* (DHB)

Transparency

The *port of Dover* (DHB) had a long record of surveys on environmental issues and a short yet impressive record of environmental reviews of established managerial processes already in the 1990s (see annex1 p:40). Aiming to understand the environment in which port operations and developments were taking place, as well as, to ensure compliance with wildlife legislation, DHB considered as essential to progressively integrate environmental quality aspects in organizational processes. The result was that various environmental aspects, related to different port activities, were connected with environmental metrics and goals. What was needed for the existing system of processes to become an effective EMS, was the structural integration of the different (aspect related) environmental management capabilities. The use of both EcoPorts tools, SDM and PERS, was catalytic in this respect. Based on established specialized in-house capabilities in monitoring, (see annex1 p:47) and the SDM results, under the PERS scheme the port produced specific performance indicators to effectively manage its environmental performance (see annex1 p:44). DHB's environmental policy was gradually enhanced through the years, in order to ensure sustained environmental quality in the port area. In this respect, the key themes and issues that have been of greatest interest or concerns of the port's environmental management and build-up of the port's EMS implementation were: pollution prevention; environmental quality; environmental resources; and dedicated environmental communication.

During the 2000s the PA further focused on plans to enable constant improvement. The port's waste management plan evolved in an effective Recycling and Waste minimization Policy that produced positive results, especially for various recycling schemes in the total of the port area since it also involved the port's tenants (see annex1 p:29-32). The RERS revision in 2006 and the ISO140001:2004 certification in 2008, incorporated new policy components in the port's environmental policy and the port pollution prevention strategy which was built up based on five thematic areas: environmental management; environmental resources indicators; environmental pollution control; environmental quality; and environmental communication. Since 2006, an integrated Energy and Water Policy has been constantly updated and produced tangible eco-efficiency results (see annex1 p:33). The ISO14001:2004 requirements brought up a Contractors and Suppliers policy. This separate policy ensured that tenants and all kinds of port facilities are monitored and audited for compliance to the PA's EMS. DHB was recognized as a best practice example of how a port influences EM tenants. Since 2008, DHB's environmental policy has incorporated sustainability principles and the PA has been engaged in air quality actions addressing a particularly sensitive local issue in Dover port-city. Carbon management has been a top priority of DHB's environmental policy both as a terminal operator and as a PA (see annex1 p:36).

Based on the accomplished environmental monitoring capabilities, and using both the SDM and PERS standard, since 2002 DHB has facilitated its performance indicators to monitor actual environmental performance (see annex1 p:44). Until 2010, DHB had more than a decade of experience in environmental reporting. After having been PERS certified, DHB produces an Environmental Board Report on a monthly basis, reporting on environmental quality in the port area. Since the ISO 14001 implementation in 2008, DHB has been producing an annual environmental report publicly available, and an annual environmental bulletin downloadable on its web-site.

PEM on quality management

In the early 1990s, DHB initiated a number of structural changes which enabled the formation of an internal organizational unit specialized in environmental protection practices at a procedural level. An environmental manager was appointed in the safety and environment unit of the organization, and a surveyor was designated with specific environmental responsibilities. Through the years, DHB has upgraded environmental performance relying on an updated and efficient environmental office. A positive contribution to this, was the constantly co-partnership work with various "green agencies" (see annex1 Fig.3.8 p:39; p:47). Alongside implementing EMS, through the 2000s, the port also developed its quality management and health and safety systems. The environmental officer considered that the similarities of the PERS standard with the health and safety management system helped to better understand the activities and operations in the port area. After many years of working its safety management system, in 2010 DHB was successful in achieving the OHSAS 18001 standard -an internationally recognized management system for occupational health and safety. The quality of port services was also verified in 2010 and DHB was accredited with the internationally recognized ISO 9001:2008 standard for its Quality Management System.

Employee training - involvement

DHB's environmental policy was extensively communicated to all staff, allowing employees to endorse the top management's environmental principles. The PERS standard promoted in-house intensive training programs which enabled the staff to understand the needs and requirements of an EMS, while by mitigating the effects of pollution incidents in the port all response personnel were adequately trained. Especially, oil spill response training for all DHB operational staff working on land in the Eastern docks, aimed at effectively respond and co-ordinate the cleanup operation. Although this kind of training could not prevent pollution, it was crucial to the extent that it was effective in minimizing the impact of any resulting pollution of the environment.
Staff involvement has considerably improved since DHB energy awareness initiatives in 2005, when the DHB Board recruited 35 members of staff to be ‘energy monitors’ across the port (see annex1 p:34). However, employee involvement in consultations related to environmental issues did not have the same density or it did not exist at all in other green practices or EMS processes.

- *Port of Thessaloniki* (ThPA)

Transparency

The possibility of using this management tool as a support for pursuing legal compliance is one of the most effective drives towards EMS implementation. The *port of Thessaloniki* (ThPA) has experienced a real improvement in monitoring and managing compliance to environmental laws. With the PERS implementation it was able to acknowledge a (previously unsatisfied) legal provision while defining the register of law requirements relevant to the different environmental aspects. The register, in particular, turned out to be a very useful tool.
However, the significance of the PERS implementation for the port, relies on the formation of the ThPA’s first environmental policy statement, which reflected the need of environmental imperatives to be integrated into the everyday organization of the port’s activities (see annex2 p:41-42). This strategic objective was also defined as a high priority of the port’s core efforts, *both* in building a vision of sustainability *and* in accelerating progress towards the actual environmental results. In order for this objective to become feasible, it was essentially crucial that the port’s top management recognized the need to demonstrate how this ambition could be translated into practical reality.
In essence, the immediate PERS certification recognized the port’s commitment that a sufficient number of environmental protection programs, -related to its operations-, would follow the recommended best practices of the ESPO’s Environmental Code of Practice. The PERS gave the port a practical *tool*, to ensure that the most significant environmental effects were identified and to determine the ways in which they could be tackled, as well as, a certificate to demonstrate its environmental protection commitment to regulators, stakeholders and the community. At this stage reporting was still at a very general level.
Both the key role of the appointed Environmental Coordinator in the port’s organizational structure, and the ThPA green inter-organizational cooperation (see annex2 p:41), managed to achieve the above objective within a limited time. After ThPA’s initial PERS certification, the port benefited by joint R&D projects with local academics that provided guidance in setting up management plans for specific environmental aspects related to its activities like, dust emission management, waste management, contingency and resource consumption plans (see annex2 p:28,32,36,37). The collaboration provided the implementation of monitoring programs, -including access to the state-of–the-art research equipment and software-, and facilitated management skills for the port’s personnel through educational and training schemes.
Most importantly, the academic support made it possible for the PA to identify the appropriate indicators, related to significant environmental aspects in the port area, that provided reliable scientific evidence of green behavior. Based on that result and on the initial PERS implementation which commenced the synthesis of the port’s environmental report, since 2005 ThPA has started reporting

every two years (see annex2 p:43). Actual results of the environmental performance emerged mainly from the aforementioned implemented action plans. Particularly, the dust air pollution monitoring program was very effective in monitoring the successfully implemented mitigation measures for the port's cargo handling operations, while yearly based audits monitored the success of waste production minimization and the improved efficiency of the port's recycling and energy consumption schemes.

PEM on quality management

The port of Thessaloniki- followed by the port of Piraeus- was the first Greek port that undertook initiatives of environmental management beyond those compelled by legislation in the 2000s. In harmonization with the community directive 2000/59/CE and the MARPOL 73/78 Convention, ThPA had already implemented a ship's waste reception and management plan (see annex2 p:34), before applying its first EMS according to PERS standard. In a limited time, the port identified its actual environmental situation using the SDM and PERS EPF tools successfully and effectively *and* it gradually built specific green operational capabilities towards pollution prevention until 2010.

Parallel to implementing its EMS, ThPA was among the few EU ports that developed a Health and Safety Management Plan (see annex2 p:26-28). The plan particularly emphasized the assessment of noise and chemical agents to which port workers could be exposed. The port's Environmental Department contributed to the improvement of occupational safety and health conditions and the port had advanced significant reduction in labour accidents' occurrence and severity indicators until 2010. ThPA had also in place its security plan, that is fully complied to the ISPS Code requirements and regularly updated to international and European regulations. In 2007 the port's Environment H&S Department went ahead implementing OHSAS 18001, the most acknowledged standard dealing with health and safety issues, while the International Labour Office (ILO) granted the ThPA with the Greek translation and editing right of its code of practice.

In Greece, EU legislation (2001/96/EC) has been the driver for port quality management. Chlomudis and Kostagiolas (2011) outlined that there was a growing interest in ISO 9001 certification among Greek ports in the 2000s. The privatization of the container terminal in the port of Piraeus and the recurring discussion about whether the container terminal in the Port of Thessaloniki should be also privatized or not, gradually introduced a need for renegotiation of quality standards. ThPA has been according to ISO9001:2008 certified for both its container and bulk terminals.

Employee training - involvement

The PERS standard implementation initiated the port's employee environmental training program. ThPA mostly carried out employee training in cooperation with specialists of the local university. The setting-up of the program involved short courses and seminars on the port's environmental policy for the key personnel; staff training in line with the potential impacts associated with their position; and an environmental awareness-training program for all port employees. The program was not a one-time effort and it eventually evolved to long-term program aiming to follow the port's updated environmental goals and objectives.

Until the PERS standard re-certification in 2008, ThPA administration and qualified port personnel continued to be actively involved in consultations specifically related to the port's EMS and supported by the local academics (see annex2 p:44). Consultation activities were strictly related to environmental effects within the port area.

- *Port of Valencia* (VPA)

Transparency

The *port of Valencia* (VPA) initiated its environmental policy in 2000, which was modified in 2006. The policy very clearly determined action lines, that progressively introduced environmental management into the PA's corporate policy and eventually built up the port's pollution prevention strategy. VPA's EMS was also initiated with its own ECOPORT project in 2000, which until 2008 pursued verification and accreditation of all possible EMS standards. The port extensively used EU funding, commissioning various R&D programs to excel in green practices, and it also joined related programs within its national context. Most of those programs enhanced its monitoring and evaluation management system for different environmental aspects related to the port's own activities.

Particularly, the system of indicators that facilitated the effectiveness of the port's EMS was further enhanced by the establishment of a real time monitoring system of different environmental aspects in the port area (see annex3 p:32). The PA was distinctively focused on environmental integration and thus, it was successful in incorporating different managerial green practices in its EMS.
VPA was truly committed to environmental protection and, through the years, the developed actions and several projects brought actual green results. The port managed to successfully control air, water, noise in the port area (see annex3 p:16,17,18). The control and handling of waste, via the port's own Waste transfer Centre, following an updated waste management, gradually improved the collection and management of its own waste and waste produced on the cluster port premises and benefited from the savings offered by economies of scale, but it also, upgraded its waste storage conditions and recycling outcomes (see annex3 p:19-20). The VPA's Strategic Plan (2015), -adopted in 2002- and its related actions supported synergies in the cluster port in order to improve the quality and efficiency of the port services whilst preserving the environment and working towards better port-city integration. A clear example of that, is the port's Ecoefficiency Action Plan (see annex3 p:29) that reflects the complexity of planning and implementing an eco-efficient model in a cluster port area. VPA's EMS produced actual results based on established ecoefficiency criteria that applied in the following areas: electric and energy ecoefficiency (both for the PA and the cluster port area), resource consumption, renewable energy, sustainable mobility and the creation of a greenhouse gas inventory.

VPA was very conscious of the importance of the role that environmental information plays in a strategy of sustainability. *External communication* was the aim of periodic issue of publications which were related to promoting information on environmental matters in the port. Consequently, since 1999, VPA has been publishing an environmental newsletter every four months featuring analytic descriptions of the environmental activities carried out in its cluster port. VPA's first Environmental Report corresponds to the year 2001 and it was published with the aim to provide actual results of its environmental commitment and environmental actions (see annex3 p:33). Since then, the PA has published detailed annual environmental reports. Both the ISO14001 and EMAS standards further enhanced the port's communication on environmental results and VPA's environmental newsletters have been upgraded with an international and national circulation. The port's experience in managing various environmental aspects and EMS implementation was internationally disseminated through various publications of its own, including guides of good practice. (see annex3 p:38).

PEM on quality management
The large amount of VPA's, both internal and collaborative, R&D projects provided diverse EM practices, which were gradually integrated in its EMS, built up its pollution prevention strategy and have eventually promoted improvement in the port's environmental performance (see annex3 p:23). It is crucially important to point out that, as much as complicated and extensive the port's pollution strategy was, it was also an integrated part of a business model, designed to be shared with the port community. This business model acknowledged the different interests of all stakeholders in the VPA cluster port and logistics center and advanced the deployment of different strategic actions including pollution prevention and CSR (see annex3 p:28; p:35), as part of the fourth strategic axe in the PA's Strategic plan (2002-2015) (see annex3 p:9).
VPA's quality management has incorporated both *internal quality management* in the PA itself, and *external quality management in the port community*. VPA advanced its own Quality mark, a tool to provide quality standards for the port community companies, while it used the ISO9001 for certifying the quality of the PA's internal processes (for an overall of VPA's certified quality management systems see annex3 p:11).

Employee training - involvement
VPA's own ECOPORT model provided an EMS framework that regarded environmental training, -both for the PA's own staff and all members of the port community-, as one of strategic value. The framework aimed at creating port personnel increasingly conscious of the port's environmental implications. As a result, permanent training systems and awareness courses have been established on an annual basis. Additionally, from 2003 to 2005, staff training finally enabled the effective functioning of the VPA's Emergency Control Centre. Since waste management and energy eco-

efficiency were integrated in the port's EMS, training for waste and resource optimization and energy efficiency were regularly implemented until 2010. Ongoing training of the staff is also undertaken through its own ECOPORT II project (2006-2008), in which, VPA conducted training and awareness campaign at the port community level aiming to achieve maximum synergy in the application of its environmental policy (see annex3 p:34). In 2005, the ISO14001 implementation boosted further various training initiatives. During the standard's implementation, the port developed an environmental training plan which allowed all employees to identify their environmental problems and ways to control them. At the same time, VPA was responsible for developing a Guide of EMS for port facilities and port communities within the EU ECOPORTS project completion, and the collaboration with various EU ports facilitated the VPA's environmental training experience to be disseminated in the field, as well as internationally (see annex3 p:35).
Particular importance was given to communicating the management's environmental plans to all company staff and members of the port community. Internal environmental communication was a key tool of EMS development, as it intended to be both interactive and bidirectional, providing an opportunity for discussion and consideration of the different proposals and suggestions, and it was occasionally successful.

- *Port of Rotterdam* (PoR)

Transparency
Since the late 1980's, the municipal management of the port of Rotterdam (RMPA) was involved in various projects related to environmental issues. In the 1990s, under the *'clean port'* policy the key element for EM implementation was maintaining legal compliance. Organizational audits and inspections ensured that the environmental risk related to port and service providers' operations, as well as to the development and maintenance projects, were identified. The Harbour Master's role in reducing oil spills and other sources of water pollution was essential in this respect (see annex4 p:45). Within the port area, space utilization, tailored to the restructuring of existing sites and the development of new premises for the future needs, was based on rigorous environmental requirements. The role of DCMR (see annex4 p:5) in controlling the issuing licenses was critical for ensuring compliance with policy and regulations. With RMPA applying strict controls regarding soil and groundwater quality national policy requirements, the emphasis of the *'clean port'* policy implementation was based not only on issuing licenses for new initiatives but also on modifying the existing ones (see annex4 p:50). According to the PA the permits and licenses to a large extent also verified risk prevention. In addition, the port gradually upgraded its environmental performance based on the successfully achieved objectives of various projects. The PA constantly developed new skills for the management of new environmental processes.
Since launching the Rhine Research Project, more than 20 years ago, (until 2010), RMPA worked in collaboration with various institutes to address the environmental problems related with its maintenance dredging produces. The port's efforts were not only outside its own immediate fence line, but also beyond the country's borders (see annex4 p:14). While problems *do* remain and some highly-contaminated sediments dredged from the port are still placed in the Slufter (see annex4 p:15), the quality of the Rhine water, as well as the quality of the dredged material in the port of Rotterdam has been improved. Along with that, -the ecological situation in the Rhine-, the North Sea coastal zone has also recovered significantly. The PA aiming at emission control, harmonisation of water and sediment policy, shifted its policy towards *integrated sediment management*. The target is for all dredged material to be clean enough, either to be relocated in the North Sea or to be beneficially used until 2015 (see annex4 p:27-30).
National law was also behind the need for noise management implementation in the port area. Once again, the process of environmental permits by DCMR as well as control and enforcement by the PA specified how much noise the port facility was allowed to make and as a result the noise problem in the port area was effectively reduced (see annex4 p:42). The system was also valuable in providing data for the production of regional noise maps based on the Environmental Noise Directive. The PoR's participation in the EcoPorts-NoMEPORTS project (2005-2008) provided knowledge of an important aspect, particularly interesting for the Rotterdam case, the ships' contribution to environmental noise

primarily coming from the operation of internal combustion engines. The project revealed the cold-ironing system as an effective measure for reducing the noise levels (see annex4 p:44).

Both the municipal and corporate administrations of the port developed long term strategies towards greening; the Port Vision 2010 (from 1993) and the Port Vision 2020 (from 2004). Especially the port's corporate management, considered its strategic port vision towards sustainability, essential for future business development of the port. The plans for industrial development in the port area have been strategic to PoR for decades, but since the late 1990s the gained knowledge through various R&D projects that addressed sustainability issues (see annex4 p:50), as well as the Maasvlakte2 expansion planning experience, has made the shift to a long-term planning for sustainability possible. In the harbor were already, or were to be developed, the conditions that could support change to such a policy.

The political attention to CO_2 emissions, especially those of the shipping sector, -as emissions from ships had been sidelined for a long time-, put the issue of air quality as a priority green objective for the PA. As part of its air quality program, PoR developed and adopted environmental innovative action projects on three different levels: the PA (own operation activities), the port and industrial complex, and the supply chain level (see annex4 p:31). Regarding the port's *own business and operations*, the CO_2 footprint of the organization has been actively minimized (see annex4 p:39). Electric company vehicles, energy efficient working boats and the use of renewable electricity in the buildings are examples of these efforts. The PA has been in the process to include sustainability criteria in the procedure of purchasing and setting out calls for tenders in the Maasvlakte2 expansion.

In the *port and industrial complex*, the Rotterdam Climate Initiative (RCI), with the 50% CO_2 reduction target in 2025 compared to 1990, provided explicit conditions for sustainability developments. With its partners of the sustainability program, PoR aims to increase energy efficiency, stimulate the use of renewable energy and prevent CO_2 from going into the atmosphere. Wind energy and biomass are used to generate environmentally friendly energy (see annex4 p:37). Carbon capture and storage (CCS) as well as carbon capture usage (CCU) are being examined together with authorities and private partners. It is expected that this will contribute to about 60 to 70% of the port's CO_2 reduction goal (see annex4 p:35-36). High levels of particulate matter (PM), NO_X, SO_X and other harmful exhaust gas emissions in the port can be barriers to the port's growth. Therefore, the port, stimulates the use of LNG as a marine fuel (see annex4 p:36). The PA rewards ships with low emissions by reducing their port fees through its ESI (Environmental Ship Index) score for oceangoing ships and for inland ships that meet emission requirements (see annex4 p:41). The port's cold ironing infrastructure allows ships to switch off their engines and to use electricity from the shore, so while ships are moored they can switch off their diesel generators and use this shore power *thus* eliminating local exhaust gas emissions in the port (see annex4 p:42). Even though the port has limited influence over the *supply chain* impact on air quality, the impact of changes at this level is large. Some of the port's policies at this level has been the barge (engine) replacement program and barge speed reduction program; actions under the RCI sustainable mobility pillar (see annex4 Table 3.3 p:39); and the modal shift policy from truck to barge and train.

Nature was taken into account by the PA in its port development. The Maasvlakte2 planning experience as well as knowledge gained from related projects like the Paralia Nature project (see annex4 p:48) facilitated the PoR's Nature Plan 2004, that is the PA's policy strategy for ecology-related matters. Protecting the breeding grounds and natural habitat of plants and animals, -these include wild horses, seals, protected orchids and the endangered natterjack toad-, has been a priority for the port; moreover, making these nature reserves accessible for recreation has been another port priority (see annex4 p:49).

The Port Vision 2020 involved a wide range of measures to stimulate local industry, economy, protect wildlife and nature and most importantly it enhanced the quality of life for the people living in the surrounding area. In 2007, PoR applied the PERS standard to identify its environmental aspects in a structured way and assess processes of various environmentally friendly activities according to the standard. The standard's implementation stimulated the integration of the various policies incorporated in the port sustainability vision within an EMS framework and provided auditing objectives and a reporting tool to the PA.

The municipal management of the port provided limited information regarding its environmental actions within its annual reports. After the port corporatization, the annual reports ensured that sustainability objectives remain points of attention, as a substantial part of critical performance indicators is focused on sustainability. Since 2008, the PA has considered its CSR annual report as the basis for the PA to enter into a dialogue with various stakeholders and therefore, the report is available online and it focuses on transparency, both internally and externally (see annex4 p:51).

PEM on quality management

The Rotterdam approach in quality management is characterized by attention for the entire port and industrial complex as well as by making use of different quality control systems. It is an acclaimed and proven port management system based on the landlord principle, which is consistent with world-class standards in rules & regulations.

In the port of Rotterdam, regarding health and safety, a combination of tightening legislation, better control and improved awareness has likewise brought about steady reduction in both accidents and incidents (WORKPORT final report, 2000). The Harbour Master Division is responsible for port security and participates in the Port Health Authority, a cooperation of various parties which deals with health care in the port of Rotterdam, while it supervises and advises vessels in the event of health problems on board. Thus, the Harbour Master ensures that the level of safety in the port of Rotterdam remains at the right level despite the increasing shipping and complexity.

The Green Award certification scheme was set up in 1994 by RMPM and the Dutch Ministry of Transport, Public Works and Water Management, with the aim to improve safety and environmental standards on board seagoing ships. The basic requirements of the Green Award consisted of compliance with national and international laws and regulations which are known and accepted in the maritime industry world-wide. On top of the basic requirements, a set of additional elements was set up, -like management control, safety and environmental protection; established and documented contingency arrangements; oil leakage and pollution prevention; vapour emission control systems; disposal of waste; effective tank cleaning; exhaust emission. Thus, the certificate has been a combination of various inspectorates. The ship-owner indicates which of those elements are met and the Bureau Green Award assesses compliance with them. The Green Award was originally open to crude oil and product tankers with a deadweight capacity of 50,000 tons and above, which has been lowered to 20,000 tons and above. Bulk carriers have been admitted since January 2000 and the scheme was expanded in several geographical areas around the globe. The incentive for joining the scheme is lower suppliers' fees and the certificate is valid for three years unless withdrawn by the Bureau Green Award. The intention has been to give an international status to the certificate. Until 2010, 238 ships were certified.

Employee involvement

RMPM had appointed staff members directly responsible for environmental protection in three different organizational directorates. Activities were coordinated by a group which informed the management board. DCMR assisted in the training of personnel focusing on inspections, supervision and the issuing of permits.

Since 2004, PoR has identified sustainability as a crucial starting point for the future in its Port Vision 2020 and additionally to new technology, procedures, rules and regulations, the port realized that it also needed to educate and inspire its employees to play a part in shaping a sustainable future. Therefore, the PA organized both collective and individual training programs for its employees' environmental training. Special marine environmental awareness courses for the port personnel (both port inspectors and policy makers), addressed both the sea and the port perspective regarding sustainability and marine ecology. The courses aimed to contribute to the general awareness of the importance of sustainable development and to the involvement of people, as well as, invite port personnel and policy makers to play an active role towards a sustainable future. Since PoR was convinced that CSR is a *"crucial precondition for a healthy development of the port in harmony with the surrounding area"* (PoR CSR Annual Report, 2007), the focus for the following years has been, beyond environmental training, on further knowledge exchange and embedding of sustainability in the port organization.

The following comparative Table 6.1 illustrates the differences among the four port case studies regarding the pollution prevention framework that each port developed in order to improve practices that aimed to minimize or avoid pollution in the port area.

Table 6.1: Pollution prevention (Hart, 1995)

		DOVER		THESSALONIKI		VALENCIA		ROTTERDAM	
Empirical indicators		LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Transparency	Environmental policy								
	environmental reports / newsletters							**moderate**	
PEM on quality management	Applied of EM practices			**moderate**					
	Applied Health - Safety strategy								
	Applied TQMS								
Employee involvement	Employee (continuous) training							**moderate**	
	Employee involvement in consultations related to environmental issues					**moderate**			

6.2 Stakeholder Integration (Sharma & Vredenburg, 1998)

The recently evolved necessity for PAs to be environmentally accountable to various stakeholders and the public, has motivated proactive ports to employ new approaches on how to address most of their expectations (Acciaro, 2013; Wiegmans & Geerlings, 2010; Adams, et.al., 2009). The ESPO/EcoPorts Environmental Review in 2009, confirmed that the stakeholder involvement has joined the list of high priority significant environmental issues according to the port managers' perceptions. This newly evolved issue was characterized as forming another crucial aspect that should be integrated in the overall environmental strategy of a port aiming to turn green.

○ *Ports differ substantially from other organizations*

Although the public perceives the port as a spatial unit regarding its environmental impact, this is far from addressing the port's business reality. The port concept can vary depending on local and business characteristics, but when speaking of a port, the term rarely refers only to the PA, which most commonly is the landlord or regulator, even though other functions also exist. The port concept comprises the entire port community, consisting of several companies and authorities operating in the port area. Actually, beyond the PA, tenants, operators of the infrastructure, different kinds of facilities and vehicles and various entities depending on the individual port characteristics and the related daily operations cannot be subjected to a uniform environmental management. It is also important to point out that a lot of factors and movements -in and around the ports-, are not within the control of the port operators and the PA. As such, the extent of going green at ports is heavily influenced by the behaviours of their users. For this reason, for ports to go green, their operators, and even more the PA through its authoritative role, need to engage port users in greening and to ensure that they observe green practices (Lam & Van de Voorde, 2012). Stakeholder engagement, especially at the port community level, can crucially help ports manage their environmental issues. It can even act beyond compliance with environmental regulations in building up their corporate social responsibility and image (Acciaro, 2013).

○ *Port Infrastructure development and maintenance depends on stakeholder capability.*

Stakeholder pressure has the effect of influencing and forcing organizations to take certain actions. From the local community perspective, improved knowledge and awareness of the existence of the port's negative externalities (in most cases noise, traffic congestion, emissions and waste generation), has led to an increasing amount of legal procedures which aimed at either reducing port activity in a region, or at port development project abolition based on environmental concerns. Today, contributions to stakeholders' expectations is another distinct element of legitimacy that provides the 'license to operate' (Post, et.al., 2002). A clear example has been the Maasvlakte 2 expansion project of the port of Rotterdam. Thus, PAs through their core business i.e. managing and developing infrastructure, were in many cases obliged to build up stakeholder capabilities (Dooms & Verbeke, 2007; Lam & Van de Voorde, 2012) and adapt communication strategies towards local community stakeholders (Parola et al, 2013).

○ *Stakeholder capability as part of communication strategy*
Transparent and innovative port communications that make the accurate information available to stakeholders secures the support of a local population, and allows the port to keep its *'license to operate'* and to remain a legitimate economic actor. Moreover, it provides the means that distinguishes successful port-cities from less successful and more polarized ones (Merk, 2013).

○ ***Collaboration within the port community on environmental issues and problem solving***

In the *port of Dover* (DHB) port community, various port user groups were established from 2000 to 2010, so as DHB to establish a more focused and senior-level dialogue with those who were the key users of the port. This included ferry operators, border agencies, terminal operators, cruise lines and major tenants. Most of the collaboration initiatives, regarding both environmental issues and ad-hoc problem-solving, took place under the umbrella of the Dover Port User Group which embraced representatives from all the aforementioned port users. The DHB's Waste Management Plan was the result of a comprehensive consultative process from 1998 to 2004 between the PA, port users (ferry operators, terminal operators and ships' agents), and policy makers (the Environment Agency and DEFRA) (see annex1 p:29-32). In the late 2000s, DHB engaged different tenants in its port community to deliver effective results in its carbon footprint through project-based collaboration (see annex1 p:36).

The *port of Thessaloniki* (ThPA) environmental manager confirmed that the PERS application provided opportunities for contacts with key stakeholders in the port community. After the initial PERS implementation, ThPA was committed to delivering results by establishing management frameworks in order to tackle the identified inefficiencies. Some of these elaborated plans involved stakeholder consultation at the community level. The comprehensive Health and Safety Management Plan, for example, involved broad consultations with port personnel, workers in the port area and port users' representatives to formulate the plan (annex2 p:26). Additionally, as part of ThPA Waste Management Plan and particularly the port's recycling scheme, the PA's employees and port users' awareness program was organized through meetings at the port community level. There was also collaboration with port companies for waste product alternative management, especially for waste oil (see annex2 p:32-35).

The *Valenciaport* (VPA) was particularly engaged in working towards stakeholder integration in its port community regarding EMS implementation. The tools obtained by VPA's ECOPORT project (1998-2001), -which aimed to enable EMS application to various facilities in the Valenciaport's port areas (VPA manages a cluster port)-, were gradually adopted in use within the Valencia port community. The VPA's ECOPORT project defined the port's own field of innovation in PEM.
The project benefited from the analysis provided by the proposed model and managed to detect a series of unsolved needs, including allocation of human resources for environmentally related matters, Legislative Information System on environmental issues for the port community, enhancement of emergency measures in relation to the atmospheric pollution (particularly in terminals handling grains not apt for consumption), and a Waste Transfer Center. All of them were collaboratively addressed by the participated companies and the PA (see annex3 p:22).
The following ECOPORT II project (2006-2008) intended to facilitate EMS initiates, particularly focusing on ISO14001 implementation for all the companies located in the port area. The PA managed to co-ordinate and to progressively achieve board stakeholder engagement in EMS application in its port community. A suitable co-ordination tool, namely a port environmental committee, reinforced regular working meetings upon the participated companies and appointed tasks according to the participants' needs (see annex3 p:23).

In the *port of Rotterdam* (PoR), -in a tremendous and complex port area like the one of Rotterdam-, the stakeholder engagement can involve various issues and policy related objectives *ranging from* the modal shift policy from truck to barge and train -where agreements with stakeholders involved reducing the share of road transport in the container hinterland transport mix, by encouraging greater use of inland shipping and rail transport-, *to* industrial symbiosis programs. Within the port community,

the PA, the industrial association Deltalinqs, the regional environmental agency (DCMR) and the Rotterdam Municipality cooperated in various organizational frameworks for stimulating environmental results, and they were as well involved for a long period of time in a stakeholder dialogue (Baas & Huisingh, 2008).
In the Rhine Research Project (RRP) (1998-ownward), discharge into the river has been internationally and successfully tackled by means of agreements between the PA and the industries along the Rhine with regard to the reduction of discharge. The purpose still remains that by 2030 all dredged material will have been cleaned so that the distribution in the North Sea or reuse on land will be possible (see annex4 p:29-30). Discussions were ongoing with public authorities and the various business entities, regarding an integral approach of the existing soil contamination in the industrial complex under the umbrella of the WELCOME project (2002-2004) (see annex4 p:48).
PoR's leading work on air quality and climate change, launched the Rotterdam Climate Initiative, a program designed to reduce the 1990 level of CO_2 emissions in the Rotterdam area by 50% until 2025 (see annex4 p:32). This again is in conjunction with local and regional partners including the municipality of Rotterdam, DCMR and Deltalinqs. In an attempt to internationally collaborate in developing responses to climate change, the PA held the conference 'World Ports for a better Climate' in 2007, where 14 of the world's largest ports (including Antwerp) gathered to discuss their responsibilities in helping to reduce greenhouse gas emissions.
The PA's approach of coping with air quality in the port area (see annex4 p:33), manages to engage business investments in this respect. Cooperation initiatives have been in progress for the realization of shore connected power facilities for inland vessels and consultations for the installation of shore connected power at the Hoek of Holland terminal for seagoing vessels. The Rotterdam R3 industrial symbiosis program, embraced a stakeholder dialogue platform through a dynamic multi-stakeholder approach (Baas & Huisingh, 2008), providing innovative co-sitting options (see annex4 p:47). All of them are in line with the port's ambition to realize its sustainable energy port.

- ***Collaboration within the port-city interface on environmental issues and problem-solving***

The initiation of its Environmental Policy in 1998 engaged the *port of Dover* (DHB) into a *"co-operation with relevant authorities and consultation with port users and interest groups"* (DHB Environmental Policy Statement, 1998). The port was focused on creating long-term relationships within the port-city interface to collaboratively address both environmental issues and problem-solving. Therefore, DHD supported an open engagement and debate between the port and the local community, aiming to enable port representatives to develop a better understanding of the needs and perceptions of its important local community stakeholders. According to DHB's Head of infrastructure development, the *"experience in Dover is that consultation is the key".* The progression of consultation for the redevelopment of Terminal 2 (Dover Western Dock) illustrates the close collaboration with the local authorities, in terms of meetings and technical tools addressing implications of future congestion and air-quality issues (annex1 p:23; p:46).
Through a comprehensive Stakeholder Management Plan (see annex1 p:19), DHB managed the extensive consultation process that initiated the required EIA process (to identify and quantify the impact of the proposal and to suggest mitigations measures). The plan identified key groups and set out the approach by which each group should be consulted. The port of Dover (DHB) planning for Terminal 2 was undertaken in consultation with regulators and stakeholders at a very early stage, something that allowed the input of experts from a wide variety of fields. As a result, environmental considerations were an integral part of the planning and DHB had the best possible understanding of the impacts and implications of the new development which allowed the port to be realistic and confident during the meetings with the local authorities.
Air quality is a particularly sensitive local issue in Dover port-city. The national Air Quality Strategy and Air Quality Regulations assigned each local authority to take responsibility for the air quality within its boundaries, and to work towards meeting the required overall objectives. Since 2002, DHB has closely worked with the local authorities regarding the Air Quality Management Area (AQMA) scheme by the Dover District Council, as well as the issue of air-quality in Dover as a high priority environmental impact of the port's new development (see annex1 p:46). The local AQM Action Plan drawing-up achieved consensus from a broad range of stakeholders including local residents,

community groups and local businesses, but also their active participation in achieving the required measures. It was further reviewed and improved through consultations with relevant environmental health and transport representatives from Dover District Council, the Highways Agency, Kent County Council and DHB.

Regarding the *port of Thessaloniki* (ThPA) case, the PERS standards mobilization identified contacts with stakeholders in the port community and emphasized the way that the port should build a relationship with the local administration, *albeit* with controversial results. The fugitive dust emissions management plan of the port which addressed a high priority problem for the PA aimed to manage the problem in an integrated way that could also support a co-operative action plan in the port-city interface. The final plan entailed complex technical methods (application of computational dispersion model and dust monitoring) as well as preventive management procedures and measures strictly related to the port area. The port addressed the local community's interest in this specific issue by just providing information about the applied scheme and by accurately explaining the port's efforts without being overly technical (see annex2 p:28-32). In contrast, dealing with oil spills and water pollution ad-hoc problem solving, the ThPA Contingency Plan has analytically described which stakeholder (both at the port community level and in the port-city interface) is responsible, as well as, the degree of involvement (annex2 p:36).
Perhaps, the most successful ThPA management efforts to integrate stakeholder in its EMS procedures are reflected in the port's Waste Management plan. The latter revealed the broadest stakeholder involvement that the port has faced since its initial EMS implementation. The port went through extensive consultation procedures and comprehensively dealt with the exposed different main interests (see annex2 p:35).

The *Valenciaport* (VPA) addressed the issue of collaboration in the port-city interface on a project base. The SIMPYC project (2004-2008) aimed at the design of implementation of an environmental action plan for commercial ports and the development of an awareness and social involvement program. The project designed and developed joint port-city monitoring tools for noise and air pollution and studied measures for minimizing visual impact by providing technical as well as management meetings (see annex3 p:26-27).
VPA addressed the port-city interface collaboration as one deserving an adequate environmental aspect management plan, both at an urban and port level. Following the SIMPYC project recommendations, the port's administration considered that coordination in the port-city interface was a "must" -due to the confluence of various interests and responsibilities-, and went through creating the adequate coordination mechanism in order to promote environmental problem-solving and address sustainability for both the port and the city management.

In the case of the *port of Rotterdam* (PoR), the stakeholder management involved closely following relevant regional, national and European issues that were important for the port's development.
In the 1990's, the Rotterdam port's demand for expansion was strongly supported by the government but not by the local communities. It was after the environment was used as a key for expansion and the intensive dialogue with stakeholders that, in the end, provided better utilization of current facilities and 1000ha expansion for the port (see annex4 p:23). The support and commitment of a broad range of stakeholders was early secured in the development of the plans for Maasvlakte2 via a series of signed agreements overseen by the ROM-Rijnmond organization (see annex4 box3.3 p:46). The Maasvlakte2 was agreed to be constructed, on the edge of the new port area, where a natural dune landscape has to be developed on the soft sea defenses with rich and varied flora and fauna. The expansion boosted a new era for the port. The agreements provided a clear framework for the different stages of the project, and because of the efficient procedure, the outcome was improved. The informal interaction with the EC at an early stage, that was also crucial, should be noted (see annex4 p:24).
Maasvlakte2 decision-making gradually evolved from a top-down steered process towards an interactive process in which many stakeholders were involved. In this sense, it was considered as a fine example of dealing with the complexity of stakeholders. It is observed that the actors get involved in joint-fact finding (Van Buuren & Edelenbos, 2006; Klijn, 2004), which developed compensation packages and thus broad consensus was built. The PA was in the center of decision-making

throughout the process, while representatives of the PA were involved in coordinating organizations. In the end of the process a monitoring and evaluation system was formed as a preventive means in case of effects different than expected (see annex4 p:50).

PoR, like its main competitor the Antwerp PA, was involved in a number of European-level projects and networks exclusively oriented in sharing best practice on how nature preservation management and ecology aspects integrate in port areas. This included New!Delta, Paralia Nature projects and the Ecoports Foundation. The PAs considered networking, especially for these kinds of issues, as the proper way for enabling the authorities to better understand the requirements of the Birds and Habitats Directives (Paralia Nature, 2005), as well as, for maintaining and strengthening links with the EC.

The port's Port Vision 2020 was developed in cooperation with about 40 stakeholders. The City Region Rotterdam and province of South-Holland, the regional environmental agency DCMR, the Rom- Rijnmond cooperation, the national government and private actors (companies, knowledge institutions and societal organizations) participated. This policy framework presented the port as one of multiple quality (van Gils & Klijn, 2007) involving, among others, the *sustainable por*t in which industries should engage in less polluting processes and change to other energy sources; the *knowledge* port, where cooperation between knowledge institutions was described as important; the *attractive* port for the surrounding community; and the *clean* port, particularly focusing on environmental problems like air quality, noise, soil and water pollution reduction. The port plan *does* focus on six main qualities and has endorsed numerous policies to reduce environmental impact in which the stakes of the broad variety of stakeholders can be recognized. Until 2010 critiques on the plan indicated that the plan was aiming at too many abstract principles and did not really function as a guideline for concrete future developments, but it still remained a long-term plan aiming at 2020 targets.

One can also observe that the PoR's CSR initiative has been complementary to its Port Vision 2020 implementation. PoR is particularly investing in gaining public support for its commercial activity in the Rijnmond area; in fact, the port invests to maintain its *'license to operate'* by pursuing a policy of Corporate Social Responsibility (CSR) (see annex4 p:51; p:4). The PoR's CSR (2006-2010) plan focused on both internal and external stakeholder dialogue through sustainable reporting using its published CSR reports. The PA aims to address its shareholders at the local and national level: clients, government (local, national, international), communities, NGO's, Employers organizations, Trade Unions; and investments related to the port community, mainly sustainable entrepreneurship.

Now that finally the port in Rotterdam is gradually shifting further away from the city, towards the west, a constructive relationship between city and port is also important for the allocation of new functions to outdated port areas also from an urban perspective (for example house building). *CityPorts Rotterdam* has been a collective term for a number of harbours on both sides of the Nieuwe Maas of approximately 1,600 ha. In the Rotterdam city ports area, there are short and long-term opportunities for economic and urban renewal. In fact, the City-Port development could be turned into an opportunity, as, in many instances, the transformation of the port areas is also used to reconnect the local population with its port, in terms of newly established or future combined working and residential environments.

In addition to CityPorts Rotterdam, the PA is also investing in other ways of building up the city-port relationship. Cycle routes through the port, nature areas in the port, working at an attractive port, as well as cooperation with other European ports on projects like the 'People around Ports' project, are all new ways of approaching the port-city interface. The World Port Days, which attract many visitors each year, provide a living platform on which the port and its local people can get to know each other and strengthen the bonds between them. The FutureLand information centre at Maasvlakte, which opened to the public in 2009, also contributes to this aim. The port has further been a defining element of city marketing, as the city of Rotterdam promotes itself as a world port-city, which in turn helps to create or sustain local goodwill for port activities, (Merk, 2014).

- ***Port's ability to guide developments through public consultations***

Within the <u>*port of Dover*</u> (DHB) port community, there is a built consensus that environmental challenges of a port area are more likely to be vanquished if the port community works together. DHB's systematic public disclosure of the port's targets and objectives generated awareness within

the port community and acted as a driver for further improvement of the port's environmental performance. An ethic of *'compliance plus'* has been therefore embedded by promoting a culture of environmental awareness and most recently of corporate social responsibility amongst all staff and port users.
In the UK, the Planning Inspectorate, an agency of the governmental department for communities and local government routinely holds public inquiries into a range of major and lesser land use developments, including transport proposals. Port developments plans have to be supported by environmental impact assessment (EIA) studies and a special assessment if Natura 2000 sites are involved (see annex1 p:19). During its Terminal 2 development planning, DHB used a regular communication mechanism, the Port Consultative Committee (PCC), for addressing interests in environmental issues (and beyond) from varied stakeholder groups ranging from local groups (including residents' associations, such as the Dover Society, local business, interest groups such as A20 Action Group and local government representatives), national trade associations and government agencies (DHB, 2010). The Terminal 2 development was a core item at each meeting of the PCC and the stakeholder diversity facilitated wide ranging discussions, allowing both DHB and the different elements of the stakeholder community to better understand the full range of issues and views associated with the port's proposals.

The *port of Thessaloniki* (ThPA) environmental policy in 2003 included, -in the form of short statements-, both communication and consultation, as key themes for the port's EMS implementation. The PERS preparation was a productive phase (see annex2 p:39). Different stakeholders and key persons in the port-city interface were informatory addressed during the initial phase of implementation. Additionally, the PERS identification of the port's most significant environmental aspects procedure also revealed that the port users affect the environment with their daily operations. The progressive phased development of further action plans, which the port elaborated from 2003-2010, involved partial and selective stakeholder engagement. The port's administration has classified full integration of stakeholders' interests as a priority for future steps towards greening (see aneex2 p:43)

EMSs are practical tools for addressing environmental policy in daily port operations and a way towards self-regulation and sustainable development. In order to implement these systems, changes must take place in port community business cultures. During the last two years, the *Valenciaport* (VPA) ECOPORT project (1998-2001) and the circulation of the results within the port community, the PA managed to create an *'ECOPORT spirit'* in the port community of Valencia. The next step was to transfer the results obtained from the project to all other port operators, and until 2010 the PA was particularly successful in doing so. In this respect, the ECOPORT project was a good example of how cooperation among companies sharing the same space and problems is possible and beneficial in terms of environmental management.

Hundreds of thousands of people live and work in the immediate vicinity of the *port of Rotterdam* (PoR) and industrial complex. For a large seaport, this is an unusual situation which demands mutual understanding. The PA is convinced that the increasing attention given to sustainability by the local people, public organisations (NGOs), capital providers and port users crucially demands greater effort to improve its environmental performance and to be engaged in sustainability both for the port and industrial complex. Therefore, the PA has been focused on consensus and a permanent dialogue with its surroundings, closely following the regional (Rijnmond), national (The Hague) and European (Brussels) issues that are important to the development of the port of Rotterdam.
For PoR, according to its port vision, sustainability means both improving its own performance, by encouranging and stimulating sustainable enterprise in the port and industrial complex, but also creating sustainability affects supply chains and transport around the world. Therefore, since the mid 2000s the PA has invested in establishing the optimum and attractive conditions for business, in connection with the licence to operate. This includes improving the port area's quality and the innovation climate, but also increasing sustainability and stimulating collective transport facilities.
"Investing in partnership is the best possible pre-conditions for a port business community to succeed" (PoR, 2010) and therefore, PoR supported various educational initiatives in this respect. Although, de

Langen, (2004) observed that trust amongst companies in the port of Rotterdam community was relatively low compared to Hamburg and Antwerp, the infrastructure for knowledge-sharing is present at the port, through organizations like Deltalinqs and the Erasmus Smart port.

The following Table 6.2 provides an illustrative comparison among the examined port case studies in terms of stakeholder integration based on the Sharma and Vredenburg (1998) proposed empirical indicators.

Table 6.2: Stakeholder Integration (Sharma & Vredenburg, 1998)

Empirical indicators		DOVER		THESSALONIKI		VALENCIA		ROTTERDAM	
		LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Collaboration within the port community on environmental issues	Regular meetings								
	Capability of explaining port's point of view								
Collaboration in the port-city interface on environmental issues	Regular meetings								
	Capability of explaining port's point of view								
Collaboration within the port community on problem solving	Ad-hoc meetings								
	Ability to solve problems collaboratively								
Collaboration in the port-city interface on problem solving	Ad-hoc meetings								
	Ability to solve problems collaboratively								
Ability to guide developments through public consultation	Port culture of approaching the port community level								
	Port culture of listening to local communities & environmental groups								

6.3 High order learning (Sharma & Vredenburg, 1998)

An EMS is a highly systematic framework focused on various aspect related environmental policies that are people intensive and depend upon tacit skill development through employee involvement and participation (Hart, 1995; Sharma and Vredenburg, 1998). Especially, employee involvement is crucial for the success of EMS implementation. Employees of a port organization should also be considered as key stakeholders and thus, their role in main environmental issues, their ways of engagement as well as the benefits achieved from their proactive participation in the port's EMS are important in organizational learning. The ISO14001 standard in particular, identifies an organization's total employee involvement as a pre-requirement to environmental and quality objectives.
In the early 2000's, ESPO evaluating its environmental review in 2001 recommended that the EU ports should consider the type of environmental monitoring required in order to assess their environmental progress. Thus, the selection of adequate indicators to monitor progress derived in the quest for port greening. The sector began to identify port-specific performance indicators for both environmental quality and environmental management activities. Various, chemical, biological and managerial indicators were emerging and were being applied over a growing number of port areas. These in turn, required the development of environmental management information systems (EMIS), in order to structure information into a retrievable form and maximize the component which allows an integrated response. In addition, the monitoring tools that are the most effective can be organized within a well-designed monitoring network, as well as the real-time capability of a monitoring network and the integration of information in the management system are critical elements of an EMIS effective implementation.
Another crucial problem is that, because the primary business focus for ports is the transport of goods, most of a PA's employees do not have an adequate educational background to understand the proper

way in which the environmental data is processed. Therefore, employee training for environmental and technical skills is required as an important factor, especially in successful EMIS implementation (Puig, et.al.,2015).

- ***Employee integration in environmental information exchange***

The *port of Dover* (DHB) feedback system for reporting environmental results is traced back in 1992 with the establishment of the port's environmental monitoring program, which was initiated in order to ensure sustained environmental quality in the port area. Quarterly and biannual monitoring procedures drew attention to changes caused by natural or anthropogenic factors, based on specific environmental quality and resource conservation indicators, and incited immediate management responds (see annex1 p:44). Additionally, in 2005, the port established a computerized environmental incident reporting system unique in Dover. The monthly statistics produced, based on this reporting system, enable the environmental office to evaluate the port's actual environmental performance (see annex1 p:47). Although the structure of DHB's environmental management organization (see annex1 Fig.3.8 p:39) demonstrates a spread of different departments involvement in dealing with environmental issues, this mostly reflects the management level. The involvement of the operational staff mostly occurred in project based initiatives, like the successful port's energy conservation campaign (see annex1 p:33-34). Since 2008, the port has established its 'green week' event to further enforce staff involvement (see annex1 p:48).

The *port of Thessaloniki* (ThPA) initiated its environmental policy and approached its first EMS implementation according to the PERS standard, in cooperation with the local academics, through a joined competent group of academic specialists and qualified experts from the PA. Until 2008 and the port's PERS re-certification, the aforementioned group had developed and implemented specific action plans that enhanced the port's EMS and set up consultation activities, workshops and training courses, which allowed dissemination of environmental practices at the operational level. Information dissemination among the port management personnel, which was appointed with environmental responsibilities, took place through frequent informative meetings with all the actors involved. The training involved both obtaining knowledge of the port's environmental impact, as well as, how to use the identified environmental performance indicators that were developed based on the SDM methodology results (see annex2 p:42-43). Until 2010 the port still used the SDM as the main tool to track feedback on its environmental performance, since the tool incorporates a gap analysis between a port's current EM and the more comprehensive system like ISO14001 and EMAS. Thus, to a large extent, ThPA has been depending on an effective system process implementation to support its green self-regulation scheme. The last remark is also highly supported by the role of the port's environmental coordinator in terms of its appointed tasks, which underpinned the inter-organizational cooperation in greening (see annex2 p:41).

In 2000, by completing its own ECOPORT project, *the Valenciaport* (VPA), developed an in-house EM framework, in order to reach the environmental objectives defined in its policy. The project facilitated the port's EMS, which from its early stages aimed to accomplish an integrated-knowledge management system by addressing all kinds of port operations based on the EMAS standard requirements (see annex3 p:36). Over the years, VPA has carried out internal and collaborative initiatives specialized in port environmental pollution (see annex3 Table3.4 p:24) which enhanced the port's EMS with a system of environmental performance indicators and tools- most of them are giving real time control- that allowed the integrated control of the port's environmental aspects. The ECOPORT framework also produced its own assessment process based on legal compliance and EM process evaluation (see annex3 Table 4.1 p:32).
Until 2008, the PA had formulated its networks for monitoring environmental aspects and integrated them into the management system in order to improve performance and fulfill requirements for updating its EMS according to the PERS, ISO14001 and EMAS standards. In this regard, major milestones were the air and water quality, noise and energy consumption monitoring networks (see annex3 Table 4.2 p:32). Parallel to these improvements in the networks, integration was further enhanced by technological means which further supported the port's feedback system for reporting

the actual environmental performance. A single application, that can be accessed from different monitoring points in the port area, allows network data and field sensors to be visualized and monitored. However, employee integration was approached rather conventionally, through permanent training schemes and awareness courses that were established on an annual basis. During the ISO 14001 implementation in 2005, the port's training courses were further boosted by an environmental training plan which allowed all employees, to identify their environmental problems and how to best minimise and control them. At the port community level the Ecoport-Lex data base of environmental legislation, consulted port companies on mandatory obligations (see annex3 p:23).

The *port of Rotterdam* (PoR) with more than two decades' efforts until 2010 had faced almost all environmental challenges that the EU ports have been confronted with. Since the early 1990's, PoR's *'clean port'* strategy, under the Port Plan 2010, was highly supported by the ROM-Rijnmond Plan which was collaboratively agreed among various authorities (see annex4 p:13). Even more, since 2004, the corporate management of PoR, under its Port Vision 20020, has aimed to ensure that the sustainability objectives remain points of attention. The PoR's sustainability strategy, as expressed in its Port Vision 2020, is highly interconnected to the Rotterdam city's sustainability strategy. Jointly with a number of other actions, the sustainable port supports -to a great extent- the Rotterdam's city possibility to turn into a sustainable city. In the case of Rotterdam, the regional environmental agency (DCMR) is responsible for the regulation of the industries operating within PoR's port area, as well as for the environmental monitoring of issues such as air quality, noise, safety, soil, energy. PoR uses Environmental Ship Index (ESI) to assess the emissions in air pollution (NOx and SOx) and global warming (CO_2) of sea-going vessels and because of the international importance of the port, it has facilitated this emission control as the global standard (see annex4 p:41).
Within the PA organizational structure, environmental responsibility is defined at the board level. The Executive Board continues to consider sustainability in the decision-making process concerning investments and important environmental aspects, while part of the port's performance indicators has been focused on sustainability. Since 2006, the PA has interpreted CSR as a working method that is sustainable, committed and transparent (see annex4 p:54). Environmental practices were gradually incorporated in the management practices of the different port departments. Although, there is strong integration of environmental planning and environmental practices implementation within the strategy of three different departments of the PA, there is also frequent lack of internal communication and thus, pure employee integration and dissemination of environmental practices. Since 2008, PoR has employed the PERS standard, as according to the PA it "comprises a set of guidelines formulated for and by ports for the purpose of evaluating a port's individual environmental management performance", but also as an EMS tool that focused on the integration of different environmental aspect based policies in an attempt to manage insufficiencies.

- ***Continuous expansion of knowledge about port environmental issues***

Since the early 1990's, the *port of Dover* (DHB) had confronted the need to precisely evaluate the environmental problems in its port area. DHB continuously worked in partnership with various educational and research bodies across the local and national network updating knowledge about environmental issues (see annex1 p:47). The port extensively used both the EPF tools -its long records in SDM application starts in 1998- and since 2005, it has created a centralized database for its EMS, based on the PERS standard implementation. The port was among the leading ports in sharing its environmental practice experience within the EcoPorts network. The DHB environmental officer chaired workshops at EPF conferences and gave presentations to other EU port representatives on the application and benefits of using EM practices within their ports. The port has enhanced its EMS by constantly maintaining reporting systems and regular specialized monitoring programs for different environmental aspects (see annex1 p:40; p:44). For both, it has developed in-house expertise. Since 2008, DHB's environmental monitoring database has been imported into a GIS which was installed with the added functionality of being able to undertake spatial modeling analysis. This system was initially applied for updating the port's water quality, ornithology and marine faunal data. Until 2010 it was continuously being developed in order to increase the type of queries that can be performed on additional datasets.

In the *port of Thessaloniki* (ThPA) case, the development of a policy framework for environmental protection in 2003, was realized almost simultaneously with the port's ability to understand the environmental impact related to the port operations. They were both built up with the use of EPF tools and until 2010, the port's environmental department had advanced environmental information exchange through the EcoPorts network. ThPA, to a large extent, built up its EMS, from 2003 to 2010, without having any sort of experience in EM practices, and managed to progress a constantly upgraded knowledge about environmental issues related to its operation, as well as, to demonstrate areas of good practice, but it did not proceed to the next step towards ISO 14001 or EMAS, as it was highly recommended by EPF (see annex2 p:44-45). What is particularly interesting in this case is that it can illustrate the perceived benefits of building up and updating knowledge about environmental issues within a context of a highly-specialized port network without the port having any former experience. Especially, when the industry -as a whole- assists networking amongst its members to exchange good practices and experience. Although, EcoPorts professionals and academics, -that ThPA consulted-, identified the PERS benefits in terms of cost savings from efficiency and efficient handling, as much as profits expected from competitiveness and efficiency, it seems that the port availed of the PERS standard, in terms of efficient distribution of the cost related to EMS implementation (see annex2 Table 4.3 p:45). The latter, eliminated the disadvantage of the considerably high cost for the direct application and maintenance of a more comprehensive EMS like EMAS and ISO 14001.

The *Valenciaport* (VPA), for over 20 years, has been committing itself to environmental protection of all activities around the port area (see annex3 p:31). The port's administration strongly considers that the port's EMS standards certifications demonstrate the port's commitment to continuous environmental improvements. In the late 90's, this commitment led to the development of the VPA's own port environmental management system, labeled ECOPORT, which also initiated the port's first environmental policy in 2000. Within the following decade VPA adopted various plans and participated in many national and international projects, aiming to improve its environmental performance. As a result, the port, using the available technology, has constantly upgraded both its knowledge about environmental issues and its data base of environmental information regarding air and water quality, noise and energy efficiency. Studies regarding birdlife and underwater flora and fauna formed VPA's biodiversity database (see annex3 p:21). Compared to the Dover case the VPA's knowledge database of environmental information is lagging behind in terms of the total time period that the data was monitored.
VPA's ECOPORT model became a reference at the European level in PEM and allowed VPA to have a leading role in various subsequent cooperation projects, such as Ecoport II, Climeport, Greencranes and Greenberth that further improved and extended VPA's ecoefficiency action plan (see annex3 p:28-29), as well as, SECURMED, Elefsina Bay 2020, MADAMA and EUROPHAR project that formed a Mediterranean oriented port network which has been also engaged in the information exchange (see annex3 p:28). In this respect, the PA encouraged the staff, directly involved in the environment, to attend both national and international forums and seminars and has welcomed at its premises technical staff from other ports. Formal and informal channels for environmental information exchange in the Valencia case include the strong links of the port with academic and research institutes at the regional, as well as, links within the national port system.

In the *port of Rotterdam* (PoR) case, many project-based initiatives, since the late 1980's, have constantly updated the port's knowledge of environmental issues. Most of them revealed the complexity of port environmental aspects, in terms of adequate knowledge production based on both science and management oriented approaches that can sufficiently confront them. A clear example is the PoR's Rhine Research project (see annex4 p:27-30)
Although the port was actively involved in many diverse environmental activities, it was the need for space growth that highly supported the 'mainport' approach and the way the long-planning process of the Maasvlakte2 expansion evolved, that shifted the port's strategic vision towards a more sustainable 'model'. In order to be finally approved, the planning itself required a number of aspects that guaranteed sustainable port growth and a healthy ecosystem functioning. Even more, the

planning of the Maasvlakte2 future use, over time was framed within the perspective of ecological sustainability awareness and within the perspective of the climate change. Both have been evident in the strategic approach of the PA towards air quality (see annex4 p:31), the PoR's 'energy port' strategy (see annex4 p:33-40), and sustainable mobility actions (see annex4 box 3.2 p:41), as well as, in the PA's species and habitat management scheme (see annex4 p:51).
For an eye-bird on the different aspects involved in the PoR's environmental management of three-level approach (see annex4 Table 4.3 p:51). The building up of this complex task approach was based on mutual consensus among different stakeholders from the public and private sector, as well as, an extensive network of research partners, especially at Erasmus University and Delft University. For example, PoR set up a research group called SmartPort in collaboration with Erasmus University. Independent consultants assist many companies in the port, and Deltalinqs can offer similar services as well, especially in case of co-citing investments in the port area. Formal and informal channels of environmental information exchange, on the basis of mutual collaboration on sustainability issues, eliminated competition among the Dutch ports. The EcoPorts network from its initiation, has also been another point of reference in information exchange for PoR.

- ***Ability to look for alternative solutions to problem-solving***

Since the early 1990's the ability to understand the environmental impact of its port activities has been apparent in the case of the *port of Dover* (DHB), as a result of following both legislative demands and the growing awareness of the UK port sector to extend knowledge about port environmental aspects. Progress towards a more integrated approach in EM was assisted by the appointment of environmental staff and the setting up of the port's monitoring system. Since the early 2000's, the use of the PERS standard has enabled the use of a system approach that worked for the port to set further priorities which, since 2008, have developed and extended to meet the ISO14001 standards requirements. In the 2000's, the DHB 30-year master plan (see annex1 p:13-14), which was acclaimed by the UK Department of Transport as a leading example of long term planning -mainly because of its ongoing, early and integrated assessment of environmental issues- has further extended the port's knowledge of environmental issues. The port's environmental manager considered that DHB's EMS implementation has reflected the need to address an environmental aspect on the basis of the port's particular local environment, as well as, the port infrastructure operations. Nevertheless, the EcoPorts network membership allowed the port to be aware of alternative solutions.

In the *port of Thessaloniki* (ThPA) case, it is not an exaggeration to state that without the SDM implementation the port would not have been in the position to advance understanding of its existing environmental situation (see annex2 Table 4.1 p:44). Especially, without network interactions within EcoPorts and advancing green practices transmission, the immediate PERS application could not have been effectively supported by the port's existing human resources and the level of environmental knowledge. Until 2010, the EcoPorts network and its database of best practices remained the port's main provider of alternative solutions to problem solving.

The *Valenciaport* (VPA) possessed, through its ECOPORT project (1998-2000), the first of the two generic procedures for the identification and assessment of port environmental aspects within the EU port sector; the other one was produced by the EU EcoPorts project (2002-2005) (Puig et.al.,2015). Working on its own model it was able to proceed to a systematic analysis and evaluation of its cluster port area activities' environmental impact, as well as, to effectively build up its EMS implementation (see annex3 p:40). Diffusing outcomes was considered essential for promoting and demonstrating the port's own achievements, but being part of the best experiences available, nationally and internationally, limited the port's perspectives to be aware of possible alternative solutions to problem-solving.

In the *port of Rotterdam* (PoR) case, although the PA has various responsibilities, the initial approach on environmental protection, especially during the 1990s, was based on effective licensing and permit procedures for various activities in the port area, as well as effective enforcement of legislation, which were both provided by the regional environmental agency (DCMR). The importance of compliance with legislative demands was a priority and by securing that enforcement was effective and successful, the PA was not much receptive to be aware of alternative solutions to problem-solving. In the ad-hoc case of such demands, the information exchange within the sector, both at the European and national level, was also an efficient source of problem solving.

The following comparative table 6.3 once again provides the differences among port case studies in the way they have built up their EM approach in terms of the high order learning capability and the related empirical indicators as proposed by Sharma and Vredenburg (1998).

Table 6.3: High order learning (Sharma & Vredenburg, 1998)

Empirical indicators		DOVER		THESSALONIKI		VALENCIA		ROTTERDAM	
		LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Employee integration in environmental information exchange	Integration of different levels of employees and dissemination around environmental practices	**moderate**				**moderate**			
	Feedback systems for reporting of environmental performance								
Continuous expansion of knowledge about port environmental issues	Level of knowledge data base of environmental information and biodiversity					**moderate**		**moderate**	
	Constantly updating knowledge about environmental issues								
	Formal and informal channels of environmental information exchange								
Ability to look for alternative solutions to problem solving	Ability to understand the environmental impact of port activities								
	Awareness of alternative solutions to problem solving	**moderate**				**moderate**		**moderate**	

6.4 Continuous innovation (Sharma & Vredenburg, 1998) Continuous improvement (Hart, 1995)

Proactive port EMS implementation should also seek immediate environmental management actions to timely and properly address regulation and norms change, -as well as try to anticipate those changes-, much as Hart (1995) illustrates it in his organizational continuous improvement capability. Beyond this, innovation is most likely essential for port organizations to succeed in greening, as it is highly important for them to gain the most out of the new practices' adoption. To the extent that innovation is distinct, the organizational capability is directly related to an organization's ability to introduce innovations in different processes.

Port organizations with high levels of process innovation capability are likely to have better understanding of how EMS processes and practices may improve. This understanding is likely to aid them in their policy objectives and their related measurement and indicators identification (most probably through experimentation), monitoring, documentation of environmental impacts and the implementation of corrective actions, which are integral to the EMS standards' implementation process. Thus, port organizations with higher process innovation capability are likely to implement the EMS to a higher extent. Christmann (2000) suggests that process innovation capability is important in dealing with environmental issues earlier than competitors or in gaining a cost advantage from implementing environmental best practices such as the use of clean technologies.

Further than monitoring environmental performance and applying preventive or corrective actions to reach the goal of a sustainable port, the port organizations have to employ technology innovation, make the necessary green infrastructures and even more important in their case they have to adopt regulatory control and alert green behavior within the port community (Lam & Notteboom, 2014).
In addition, the port environmental impact -especially for those ports surrounded by communities- constitutes a challenge for the port management, in terms of the need to evaluate the significance of various environmental issues and to employ innovative solutions so as to adjust ports to the new reality of the sustainable port. In this respect, the capability to innovate has the potential to turn into a source of competitive advantage since innovations are knowledge-based, socially complex and causally ambiguous (forming the inimitability of strategic organizational resources) and therefore, it is more likely to be distinctive of a port's organization greening process, in which the capability is inherent (Barney et.al, 2001).
Experimentation in port greening as an on-going challenge is costly and it demands human resources involvement from various organizational levels. Within the time that the research was conducted, environmental practices in the examined ports were initially produced as ad-hoc problem-solving and in most cases through collaborative research projects. Originally, the quest for environmental practices application was purely aimed at legislative compliance. With the exception of the port of Rotterdam, where environmental protection has been effectively secured through licensing procedures by the regional environmental agency and environmental practices tended to be improved through specific policy frameworks- that in most cases involved collaboration of actors at the port area or the local level-, the rest of the port case studies relied on building their EM policies and EMS standard implementation in order to constantly improve their environmental practices.

- *Port of Thessaloniki* (ThPA)

In terms of almost all the empirical indicators selected to prove that continuous innovation capability resides within the port organization, the case of the port of Thessaloniki (ThPA) is the poorest one. The port, *either* did not invest -or could not have invested- in building up innovative processes through experimentation in its EMS implementation, *or it* was not in a position to act before the industry as clearly while striving to establish a good status-quo in legislation compliance and it has consciously built up its EMS implementation according to the sector's norms.
Until 2010, the Greek ports were still deficient in providing customer-centric services, or promoting inter-sectoral collaborations and alliances between the public and the private sector, mainly because of experience lack and resistance to change (Marianos, et.al., 2011). They actually provided only a small number of the available electronic port services, so -compared to the larger container terminals in Europe-, they were lagging behind, in providing advanced electronic port services and especially in enhancing ICT infrastructures which could help them achieve competitive advantage in the wider area. ThPA could not go further in assembling any advanced technical operational knowledge that could have further boosted its EMS through real time monitoring processes.
In contrast, the PA made an effort building up its ability to continuously improve its EM process. By the end of this research time-frame, ThPA had enhanced its EMS procedures through specific research outcomes and it had advanced specialized knowhow -particularly in managing waste and dust problems in the port area-, but it was also prompt with its comprehensive H&S management and contingency plans.

- *Port of Dover* (DHB)

Before being capable of advancing technical operational knowledge in real-time monitoring EM processes, the port of Dover (DHB) had proactively facilitated various EM practices, based on quantified environmental objectives, mainly through scientific research. It was the structure process orientation of its EMS standard implementation and its upgraded technological knowledge at the operational level, that have mainly formed the port's ability to improve its operation and produce actual results in environmental protection. DHB built up its environmental credentials though EMS standards implementation and its carbon reduction commitment and had timely outperformed all UK and most European ports. In this case, and within the time frame of the research, the ability to continuously make improvements in various EM processes was entirely process-oriented by upgrading the

standard (from PERS to ISO14001 within a five-year period of time). Through the 2000s, the port fully integrated its EMS in its quality management and health and safety systems.
It is the business orientation of the port and its extremely close proximity with the Dover society that bounds the port culture of innovativeness, although DHB is a good example of where general business activity is supported by the port administration. The port has worked with the District Council to put forward plans in order to develop a business centre within the port site (White Cliffs Business Park), and it also aims to develop some of the port site as residential buildings, town infrastructure (bus depots, commercial space) and an education facility focused on maritime skills. DHB's ability of long-term view of experimental actions was embedded in its decision to regenerate the port's Western Docks (see annex1 p:15-20). The project faced all potential environmental constraints, but it was also carefully undertaken in consultation with all possible stakeholders involved and allowed environmental considerations to be an integral part of the planning at an early stage, without further letting experimentation in the port-city interface.

- *Valenciaport* (VPA)

Innovation is one of the key values of the Valenciaport (VPA) strategic development and its current 2020 Strategic Plan. Consequently, VPA has devoted important resources and efforts to enhance knowledge of both its personnel and its port community as part of its main R&D lines that concentrate- among others- on competitiveness, sustainability and energy, as well as the port-city integration. The port's strong culture of innovativeness is the reason behind the setting up of the Valenciaport Foundation, a non-profit organization that acts as a think tank specialized in port cluster research and fosters innovation by joining together various regional institutions, two public universities and various leading members of the port community.
Since the 1980s, VPA has pioneered the development of IT systems in Spain. In the late 1990s, it developed a centralized system that exchanged information within the port community, but it was in the mid-2000'sthat an integrated IT tool, -which allowed electronic data interchange for the total actors of VPA's port community-, achieved an extensive reduction of information transaction costs. As a result, having a positive impact on the competitiveness of the various firms' operations in the port, VPA is currently outperforming its direct competitor ports (see annex3 p:10). This type of established technical knowledge also enabled the *technical operational knowledge,* related to environmental management process, to be regularly updated and to finally provide integrated control of the port's environmental aspects through a real time centralized monitoring system (see annex 3 p:32)
Since 2000 the port has established its environmental policy and has gradually integrated environmental considerations into planning processes. VAP's environmental policy has focused on preventing and reducing emissions, energy and natural resources consumption, based on EMS standards implementation (updated from PERS to ISO14001 and EMAS from 2003 to 2008), while encouraging the same for its port community members. A large part of the VPA 'green port' outcome lay in improving knowledge by taking part in cooperation and innovation projects. This involvement had two facets, the more innovative aspect that progressively enhanced the port's ability to improve EM processes and the fact that the VPA demonstrated and shared its findings with any interested third parties, which in turn has made it possible for the PA to act before the rest of the industry.
Through its ECOPORT I-II projects (see annex3 p:22-23), VPA has guided several initiatives in order to enhance environmental protection and eco-efficiency among port community companies. The port's commitment to greening, -at the port community level-, was based on long-term project experimentation which provided a methodology to support involvement of the port community members in adopting the aforementioned environmental management programmes. These public-private joint efforts have resulted in successful EMS standards certifications for various firms in the port area and have made the VPA administration consider incentives, such as tax discounts, for companies successful in this respect. Another long-term project experimentation effort has been the co-ordination mechanism for environmental management processes carried out in the port and city environment, which was produced through the VPA's SIMPYC collaborative project (see annex3 p:26-27) and allowed the effective implementation of a long-term action plan in the port-city interface. The plan involved various joint port-city environmental monitoring initiatives and it has been successful in establishing a better port-city relation and in producing the related environmental disclosure within the VPA's regular publications.

o *Port of Rotterdam* (PoR)

In the port of Rotterdam (PoR) case the port's culture of innovativeness is clearly illustrated in the following statement from the early 2000s: "*Rotterdam is willing to invest in innovative concepts which reinforce and broaden the basis of the port",* (PoR Annual Report, 2001). Even more, the Business Plan (2006-2010) demonstrates the necessity for knowledge and innovation, because: *"problems are becoming so complex that we deprive our clients, society and ourselves by automatically choosing standard solutions."*

PoR has a tradition when it comes to making long-term plans. The port's Port Plan 2020, although it has been blamed that it is far from being instrumental in providing proper guiding, it *does* promote the development of innovative infrastructure and the facilitation of innovative policies and long experimentation in the port area, more than its precursors. The plan has focused on producing the Rotterdam *'quality port'* according to five innovative targets, aiming to be at the forefront of sustainability.

All the more, under the *'sustainable port'* target, since the mid-1990s, the PoR's Maasvlakte2 expansion planning process has highly demonstrated a long-term experimentation process on how knowledge of the complex port environmental and ecological issues is developed and it is in turn used to produce future planning for a sustainable port strategy. Until 2010, for the highly ambitious quality port strategy, the PoR had explored, mainly through research initiative, all possible innovative technologies that can lead to a sustainable new port development. The result is that the PA has set strict requirements, in terms of sustainability, for the future firms' location on Maasvlakte2, aiming to control air quality and noise pollution, as well as to facilitate cleaner hinterland transport. The planning also involves infrastructures for efficient use (or reuse) of energy, and co-sitting in terms of waste heat, waste materials and semi-manufactured products.

De Langen (2007) by addressing the port of Rotterdam case summarized that seaport clustering effects have the potential to excel in issues like skills, education, innovation, productivity and therefore, they can reinforce sustainability. In Rotterdam, the chances for innovation are especially sought in the field of sustainable transport and energy transition planning.

The PA has also been strategically positioned towards facilitating intermodality through innovative infrastructure investments. The PoR's *'Container Transferium'* is a clear example of experimentation in the logistics field and a part of a comprehensive accessibility plan. Situated in the direct hinterland of the PoR, it is planned to allow a large number of containers to be transferred by inland vessels in a single movement from the sea terminals at the Maasvlakte to the Transferium and vice versa. According to the port itself, it aims to strengthen the quality of the logistical and industrial cluster.

Collective action regimes are ways in which the actors at a port deal with issues that supersede one single firm (De Langen, 2004). Beyond the Maasvlakte 2 planning experience, the development of many innovative sustainability oriented projects in the port area -like the R3 projects and its predecessors the INES and the INES Mainport projects (see annex4 p:47)- that were running from 1994 to 2010, has built up results and progressed the port's knowledge of *industrial ecology* which is an asset in levering competitiveness and attractiveness in the port of Rotterdam.

The PA foresees rough clustering in the new port area; however, the knowledge gained made it possible to incorporate the facilitation of *industrial symbiosis initiatives criteria* under the *'energy port'* policy that would enable the future creation of sustainability clusters in Maasvlakte2. This will allow more conscious clustering, compared to the past- when clusters were formed more or less autonomously-, because the PA and clients have negotiated on a location and as a result some clusters created more synergies and had a higher degree of integration than others. According to the Deltalinqs representative, the port's *"expansion offers chances for state-of-the art plants, new techniques and smart combinations".*

Yet another part of the PoR's Port Vision 2020 strategy is to maintain its position as a significant transport hub within the perspective of *energy transition* in cooperation with key stakeholders within the port area. Apart from the ambition of PoR under its *'energy port'* to be an absolute decoupling of economic growth and CO_2 emissions, in other words to obtain sustainable growth, the PA also wants to be an attractive business partner for companies operating in Rotterdam Energy Port and to strengthen the energy cluster in the port even further (PoR-Rotterdam Energy Port, 2008). Because of the geographical density and scale of emissions there are opportunities for efficient large-scale solutions and what is suggested are three complementary types of measures to reduce CO_2

emissions: *energy efficiency* that will not cause emissions (residual heat, rest steam, CO_2 for greenhouses); *renewable energy* (wind, solar, biofuels); CO_2 capture and storage, though a rather expensive solution (see annex4 p:35-36).
PoR energy transition innovative focus has been further enforced with *technological innovations*. Shore power supply is such an innovation that can support lower carbon footprint in a port area. PoR preparing for its future positioning in the market, has already made possible shore power supply for inland vessels (see annex4 p:39) and it is planning on shore power supply quays in Maasvlakte2.
LNG as fuel for maritime, inland waterways and road transport has a positive effect on the environment and noise pollution. In the 2000s, investing in safe storage and bunkering of LNG for shipping lines in port areas (see annex4 p:36) has ensured that the PA acts before the rest of the industry, as the advantage of LNG is that it is one of the cleaner alternative fuels for meeting the upcoming 2015 IMO environmental sulfur regulations. PoR is already working with partners, including the EU, along the Rhine to develop LNG as transport fuel (LNG Masterplan).
According to the PoR's manager of energy and process industry, the importance of LNG is connected with various arguments: *"LNG will increase the competition at the Dutch gas market, as natural gas is an essential element for the energy–intensive industry: local investment existing customers and potential attraction of new customers in Maasvlakte2"*; and finally *"Rotterdam can strengthen its position as business and distribution centre (transhipment), as an LNG terminal offers the possibility to develop a new industrial cluster around LNG".*
Until 2005, PoR's complex environmental protection framework had been developed following, through the years, new developments of the forthcoming legislation related to different environmental aspects and after having successfully planned various implementation processes based on effectively updated technical operational knowledge.
PoR's corporate management through its 2006-2010 Business Plan, has designated sustainability as its prime objective and was engaged in a greater effort to improve its own performance. CSR has been designated as an essential part of business processes and corporate culture (see annex4 p:51). The PERS standard was considered as a 'tool' (see annex4 p:52), that is in line with the port's ambition to become a 'sustainable port', a useful tool though, in the sense that it *"can provide to the environmental department a structure approach to scrutinize the PA's established environmental management procedures and to report on environmental results."*

The subsequent comparative Table 6.4 illustrates the differences among the port case-studies in terms of the continuous innovation (Sharma & Vredenburg, 1998) and continuous improvement (Hart, 1995) selected empirical indicators.

Table 6.4: Continuous innovation (Sharma & Vredenburg, 1998)-Continuous improvement (Hart, 1995)

Empirical indicators		DOVER		THESSALONIKI		VALENCIA		ROTTERDAM	
		LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
Ability to innovate and continuously improve operations while reducing environmental impact	Capability of constant experimentation	**moderate**				**moderate**			
	Ability to take a long-term view of experimental actions	**moderate**							
	Capability of constant technical operational knowledge								
Ability to experiment on the business/natural environment domain	Port culture of innovativeness	**moderate**							
	Ability to make continuous improvements in EM processes			**moderate**				**moderate**	
	Ability to act before the rest of the industry								
	Ability to preempt regulations								

6.5 The cause (*for certain ports*) for gaining competitive advantage by EMS standards implementation.

Port authorities indeed produce substantial environmental impact against which control measures and prevention were instituted through mandatory requirements and the sector's self-regulation in an attempt to at least minimize their consequences, as this research clearly shows. In general, sustainability strategies for ports, as for any other organization, involve seeking ways of protecting the environment that are geared to port competitiveness. In the EU green-port institutional context, a possible successful resolution of port environmental problems was estimated to bring efficiency and legitimacy gains, which -as the analysis clarifies- is related to the individual ports' strategic response and capabilities advocating the port's efforts in EMS implementation.

The analysis' findings indicate that certain Pas, through implementing EMS standards, were able to develop green competitive advantage when they proactively manage external institutional pressures and constantly build their pollution prevention capacity in relation to inter-organizational learning processes which help them to continuously improve their greening or even innovate. From the analysis of the employed empirical indicators, that were selected in order to illustrate to which extent each individual port has built up distinct specific organizational capabilities through EMS implementation, the following advantages or disadvantages emerged.

Table 6.5: Individual port competitive advantage based on organizational capabilities

capabilities	DOVER	THESSALONIKI	VALENCIA	ROTTERDAM
pollution prevention	+++	+	+++	++
stakeholder integration	+++	+	+++	++
high order learning	+++	+	+++	++
continuous innovation	+	-	+++	+++
continuous improvement	+++	+	+++	+++
competitive advantage	EMS as the means to build up transparent relations	EMS as the means that introduced green practices in the PA	EMS as the means for integrating greening at port community level; supporting coordination at the port-city interface	EMS as a tool (among others) in building up in sustainability as business opportunity

Both the ports of Dover (DHB) and Valencia (VPA) were aware of the importance of measuring port environmental performance, as a way to assure the quality and to evaluate the impact of the strategies developed in order to improve the actual environmental outcomes. Regarding these particular case-studies, the findings are in line with those advocating that the PAs are increasingly realizing that good environmental performance is required in order to maintain good relations with local communities, and also that this subsequently becomes a source of competitive advantage (Wiegmans & Geerlings, 2010; Adams et.al., 2009). They were both early adopters and based their greening on robust and self-developed EMS implementation focusing on transparency and integration.

The *port of Dover* (DHB) had a high level of scientifically based eco-consciousness that helped the port build up very systematically, -and early compared to competitors-, its pollution prevention practices. The system-based approach of the PERS standard helped the port progress in integrated environmental policy and consequently, report on environmental results in a systematic way. Environmental transparency has been one of the main priorities that boosted further improvements and advanced the port's EMS application to be updated to the more comprehensive ISO14001. Decision-making at a management level secured that the national green-policy guidelines were implemented through the EMS at the operational level but the integration of different levels of employees in environmental practices is an area which could be further exploited. Improving its pro-active environmental strategy by learning through EMS standards implementation assisted the port in developing skills which were valuable resources for building up trustful relations in the port-city interface. The latter, in return, was crucially helpful during the approval process for the port's future development plans.

The fact that it was the first UK and European port to advance in EMS standard certification boosted the port's reputation as a green leader port, which in turn influenced EMS implementation among the UK ports and the ports around Europe through network connections. The result was that the PA positioned itself on future changes within the industry and was sheltered by gaining competitive advantage from its effective proactive approach.

Fig 6.1: Individual port capabilities as constructs of DHB's environmental pro-activeness

capabilities	DOVER (DHB)	*Institutional factors*
pollution prevention	EM practices based on scientifically and eco-consciousness knowledge building. In-house expertise in monitoring PEM enhanced transparency in the DHB's environmental policy.	***coercion*** national policy requesting scientific validity in port environmental protection.
	EMS implementation facilitated its performance indicators to monitor actual environmental performance extensive and continuous employee training.	***interconnectedness*** Collaboration with UK academics and research institutions enhancing the validity of EM practices. EcoPorts network active member.
	PEM (PERS/ISO14001 certified), health & safety (OHSAS 18001) and quality (ISO9001:2008) integration	***legitimacy*** Standardization as strategic value Pioneer use of EPF/EcoPorts tools. EMS standards as legitimate tools for building the port's green image.
continuous improvement	Ability to make continuous improvements in EM processes and act before the rest of the industry	***consistency*** EMS implementation consistent to national policy guidelines. Consistent long-lasting use of the EcoPorts tools and to ESPO/EPF recommendation upgrading PERS to ISO14001.
stakeholder integration	Focus on creating long-term relationships within the port-city interface to collaboratively address environmental protection. Regular communication mechanism for addressing interests in environmental issues from varied stakeholder groups.	***multiplicity*** Multiple demands derived from the port-city interface.
	Stakeholder Management Plan supported DHB in the consultation process that initiated the required EIA process for the port expansion planning.	***coercion*** EIA according to EC Directive UK's Planning Inspectorate holds public inquiries for land use developments.
	Senior-level dialogue and comprehensive consultative process at the port community and the port-city interface that allowed various stakeholders to better understand issues associated with the port.	***legitimacy*** Adoption of environmental legislation and implementation of national policy recommendations, securing reliability for port environmental plans and policies.
high order learning	Continuous expansion of knowledge about port environmental issues, especially for reporting environmental performance and building a data base of port environmental information and biodiversity.	***consistency*** Consistent and effective upgrading knowledge to confront both coercive and normative pressures.

Fig 6.2: Individual port capabilities as constructs of VPA's environmental pro-activeness

capabilities	VALENCIA (VPA)	*Institutional factors*
	VPA's ECOPORT project (1998-2000) -that initiated its EMS- was one of the two generic procedures for the identification and assessment of port environmental aspects within the EU port sector; the other one was one of the EcoPorts tools.	***coercion*** Mandatory obligations derived by EU legislation have been applied at national law. National and regional regulatory framework aiming at sustainability objectives has incorporated recommendations focused on transparency and disclosure of environmental data.
	PEM progressively introduced into the VPA's corporate policy and eventually built up the port's pollution prevention strategy through EMS implementation that pursued verification and accreditation of all possible EMS standards.	***diffusion*** VPA environmental self-regulation has been increasingly relevant to corporate policies.
pollution prevention	Both the ISO14001 and EMAS standards enhanced VPA's communication on environmental results.	Early adopter of the PERS standard, using it as stepping stone towards ISO14001/ EMAS
	A system of indicators facilitated the effectiveness of the port's EMS, which was enhanced by the establishment of a real time monitoring system. Collaborative initiatives enhanced VPA's self-regulation.	***interconnectedness*** The Spanish port agency provided guidelines for PEM and asked for scientifically based indicators for monitoring and reporting. Collaboration in R&D for PEM at EU, national and EU regional level in the Mediterranean basin
	Individual core business principle to constantly invest in (managerial) quality. VPA advances its own Quality mark (for its port community) and uses ISO9001 for certifying the quality of the PA's internal processes.	***legitimacy*** Standardization as strategic value Pioneer use of EPF/EcoPorts tools. EMS standards as legitimate tools for building the port's green image.
continuous innovation - continuous improvement	Port culture of innovativeness. PA capable of constant technical operational knowledge and long-term experimental actions. Ability to make continuous improvements in PEM processes and act before the rest of the industry.	***consistency*** Consistent and effective upgrading knowledge to confront both coercive and normative pressures. Consistent to EMAS Regulation for building the port's EMS.
stakeholder integration	Commitment in stakeholder integration in its port community regarding EMS implementation. Own co-ordination tool reinforced collaboration in PEM at port community level	***legitimacy*** EMS toward green self-regulation at the port community level (not just the PA) – leading/coordinating role.
	Own mechanism for environmental problem-solving and sustainability boosting in the port-city interface	***multiplicity*** The national SD policy urged the need confronting multiplicity and conflict at the port-city interface
high order learning	Constantly upgraded both its knowledge about environmental issues and its data base of environmental information. Employee integration regarding feedback systems for reporting of environmental performance.	***consistency*** Consistent to national port policy encouraging quality standards implementation and to EMAS Regulation for building its EMS.

The different way that the firms recognize the need to change key resources over time and act upon building their related capabilities is also illustrated in the *Valenciaport* (VPA) case. In this port, a self-oriented approach to port greening raised the deployment of stakeholder engagement at the port community level. VPA's strategy in environmental protection was established and was further improved in consultation with the port community, as well as research institutions and social-economic agents from the Valencia region, but it was highly supported in its operationalization by EMS application. In this respect, VPA engaged itself to fostering innovation in port EMS implementation in the late 1990's, considering even the EMAS standard application and produced an in-house methodology for EMS application for port facilities at the community level. The reason behind this particularly rare advantage thrives in the port's core business principle to constantly invest in (managerial) quality. The experience gained made clear that research in performance indicators, -which could provide evidence of actual environmental performance and allow the employment of preventive and corrective measures-, was crucial. By learning through extensive project-based research, the PA further enhanced monitoring competencies and the port's pollution prevention capability. When the PERS standard was available VPA joined the small group of the early adopters. Within five years' time the initial target of the EMAS certification was succeeded by the intermediate step of the -*not less important*- ISO14001. Yet, the gradual updating of the EMS also improved its full integration by using ad-hoc technology for processing environmental information, it progressed in comprehensive environmental reporting, acted as an agent engaged in EMS implementation in various companies in the port community, and supported the building up of a co-ordination mechanism for environmental action plans at the port-city interface. VPA was particularly innovative in understanding the changing relationship between ports and cities regarding the benefits of mutual environmental policies. It timely used planning and experimentation in building up its pollution prevention capability through EMS standards implementation, but it also appreciated the integration of greening in its port community as important and perceived it as enhancing the port's quality of culture. After all, quality services were the primary cause that allowed VPA to enhance its competitiveness and its leading role among the Mediterranean ports.

The port of Rotterdam (PoR) seems from the first sight of this analysis' findings as a peculiar case.
PoR addressed a number of technological and scientific challenges to the constantly updated knowledge of port environmental issues and although it had gradually built up its pollution prevention strategy, environmental disclosure was scarce and partial until 2007, when the PA published the first CSR report. While the *former* is the result of an administration with angulations, that enforced and consciously applied environmental regulations within its area of responsibility and relied its environmental prevention strategy on a system of licensing for which the authoritative responsibility depended on the regional environmental agency (DCMR), the *latter* is the result of transforming the obsolete way of thinking and engaging the port in sustainability. PoR (as much as DHB and VPA) is engaged in annually publishing a Sustainability Report, including a wide range of sustainability indicators. Nevertheless, it seems extremely simplistic to consider that environmental competences came mostly under other governmental agencies rather than the municipal governance of the port (RMPM) especially (DCMR). PoR is a clear case of a firm having distinctive issue-based strategies (or strategic goals) that led to a unique competence building and leveraging activities within two decades. Under its *'clean port'* strategy until the mid-2005 RMPM, by applying knowledge in action and learning, the PA, through project-based initiatives, built up distinct competences in different pollution prevention schemes and policy frameworks which indeed yielded actual environmental results. A clear example in this regard has been the long-running Rhine Research project, which still addresses the complex issues related to the quality of the dredged material in the port (see annex4 p:28).
In the Rotterdam case, the change towards the sustainability target under the evolved *'quality port'* strategy, since the mid-2000s has been strongly embedded in the Dutch culture of innovativeness and mutual consensus building. The driver for change was unquestionably twofold: the change of the port's institutional governance and the Maasvlakte2 experience. The Maasvlakte2 experience did not only comprise the building up of stakeholder management competences, but also extensive scientific knowledge which was produced through specialized studies (this was common in any other complex environmental issue that the port was confronted with), which were both completed with the

Fig 6.3a: Individual port capabilities as constructs of POR's environmental pro-activeness

capabilities	ROTTERDAM (POR)	*institutional factors*
		coercion
	Both the municipal and corporate administrations of the port developed long term strategies towards port environmental protection.	National and regional spatial planning shape long-term perspectives for the SD of the port.
		multiplicity
pollution prevention	In the 1990s, the key element for EM implementation was maintaining legal compliance. Licenses issuing (and modifying) in the port area verified risk prevention, RMPA constantly upgraded its EM based on issue based projects of important environmental aspects. The Maasvlakte2 expansion planning experience, has made the shift to a long-term planning for sustainability possible	Highly diversified requirements from all kinds of environmental legislation at the EU, national and local level. Indirect governance at regional and national level. RMPA guided by an institutionalized project-driven setting in forming environmental strategy. Since 2004 PoR endorsed the Dutch Corporate Governance Code**.**
	Since 2004, PoR's corporate management, has focused on strategic port vision towards SD and continued to enhance knowledge through various R&D projects that addressed sustainability issues.	***dependence*** Strategic goals are driven by national and regional policy implementation and action.
	The PERS standard implementation (2007) integrated the various policies incorporated in the port SD vision within an EMS framework and provided auditing objectives and a reporting tool to the PA. RMPA provided limited information regarding its environmental actions within its annual reports.	***uncertainty*** Ecological and legal uncertainty crucial was overcome with extensive scientific research, stakeholder dialogue and authoritative approval. The role of DCMR decreased legal uncertainty in enforcement.
	After the port corporatization, the annual reports ensured that sustainability objectives with related performance indicators remain points of attention.	***interconnectedness*** Collaborative initiatives in the national and EU context (EcoPorts).
		legitimacy EM implementation on project based and pragmatic approach.
	The Rotterdam approach in quality management bases on different quality control systems consistent with world-class regulations standards.	High profile SD strategy focusing on research and innovation. PEM strategic targets and project realization built the PA's green legitimacy. EMS on the basis of the PERS standard, although own procedures perceived more valuable.
	RMPM had appointed staff members directly responsible for environmental protection in three different organizational directorates, coordinated by a group which informed the management board. DCMR assisted in the training of personnel focusing on inspections, supervision and the issuing of permits. PoR organized both collective and individual training programs for its employees' environmental training (since 2004).	CSR annual report and Sustainability Index (since 2008). ***Constrain*** Use of the EcoPort tools though perceiving them as unnecessary for policy development. Discretionary constraints delayed the EMS standards application.

expansion's approval; it brought about- quite early- the issue of sustainability in the port as a new way of dealing with environmental protection. They took a role in how the PA's technical and scientific knowledge was enhanced, as well as in how innovation flourished in the Rotterdam port area, having research educational facilities and numerous institutions working under this scope. After all, innovativeness in the port should be considered as embedded in a far 'bigger picture' since PoR's port area, by focusing on green innovation driven exploitation, it is estimated to maintain and improve the international competitiveness of the Netherlands (van de Bosh, et.al., 2011).
Seaports today remain under public ownership but they are moving towards more independent private-like management (ESPO, 2016). The change in port's governance brought about a number of changes among which was the PERS standard application. In 2008, the PA was the last port among the case studies to obtain the PERS certification for its EMS and joined the late adopters group of PERS certified EU ports. It was a new tool that provided a systematic approach which the PoR' environmental department managed to quickly implement and used it to report on actual environmental results. Nevertheless, we may consider it to be in a transitional phase and there is for sure a rigidity of staff in integrating the application of the ESM, and that integration is extremely not favored by the size of the firm and by the fact that environmental responsibilities are divided under three distinct departmental entities. Through the PERS certification, PoR has extensively introduced its strategic vision for sustainability through its energy transition plan and its industrial symbiosis R3 program. The benefits of industrial symbiosis and the knowledge gained for the PA were disseminated within the EcoPort network after PoR's PERS certification in 2008. Besides the ambition of PoR under its *'energy port'* to be an absolute decoupling of economic growth and CO_2 emissions - in other words to obtain sustainable growth-, the PA also started to attract its future business partners to operate in *"Rotterdam Energy Port and to strengthen the energy cluster in the port even further"* (PoR-Rotterdam Energy Port, 2008).

Fig 6.3b: Individual port capabilities as constructs of POR's environmental pro-activeness

capabilities	ROTTERDAM (POR)	*institutional factors*
stakeholder integration	Collaboration within the port community on problem solving	***coercion*** Environmental responsibility within and/or related to the port area is plainly defined: • process of environmental permits and reporting about environmental quality in the region by DCMR, • control/enforcement by the PA, • environmental enforcing of complex shipping regulations by the PoR's Harbour Master.
	Collaboration in the port-city interface on environmental issues and problem solving trough consensus and a permanent dialogue with its surroundings.	***multiplicity*** Ongoing port-city interaction. Multiple actors' engagement in port-city sustainability focus projects to confront negative image and sustain license to operate and develop.
	Ability to guide developments through public consultation	***uncertainty*** Environmental planning based on problem solving and process-oriented actions at regional level. ***legitimacy*** Indirect regulation enforcement related to the national environmental policy securing reliability for port environmental plans and policies.

Already by the end of 2000's, while the expansion was still being constructed, the PA had begun planning and exploring the process of implementing *industrial symbiosis* indirectly, as well as, building upon sustainability as a business opportunity, in the pursuit of a competitive advantage (Adams et al., 2009; Verhoeven, 2010). On the other hand, Merk (2013) points out how much more controversial is sustainability as a source of competitive advantage for those ports, like PoR, whose portfolio of activities is geared more towards cargo loading and unloading or heavy industry and that little investigation has been carried out on how sustainability impacts on port competitiveness and how such relationship actually unfolds. In this respect, future research could add valuable results.

Fig 6.3c: Individual port capabilities as constructs of POR's environmental pro-activeness

capabilities	ROTTERDAM (POR)	*institutional factors*
continuous innovation - continuous improvement	Port culture of innovativeness. Ability to act before the rest of the industry regarding industrial development that addresses sustainability issues. Ability to innovate and continuously improve operations while reducing environmental impact	**circumstances** The Maasvlakte2 expansion project urged the port to be interested in SD. Since the port's corporatization, PoR's strategy has definitively shifted towards SD, focusing on sustainable entrepreneurship. ***coercion*** National and regional spatial planning shape the long-term perspectives for the SD of the port. The most recent national policy recommends an integrated approach for the Dutch sustainable port based on thematic action.
high order learning	Constantly updating knowledge about environmental issues Formal and informal channels of environmental information exchange in PEM.	***consistency*** Consistent on upgrading knowledge on almost all port environmental challenges by means of individual and collaborative research projects. Strategic focus on building green credentials in partnership with various actors at local/regional level

Finally, the ***port of Thessaloniki*** (ThPA) that applied EMS management on a zero basis, is clearly in a disadvantaged position- compared to the rest case-studies- in terms of competitive advantage. The real advantage of the case is the EMS implementation itself that literally introduced greening to the port. The limited time, within which the PA managed to complete the standards, is a credit to EcoPorts and local academics effective guidance, as well as a combination of the very small size of the port and the skill of the employees involved. However, the PA successfully exploited this initial experience in the impending years and successfully focused on developing project-based pollution prevention policy frameworks. In 2003, ThPA was the first PERS certified Greek port, being followed shortly afterwards by Piraeus, the country's leader port in terms of throughput. Both ports, during the years that followed the EMS standard application, were effective in pollution prevention actual results in their port area, while they continued to distribute good practices in the EcoPorts network. Until 2010, their efforts in greening never incorporated progress toward more comprehensive systems such as ISO14001 or EMAS. Their competitive advantage, -opposite to competitors in the national context-, did not last long. Their success enhanced the PERS diffusion among Greek ports and in short time eight more ports implemented EMS according to PERS. The latter confirms that pollution prevention is not normally based on exclusive firm capabilities and therefore, it only generates a temporary advantage, if any (Hart, 1995:992).

Fig 6.4: Individual port capabilities as constructs of ThPA's environmental pro-activeness

capabilities	THESSALONIKI (ThPA)	*Institutional factors*
pollution prevention	EMS as a support for pursuing legal compliance ThPA identified its actual environmental situation using the EPF/EcoPorts tools. PERS implementation initiated the port's environmental policy and training. Improvement in monitoring and managing compliance to environmental laws.	***uncertainty*** Lack of knowledge in individual port environmental aspects and related mandatory obligations. Lack of authoritative guidance and frustration from legal uncertainty. ***efficiency*** Reducing liability costs through EMS implementation perceived as of organizational importance.
continuous improvement	Effective appointment of Environmental Coordinator in the PA's organizational structure Highly resourceful EcoPorts membership. Efforts to continuously improve its EM process and procedures through specific research outcomes. Issue based policy plans enhanced the port's environmental capacity (performance indicators).	***interconnectedness & dependence*** Extensive cooperation with local academics supporting research in port environmental protection. Lack of knowledge in PEM led to the port's EcoPorts membership. ***legitimacy & diffusion*** PERS standard perceived as a practical tool to accelerate ThPA's green liability. Early adopter in PERS certification. Exploiting the benefits of the EcoPort label, re-certified according to PERS.
stakeholder integration	PERS implementation enhanced the port's perspective approaching its port community and the local community.	***coercion*** Lack of integration mechanisms in the public administration prohibited integrated environmental policies. ***multiplicity*** Un-constructive interaction of the PA and administrators at the municipal and regional level.
high order learning	Constantly updating ability to understand the environmental impact of port activities	***consistency*** Consistent to EPF/EcoPorts tools use.

CHAPTER 7: The evolution of the European green port organizational field - mechanisms involved, factors of port strategic responses and port capabilities. Concluding remarks – Discussion.

7.0 Sustainable development as an important future aspect of the port industry in Europe.

In the European port policy, sustainability has been a major issue since the 1990s (Chlomoudis & Pallis, 2002) and it has consequently gained significance in the port sector (Lam & Notteboom 2014; 2012; Acciaro, 2013; Lam & Van der Voorde, 2012). The literature offers several methodologies that explore port environmental problems (Darbra et al., 2004; Darbra et al., 2005; Jones et al., 2005; Peris-Mora et al., 2005; Ronza et al., 2006; Ronza et al., 2003; Wang et al., 2004). Port research also highlighted port greening tools or led to a better understanding of ecological issues in ports (Wooldridge & Couper, 1995; Wooldridge, et.al, 1999; Haezendonck, 2001; Gupta, et.al., 2005; Peris-Mora, et.al., 2005; Darbra, et.al., 2009; Liao, et.al, 2010; Lam & Notteboom, 2012; Puig, et.al, 2013). Likewise, it gave an ecological aspect of the conventional port portfolio analysis for seaports (Haezendonck, 2001), that was also empirically applied to the context of inland ports (Haezendonck and Dooms, 2004).
Moreover, the potential correlation with port-city interface issues has commenced new concerns in port management and stakeholder relations (Dooms & Verbeke, 2007;2006; Balbaa & Liyanage, 2010). There are predictions that port greening is likely to become even more widespread in the future- with ports increasingly adopting environmental management-, and that environmental management issues, rather than technological development, might act as a change driver (Adams, et.al., 2009). Research evidence based on green port best cases suggest that environmental standards' implementation is of key importance for improving port environmental performance (Theofanis, et.al.,2005; Hiranandani, 2009; Goh, 2010). However, from the policy and management perspective, research on green ports has been limited (Lam & Notteboom, 2014) and what is more, the studies' scope did not directly cover port strategy and did not focus on how port strategic responses to EMS standards implementation evolved or to what extent these very responses were supported by individual port capabilities.

7.1 Reflections on the research's objectives and findings

Bansal and Roth (2000) advocate that firms' green responsibility should be explained for two exploratory reasons, *namely* the need to identify which mechanisms stimulate greening *and* the need to understand the factors that bring organizational green behavior. The latter identifies *-or not-* the connection between the field and the firm's level of analysis and stimulates potential explanations of what advocates *convergence or divergence* within the (green port) field. Following this specific exploratory scope, the research aimed to investigate *why* and *how* European ports attempted to adopt green practices at the individual and collective level from 1993 until 2010. Three levels of analysis were incorporated in the conceptual framework that structured and supported the research's quest.

- The *first level*, embraced the core neo-institutional perspective within which scholars have emphasized the effects of coercive and normative factors that shape the adoption of specific organizational practices and eventually encourage homogeneous outcomes. *Thus*, initially the research valued the occurrence of the European green port organizational field through the collective response of the European ports to greening, by observing the potential occurrence of isomorphistic mechanisms that could have explained *how* EMS standards might have been disseminated in the field. However, following the empirical results, the disclosed mechanisms of problem-solving and learning, that explained *how* individual port EMS implementation characteristics emerged and changed over time, gave a different perspective to the research. Having established indications of the mechanisms which shaped the ways that the European ports collectively organized their approach towards greening, this research was removed from an unadulterated institutional perspective by identifying the mechanisms that disseminated EMS standards both at the field and the firm level.

- Henceforth, the ***second level*** of the research was explicitly focused on the firm level of analysis, the port organization itself. The scrutinized examination utilized the Oliver (1991) framework-which derived from institutional and resource dependence theories-, in order to highlight the potential different strategic responses of individual port organizations towards greening through EMS standards application.
- The ***third level*** proceeded by identifying capabilities as internal 'determinants' of the individual port strategic response. This last part of the analysis advocates that the impact of EMS standard diffusion is contingent to port organizational resources and offers a more synthetic perspective of what matters to the adoption of environmental practices. It provides insights of the specific organizational capabilities' role in the implementation of port EMS standards and of the way that the investigated ports build up competences so as to address sustainability issues. The analysis depended on a resource-based perspective that defines organizational capabilities as constructs of environmental pro-activeness and as sources of competitive advantage (Hart, 1995; Sharma & Vredenburg, 1998).

Respectively, aiming to frame what was actually investigated within the three level of analysis three main questions were addressed in the research:
- *How have EU ports organized their approach to minimize their environmental impact?*
- *How field dynamics shaped the individual process?*
- *How have individual port characteristics contributed to those dynamics?*

The findings of the case studies' analysis are focused on the European green port field within the time frame from 1993-2010 and reflect the correlation between the theoretical perspective and its application in the port industry practices, adding value in the findings by representing four different European port cases from two different key geographical regions. The study contributes to the growing empirical literature on port sustainability and particularly on the emerging field of port EMS standards implementation, by explicitly introducing the mechanisms of EMS standards diffusion dissemination in the field; the individual port's strategic response to EMS implementation and the related institutional factors, as well as the role of distinct organizational capabilities in building up the individual 'green port' strategic response that could provide them with a competitive advantage.

7.2 The quest for green port legitimacy in Europe

Most of the PAs around Europe are fascinating business cases that are public entities which also incorporate private firms' characteristics. Nowadays, the latter is of emerging significance (ESPO, 2016). Although in many cases, ports keep seeking for business opportunities outside their national borders, they also sustain their strong connections with the local communities and their national political context (Debrie, et.al.,2013). The adoption of environmental practices has been a subject of considerable interest to Port Authorities(PAs) in Europe since the 1990s, and whilst ports embraced greening slightly later than other industry sectors, the result reflected the sector's peculiarities. Regarding their greening efforts, PAs are **extremely peculiar and paradoxical business organizations** mainly because their own operation and activities are not the only ones causing environmental impact on the port area and beyond, and even more, because in terms of environmental compliance, legislation considers all the environmental effects of the activities undertaken, not only by the PA itself but also by the industries located in the port, because their actions affect the port area as a whole. It is this very paradox that makes vital for port administrators to stimulate and promote environmentally friendly behavior among all port stakeholders.

Institutional organization theory strongly implies the formal and informal influence of power as a mechanism leading to institutional homogenization, (DiMaggio & Powell 1983:150). This also to some extent reflects the case of European ports. Port greening in Europe was initially compelled by direct coercive processes which were a result of the increased regulations that ports were obliged to follow. Coercive demands primarily derived from international and national mandatory obligations, the political EC supranational and national political pressures, as well as EU Directives' and national

legislative requirements. To the reminding of the reader, in the EU context the national legal competence is further extended to EU level obligations. A great amount of EU Directives, that had to be implemented by PAs across Europe, indicate that coercive isomorphism was as well induced by indirect processes *"such as the extension of the legal regulations that a state is obliged to follow"* (DiMaggio and Powell 1983:154). However, enforced homogenization was highly dependable on the support of local actors. Ports located within a national context that provided them with a well-organized policy framework or structures, supporting efficiencies or at least guiding the way towards greening, were favored in their efforts dealing with legislative requirements. In this case, divergence was the result of cross-national power imbalances -in terms of an *either* supporting *or* lacking national policy capacity. Therefore, *coercion* (or power) as a mechanism of institutional change had greatly hindered homogeneity in EM practices, as well as caused unfair competition.
The amount of regulatory actions in the area of port environmental protection, their consequences on port business and daily life, the number of actors affected by these actions, and uncertainties about the green outcomes, required knowledge that was seldom available among most European PAs. The port administrators had to deal with enormous mandatory, political and social green expectations without even having the basic knowledge of how their activities affect the environment. The Habitat Directive, which obliged port development plans to be compatible with the Natura 2000 preservation framework and forced PAs to manage sites and operate at a much more complex level -both in terms of management and politics-, was catalytic. Evermore, ports had to publicly demonstrate their competence and commitment to environmental protection while maintaining their 'license to operate' and successfully managing their operations. It was the beginning of a new era when new solutions were required, which was inaugurated with the establishment of the EU Seaports organization (ESPO). Created in 1993, ESPO is as an independent lobby for seaport interests, which ensures that seaports have a clear voice in the European Union, while over the years, it has turned into a unique knowledge network of EU PAs.

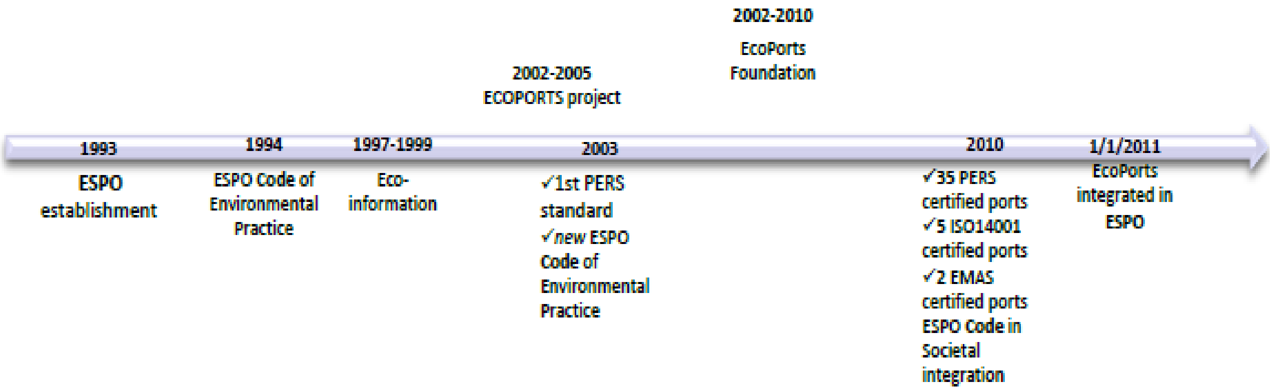
Davis and Marquis (2005:336) who focused on problem driven work orientation in the organization theory noted that the quest for novelty in capitalist economies allows us to *"be confident that actors will respond to particular pressures, but uncertain in what direction".* Over the last decades, the evolved new socio-political response to environmental issues unquestionably assumed that the ability of institutional arrangements to solve the problems occurred and that policy-making proceeded in an 'institutional void' with vague rules or governance processes to address multiple environmental issues (Hajer, 2003; 2006). Rhodes (1997) suggested that governance related to organizational change refers to self-organizing, inter-organizational networks characterized by independence, resource exchange, and significant autonomy from the state. To a certain extent, this was also the case for the port sector in Europe regarding its self-regulation towards greening and explains why PAs would be interested in committing themselves to voluntary self-regulation. It explains the urgent need for an EU green port institution in place, as well. By forming and possessing an institution, ports can influence and bargain- at a political level- to their own advantage, explicitly promoting the sector's needs and requests. Furthermore, though cooperative efforts self- regulation entails advantages like effectively coping with problem-solving by acting collectively, as well as reducing transaction costs by exchanging information and inevitably removing greening from the port competitive factors.

7.3 The way problem solving was translated into field mechanisms that produced a standardized approach

It certainly was the coercive demands that initially activated a collective learning mechanism in the field. From the early 1990's to 2000, there were seldom any organizational rules and procedures on which to rely and PAs focused on ad-hoc problem-solving efforts, while the sector's response was the gradual building up of a port greening knowledge network. Several ports in Europe recognized the need for cooperation in the development of green solutions in their port area, arguing that they could learn from each other and avoid double work, by sharing research costs to find cost-effective solutions (ESPO, Eco-information final report, 1999).

As a result, the green port field in Europe was in principal defined according to the common interest in it and the impact of legislation on the core issues of ports' environmental performance. The main approach aimed at self-regulation and it was formally defined through the ESPO Code (1994) by necessitating control and monitoring of port environmental impact as well as decision making to solve the problems involved. In terms of a mutually agreed vision under the EC political support, the Code was a milestone but the actual effective way of delivering green outcomes gradually evolved, based on individual and network collaboration, as the number of ports engaged in the ESPO/EcoPorts network was constantly upgraded. The network provided them with an important platform to learn from each other and adapt best practice and solutions to environmental protection (Sharma and Vredenburg, 1998; Kourbeti, 2003). The late 1990's, was still an earlier point in time for port greening, in terms of EMS implementation, and dissimilarities in EM initiation and adaptation among constituent ports in the field reflected heterogeneity. The degree of green practices' adoption substantially varied and *most of them were products of issue based* ***problem solving***.

Fig. 7.1: A timeline of port greening in Europe from 1993-2010.



In the period 2000 to 2010, the constantly evolved quest for cost effective and practical tools to upgrade environmental performance also integrated the need for a 'level playing field' and self-regulation through standardized procedures (SDM) and the *use of EMS standards* appeared. In parallel, EC and national policy makers became increasingly aware realizing the effects of environmental legislation in port daily management, and even more the collateral consequences and effects on port developments' plans; therefore, they consented to the sector's self-regulation efforts by extensively funding R&D related programs and projects.

Early in the decade, a certain number of ports supported the need to develop a formal environmental management framework for the industry. ESPO and Ecoports network collaborative efforts provided the European port organizations with a standardized procedure to identify their particular environmental aspects (SDM tool), and the PERS (EMS) standard which is a port specific standardized approach that measures and manages their actual environmental performance. The use of the tools from the network members, made it progressively possible for the ports to demonstrate to stakeholders that the sector has organized the way to be self-regulated in greening and especially to regulators that new legislation was not necessary any more.

Once the first certified EMS according to PERS standard was in place and introduced in the network, there was a successive interrelation among coercive demands, ***learning mechanisms*** (both individual and collective), as well as, indirect transmission of the established norms. PERS was introduced as absolutely vital since it was built upon ESPO recommendations, provided clear objectives, and the most legitimated way to the standard's performance was through independent certification. Gradually, the spread of the ***indirect transmission of the norm***, especially by advocating efficient and effective green outcomes, finally defined the evolution of normative pressures in the field. Thriving with the results of the leader green port, network interconnections evolved into a self-organized profession that was in short time formalized as the EcoPorts Foundation (EPF), creating a European port professional organization that helped members deal with the various pressures they faced. ESPO sustained its coercive character which was further enhanced through its synergetic relation with the EPF (see chapter4 p:74).

7.4 Convergence and divergence in the field

The emergence of port EMS standards, from 1993 to 2010 in Europe, was directly related to the industry efforts for self-regulation. *Beyond* and before the port sector's response, the standardized approach of organizational greening generated a variety of EMS frameworks (BS 7750, ISO 14001, EMAS) -employed within various business fields-, but apparently, a port specific EMS standard (PERS) that was produced in 2002 and supported by the hybrid institutional synergy between the industry's association (ESPO) and the formal structure of EcoPorts network, namely the EPF, was essential for the port greening evolution in Europe.

Based on the Oliver (1991) typology, regarding the individual port response to EMS implementation, the findings of the firm level analysis revealed that ***acquiesce*** is the predominant response for all the ports and that a further mixture of strategic responses existed for the three ports with the exception of the port of Thessaloniki. *Network membership was crucial and different institutional factors were the moderators that affected the individual port EMS response to implementation.* For ***early adopters***, EMS implementation was not customary-made and was built upon distinctive competences, as well as limitations. For ***reactors*** *and* ***later adopters***, information-exchange and communication among network members smoothened the progress of EMS adoption, largely favoring normative pressures on the PERS standard implementation facilitating *convergence* in this respect. However, a main conclusion of the study is that *convergence and divergence did shift over time*, and that after a particular short time of PERS dominance, the latter began to decline and EMS standard co-existence occurred although not at an advanced scale. An illustration of the divergence - convergence of EMS standard implementation from 2002 to 2010 was presented in chapter5. Fig.5.3 (p:141).

From its establishment in 2002 until its official integration into the ESPO structure in 2010, the EcoPorts Foundation (EPF) continuously shaped network interactions and interrelations around know-how in EMS implementation, through its 'custom made' approach of PEM: the PERS standard. In 2002, the port of Dover was the first PERS certified EU port. After the first successful PERS certification, dominance of the standard mainly occurred in the UK, followed by the Netherlands and Ireland. In the southern part of Europe, the spread was minor and partial in various countries. But by the time the number of PERS certified ports increased, some ports already managed to step forward and were also accredited by the more *market oriented* and *comprehensive* ISO 14001 standard. In addition, while PERS seemed to succeed particularly in the UK national context, in the southern part of Europe, the Valenciaport went through all the way from PERS to ISO14001 and finally fulfilled its initial goal towards EMAS certification; a goal that was also succeeded by the port of Livorno in Italy, another Southern European country.

- *Thus, ports were not exclusively embedded in homogenization processes during the time period of the research. Some of them managed to shift away by displaying the similar organizational routines of dealing with environmental impact according to the PERS standard, and advanced more comprehensive standards to develop their individual path to greening.*

Was the ESPO/EPF synergy a rather weak 'hybrid institution' in dealing with its main concern to bring up *new arrangements* in the governance regime of port environmental protection within its field boundaries? Was it already declining within the limited time of less than a decade? The answer is no! The PERS has been tailored to be port specific, but it has also embodied basic elements and requirements of the ISO standard. In addition, the ISO and EMAS standards have been thoroughly advised by the ESPO/EPF synergy as the proper next steps in the case of a port willing to further enhance its environmental performance. The minority of the European port cases that achieved to beneficially use the learning process during the PERS standard implementation and flourishingly apply ISO and even EMAS requirements, reflect the fair value of the hybrid institution that managed to emerge change in the field. *All the more, it is not an exaggeration to consider that this kind of change was successful in combining the governance regimes of 'traditional dichotomies' such as the state and the market (Bobbio, 2011).*

Having an exemplified form as a port specific EMS, the PERS adoption should have increased the potential of institutional effects in the individual port implementation. Yet, co-existence of standards occurred mainly because of the way the standard was defined and eventually, because the PERS standard is open to individual interpretation of how port environmental performance could be enhanced. This effect was shaped by specific organizational competences and resources and thus, individual ports reacted differently, favoring divergence within the European green port field.

- *The study highly argues that for some ports indirect transmission of the norm was actually 'translated' into new learning processes within the organization that further build up specific organizational capabilities enhancing the port's EMS implementation towards more comprehensive standards like ISO and EMAS.*

o ***Building on existing 'ideas'***

The port sector is a service sector industry. Standards are familiar to PAs managers and they existed before the environmental regulation invasion. Long before 2002, when the ESPO/EcoPorts bottom-up approach provided PAs with a port specific EMS standard (PERS) that supported European ports and 'urged' them to progress environmental protection in a systematic approach, Quality Management and Health & Safety were the key 'drivers', addressing both the common issue of risk management that had to be established as part of the port's daily business processes. All of the examined ports had in place at least Health and Safety plans before their EMS initiation. As a final point, one should consider that in their efforts to remain competitive, globally market oriented EU ports were informed about the environmental practices of other ports worldwide. The ISO14001 standard for example, was highly recommended by the American Association of Port Authorities (AAPA).
EMS standards, primarily act as an efficient organizational tool towards both mandatory obligations and voluntary environmental requirements, albeit EM practices implementation have to be fully integrated into the overall port business operations on a daily basis in order to advocate their role assisting PAs to achieve a culture change towards greening. This managerial output is appealing, similar to the way TQMS have introduced quality cultural change (Hart, 1995). Port management systems widely vary across Europe, something that primarily explains the different ways ports around Europe choose to build their EM practices on existing 'ideas'. Private ownership (ports managed by private firms which own the port's land) is common in the UK but not in the continental Europe. These ports' management is totally market oriented and their services follow market demands. Quality standards, and slightly later in the 2000s EMS standards, were a market demand for the UK ports. The uniqueness of the port environment even produced various port specific quality management initiatives (Chlomudis, et.al., 2011)- including the case of Valenciaport, which as the study revealed was the most consistent PA applying TQMS standards before EMS standards adoption.

o ***Strategically responding to institutional demands***

Following the analysis findings, the EMS standards' implementation by individual ports was highly supported -or not- by already established distinctive organizational competences and thus, produced different paths towards greening. For a comparative view of the explored ports' strategic response towards EMS implementation see the following Fig. 7.2, p:188.

In particular, among the *early adopters*, the ports of Dover and Valencia had both an Environmental Policy in place and had both identified incentives for taking a leadership role (concerning EMS standard implementation) within the field. Although the conditions that provoked the path leading from environmental awareness to EMS standard implementation and the kind of investment (established competences) were dissimilar, both PAs were able to *acquiesce* and *manipulate* the standard.

The *port of Dover* (DHB) was the first port with an EMS standard certification and was subsequently benchmarked as an environmental leader within the European port sector. DHB accomplished this result based on already established competences in monitoring and implementing environmental practices for different aspects in its port area. Its problem-solving and learning processes with more than a decade's long experience had been driven by coercive demands, involving national policy framework that required scientifically based results in monitoring procedures.

Fig. 7.2: What institutional factors made the difference when it comes to explaining strategic response

strategic response		DHB		ThPA		VPA		PoR	
		institutional factors							
Acquiesce	*comply*	coercion legitimacy consistency dependence	high high high low	coercion diffusion	high high	coercion legitimacy consistency diffusion	high high high high	coercion diffusion	high high
	imitate			multiplicity dependence uncertainty inter-connectedness legitimacy	high high high high high				
Manipulation	*influence*	multiplicity dependence	high low						
	co-opt	uncertainty inter-connectedness	low high			multiplicity inter-connectedness dependence uncertainty	high moderate low low		
Compromise	*balance*							multiplicity legitimacy dependence uncertainty	high high moderate moderate
	bargain							inter-connectedness consistency constrain	high moderate moderate

The port highly benefited from collaboratively working with research institutes and academics at the national level and within the EcoPorts network (it has been using the SDM tool since 1998). In 2002, *the decision* to use the PERS structured approach towards building an organizational process that integrated different environmental aspects and related practices, *was* successful in providing the first certified EMS standard implementation in the sector. Most importantly, the port managed to develop a system approach able to inform the PA about EM practices both internally and externally. Hence Dover was the *innovator* within the field.
DHB gained time-advantage over other ports and took a central position in the EcoPorts network, a fact that provided the ability to *influence* the standard. The PA was able to realize this because, as it is already explained, its first EMS implementation relied on distinctive and firm specific competences and because after having been certified it was in the advantageous position to possess valuable information (related to standards implementation and certification processes), such as information about policy framing, auditing documentation, specified indicators for monitoring and reporting. In this respect, the port was in the position to *co-opt* the standard by *importing influential constituents*. The port's management had long recognized that EMS implementation provides a competitive advantage. They perceived it as an effective tool in their decision-making and efficient enough to help them confront obligations that emerged from the national green policy and regulatory framework, as well as, as a suitable and accurate tool to enhance the port's image as a city-port.

The case of *Valenciaport* (VPA) is slightly different. The port had already, like Dover, accomplished competences through problem-solving and learning regarding different environmental issues, but it was the port's management orientation on quality and standardization that engaged it in a system approach towards environmental management in the late 1990s. Additionally, more than any other port in Europe, the PA was aware and convinced about the EM implementation benefits at the port community level and engaged in EMS implementation from a different perspective. For both reasons, it initiated a project based research into EMS implementation earlier than other ports. The result was that through its ECOPORT project (1998-2000), VPA possessed the first of the two generic procedures for the identification and assessment of port environmental aspects within the EU port sector; the other one was produced by the EU EcoPorts project (2002-2005) (Puig et.al.,2015).
Already by the beginning of the 2000's, it sought the EMAS standard and published its own guidelines on port environmental management according to the standards' requirements for different port facilities in the port area. At that time, it was an ambiguous self-oriented target but its in-house produce

methodology allowed the initiation of the port's Environmental Policy and comprehensive detailed objectives to be achieved. VPA was in progress of producing (again through project based research at the national level) environmental performance indicators related to the port's environmental aspects that later enhanced its EMS implementation, when the PERS standard was available. Having experience in the implementation of a similar system approach, the port was able to positively capitalize indirect-transmission of the norm almost as a benchmarking learning approach and smoothly obtain its own PERS certification one year later. The VPA's successful PERS certification was extensively introduced in the network as supplementary to the port's in-house produced EMS method. The latter was a clear attempt to *co-opt* the standard. Yet, it could be also considered as an attempt to participate in the institutional process in a productive manner (Clemens & Douglas, 2004).

Another finding revealed by the analysis is, that the early adopters were of two different types. One port of the group was the *port of Thessaloniki* (ThPA). The PA was proactive enough to be among the sector's firsts but this outcome was built on a rather limited experience in health and safety practices and lack of knowledge concerning any kind of EM practices implementation. The PERS application initiated the port's effort to form an Environmental Policy. Acquiescence to the standard was triggered by legal requirements and was effective in terms of meeting obligations at the minimum cost. However, within an impassive national political and social context regarding greening, this port case highly confirmed that when there is environmental uncertainty, organizations tend to imitate successful peer organizations. The PERS certification demonstrated the port's reliability and commitment to environmental efforts and thus, improved the port's image and reputation within the industry. However, although the early adoption of the standard was an asset to the port's business image within the sector, it is no exaggeration to qualify ThPA as an *early reactor.*

The *port of Rotterdam* (PoR) emerged as a late adopter in 2008. PoR was among the PAs that chose to wait before engaging in EMS implementation. It was the fifth Dutch port that obtained the standard. PoR is a unique example of a port that although initiated advanced objectives towards sustainability, it was the last -among the four ports- to apply the PERS standard, with a significant delay. Still in the early 2000s the management didn't deem that EMS standard implementation unreservedly promoted the port's environmental policy.

Until 2004, the port's municipal management relied on its 'clean port' strategy and on an effective licensing system for environmental protection in the port area whose enforcement was safeguarded by the regional environmental agency (DCMR). A significant number of environmental management practices for aspect related policy frameworks were gradually built up through project based, mainly collaborative initiatives, both at the national and European level. Since the mid-2000's, the evolved sustainability target- under the new 'quality port' strategy- has been driven by the new corporate management and the planning for the Maasvlakte II future operation. The PoR's updated and innovative new strategy was part of a large regional policy framework and was based on advanced learning experience -such as the Maasvlakte2 planning, its energy transition plan and industrial symbiosis R3 program. The 'quality port' strategy itself, placed the port in a unique position within the Ecoports members and consequently, made it an exceptionally late adopter regarding EMS implementation. On the other hand, willing to receive a certified recognition for its green efforts, PoR's management eventually decided to obey the field's rules and conform to normative patterns on EMS implementation. The findings strongly indicate that despite the extensive problem-solving and learning through different environmental policy framework implementation, as well as learning through innovative R&D research, the port *did* value the system approach of the PERS standard -at least as a tool for the systematic review of its numerous environmental aspects and the production of environmental reports.

The port's acquiescence strategy was based on *complying* and *habit* tactics. However, the moderate level of consistency and discretionary constraint as well as the low level of the perceived legitimacy and efficiency gains in EMS implementation, are the main predictive dimensions that explain the port's prime *compromise* strategy. PoR employed mainly bargain efforts, negotiating the value of its sustaianability vision compared to the system approach for PEM, and chose *compromise* to balance various expectations of diverse and multiple constituents between innovation policies and EMS implementation challenges.

7.5 The effect of path dependent EMS implementation on port sustainability

- *The research findings revealed an important pattern that appeared in the individual port environmental change process. What was common for all the examined ports was the presence of both the* *<u>mechanisms</u>* *of* ***problem solving*** *and* ***learning****.*

These mechanisms explained how individual port EMS characteristics emerged and changed over time and illustrated the likelihood of interconnection among them. Teece et.al., (1997) suggest that a continuity in a firm's competence development forms a proactive environmental strategy which is a firm's path dependent dynamic capability. Thus, problem solving and learning clearly demonstrated the way in which the individual port strategy built its path dependent capabilities that enhanced proactive greening.

Performance indicators was a consistent green pattern that the two port leaders developed in building up their pollution prevention capacity. These indicators were crucial for EM practices implementation and evaluation and could only be progressively realized through problem solving and the port's innovative orientation towards learning. To accomplish this goal, both Dover and Valenciaport initiated a series of research projects for the identification of site specific indicators relevant to the ports' significant environmental aspects and, developed the capacity to adopt and implement them. They extensively used their connections to institutions and academia, to secure and support their EMS with scientifically based indicators. Both PAs provided the efforts and the commitment to continuous improvement by constantly learning and building up knowledge in monitoring practices and processes indicators which had a great deal of impact on EMS implementation. While employee participation was moderate for both ports, their EMS implementation was consistent to cross-functional integration, increased employee skills and use of technological resources, that formed a proactive response, which has provided them with a competitive advantage (Russo and Fouts,1997).

In the UK, the green national context affected the ports' prescribed processes and environmental rules that port managers had to follow (Couper, 1999). Although in other EU countries, like the Netherlands, specific environmental regulations and enforcement was in place, the UK's national policy was extremely successful in terms of setting roles. It provided regulations to motivate action, and some assistance to guide explorations. In the *<u>port of Dover</u>* (DHB) case (and this is a potential explanation of the quick adoption of the PERS standard among the UK ports), the aforementioned resulted in the setting up of in-house expertise concerning environmental measurements, the use of an electronic reporting system and the formation of various performance indicators which pre-existed or initiated during the PERS implementation. The system based approach of the PERS standard helped the port to further advance the integration of different competences. The port's EMS implementation was progressively improved by an efficient, effective and accessible flow of information that constantly provided updated knowledge and the means for continuous learning. Environmental transparency has been one of the main priorities that boosted further ameliorations and enhanced the port's EMS application making it possible to be updated to the more comprehensive ISO14001.

The *<u>Valenciaport's</u>* (VPA) EMS was strategically committed to EMAS implementation. The port developed its own method for the identification and assessment of port environmental aspects on a problem-solving basis, which was a unique in-house effort that initiated the port's EMS implementation. After that, the port set up organizational processes which systematically sought out environmental problems and was progressively involved in various R&D projects to improve pollution prevention. These projects were supported by ongoing relationships with in-house expertise and external sources of advice. The gradual updating of the EMS had also improved its full integration by using ad-hoc technology for processing environmental information. The latter was crucial for the accomplishment of the EMAS certification's initial target and the intermediate step of the no less important ISO14001. The port also progressed in comprehensive environmental reporting. Last but not least, the PA invested in continuous environmental improvement and the pursuit to promote greening within its port community, as well as in a co-ordination mechanism for environmental action plans at the port-city interface.

In contrast, the *port of Thessaloniki* (ThPA), secured its green image following the norms. The PERS EMS implementation was plainly influenced by normative pressures; knowledge was stringently built up by formally configurated pollution prevention competences based on the PERS standard's framework. The port's EMS implementation was based on both managerial and operational greening processes, which were merely motivated by cost reduction and effectiveness. EMS implementation itself literally introduced greening to the port. The gap of experience in practicing port environmental protection, immensely determined further problem solving and the relevant competence building that the port went through after the initial PERS certification, which led to the apparent need for re-certification.

The port *of Rotterdam* (PoR) within the time frame of the research went through a decisive regime transformation. Before that, aiming to constantly update knowledge of port environmental issues, PoR addressed a number of technological and scientific challenges (problem solving and learning processes). The port was committed to environmental protection in the port area, by consciously complying with regulations largely derived from the national green context. Pollution prevention was progressed through long-term issue based policy planning and a system of permits and licenses for companies located in the port area -in which the role of the regional environmental agency was critical. After 2004, the new management set new ambitious environmental goals. Greening, as set up within the latest port vision 2020, is more a matter of triggering action on different innovative strategic axes towards sustainability. The port's innovative sustainability strategy should be considered as embedded in the Dutch culture of innovativeness and mutual consensus building. Although the overall goal remains extremely ambitious, the planning and implementation of different policy frameworks are embedded in a boarder regional planning. In 2008, the PERS implementation provided a structured overview of the environmental aspects within the port area, but it was not considered that it was adding any particular value to the established monitoring procedures. The PA continued to identify as highly important its own pollution prevention programs that were accomplished by the cooperative efforts of the PA and regional regulatory agencies -such as the regional environmental agency. The PERS certification was comprehensively used to promote the port's new quality image, but the standard itself was not used as a distinctive element within the port's "green vision". Yet, it remains a tool that provided a systematic approach -which the port environmental department considered useful for reporting on actual environmental results.

- The overall picture of the case studies indicated that until 2010 the green port field in Europe was at a dynamic developing stage. Following Teece 's (1998) suggestion *that* laws and enforceable regulations are essential ingredients in developing an environment that favors innovation and allows firms to profit from their investments in intellectual property, *divergence* also occurred, as PAs were likewise forced through national rules and recommendations to implement proactive strategies. This conclusion best follows the cases of Dover and Rotterdam. The latter is in line with the Lam & Notteboom (2014) findings in their comparative study of green port policies effectiveness in Asia and Europe, which disclosed the European enforcement approach for environmental standards implementation as responsible for initiating green port policies -the study explores the ports of Antwerp and Rotterdam. A second issue (which potentially creates additional diversity) is the ambition level of each port regarding greening. A clear example of planning ambition in EMS standards application and the extent of the port's capacity to achieve its goals is well reflected in the case of Valencia. VPA's own awareness and willingness towards EMAS should be considered beyond embedded in the integration of EC rules in the national context. It is a successful result combining strategic planning and individual port capabilities building. Thus, by implementing EMS standards the port organizations experienced different stages of maturity in the greening processes. The EU green port institutional context and the individual port's national context, were the main external determining factors that affected the level of exposure to green port knowledge and work methods.

7.6 Gaining competitive advantage by EMS standard implementation

As for any other organization, sustainability strategies for ports involve seeking ways of protecting the environment and are geared to port competitiveness (Adams, et, al, 2009). European ports confronted their environmental problems through a wide response, considering them as both a threat and an opportunity (Kolk & van der Veen, 2002). The study's findings highly indicate that by implementing EMS standards, PAs are able to develop core green competences which support them in order to manage external (institutional) pressures. Moreover, they assist them to constantly improve their pollution prevention capacity through inter-organizational learning processes, which, in turn, engage them into a long-term experimentation and innovation. For an overview of individual port competitive advantage based on how organizational capabilities were progressed see Table 6.5, p:174.
The *port of Dover* is a port totally embedded in a port-city interface environment due to its natural characteristics. The core nature of the competition it faces (mostly within its national borders) is that, it can compete only if it keeps its *'license to operate'*. Being the green leader in EMS standard implementation, it influenced competitors in the UK. Most importantly, the port proactively engaged into standards' implementation and developed skills, which were valuable resources that influenced the port's relation with its natural environment and the actors in the port-city interface. Especially the port's interaction with the port-city stakeholders was in turn a vital competitive advantage- in terms of effectively progressing essential future development plans.

The different way firms recognize the need to change key resources over time, and act upon building their related capabilities, is clearly illustrated in the *Valenciaport* case. In this port, an ambitious approach to port greening confronted the strategic goal of EMAS standard implementation and flourished building up distinct organizational green capabilities. This self-oriented approach further moderated the deployment of stakeholder engagement at the port community level, and additionally enhanced individual pro-activeness by connecting environmental performance *to* port community relations. The reason behind this particularly rare and advanced target, thrives in the port's core business principle to constantly invest in (managerial) *quality at the port community level as part of its cluster competitiveness.*

The *port of Thessaloniki did* improve its image. Being an 'EcoPort' and a PERS certified port among actors in the field, it means that you have accomplished the 'green port' status. As much as ritualistic this may sound, it is not a disadvantaged position for a port to be. *After all,* Piraeus, the main competitor of the port, was left behind in this respect, although this did not last. Nevertheless, the key benefit for the port was that the PERS standard initiated its environmental policy and learning processes that enabled the port to keep seeking for actual pollution prevention competences.

The interrelation between problem-solving and learning is fundamentally different in the *port of Rotterdam case,* compared with most of the European ports, based on its size and the activities' complexity in its port area. The port is a clear case of a firm which has distinctive long-term issue based environmental strategies (or strategic goals) that led to unique competence building and leveraging activities within two decades' time. The main drivers for change towards its future sustainable port (that incorporates, among others, an energy transition plan and the setting up of industrial symbiosis requirements for companies located in port), was the change in the port's management regime (to a market oriented port business model) and the Maasvlakte II expansion experience that further enhanced the port's pollution prevention competences by adding an ecological perspective. The PERS standard implementation *did* provide the port's first green certification but it could not by itself provide a competitive advantage for the port. The port vision towards sustainability though, has a strong potential.

- On the other hand, Merk (2013) points out how much more controversial sustainability is, as a source of competitive advantage for those ports, like PoR, whose activities' portfolio is geared more towards cargo loading and unloading or heavy industry. The findings of the Rotterdam case further elucidate that little investigation has been carried out on how sustainability impacts on port competitiveness and how such relationship actually unfolds (Merk 2013). In this respect, future research could add valuable results.

7.7 Concluding remarks on the theoretical framework – Reflections for futher research and future fields of action

- ***Research contribution***

This thesis research applied both *institutional* and *resource dependence* theoretical perspectives and explored the European ports' greening from 1993 to 2010, mainly aiming to add to port environmental management knowledge. The selected cases -through the criteria formulated on page 50- are very different, up to the point that one considers they might not be comparable. However, such diversity reflects the high degree of diversification in this particular industrial sector, up to the point that is not exaggerated to point once again the quote *"when you have seen one port, you have seen one port"* (ESPO Green Guide, 2012). Within the selected time frame, EMS standards implementation progressed far enough in order to provide the researcher with the opportunity to explore the institutional dynamics of the EMS standards' dissemination inaugurated period.
The research findings broaden knowledge of both institutional research and port environmental management disciplines. The outcome is important *not only* in terms of the empirical analysis that enlightens how European port organizations were engaged in greening *but also* for adding to the recently evolved literature about the EMS standards' role in serving port sustainability.
The analysis' results assist future research to recast the debate over port environmental performance beyond EMS standard implementation *and* to begin focusing the attention on individual port environmental capacity and capabilities building in a way that reflects the individual port's characteristics. Finally, understanding the emerging organizational capabilities that contribute to the port strategic responses to EMS adaptation, has managerial implications that allow to further evaluate the *pros* and *cons* of implementing environmental management by using EMS standards and other *fields of action for further improvement.*

- ***An Oliver framework suggestion***

The findings affirm that, institutional research has both a leading and supportive role in providing knowledge about the way EMS standards adaptation facilitated port greening in Europe. By combining both *institutional* and *resource dependence* perspectives, the study could better interpret the dynamics of both *convergence* and *divergence* in EMS standards' adoption among the European ports and contribute to the better understanding of the port greening peculiarities.

Oliver's (1991) depiction of a strategic choice between *conformity* and *resistance* to institutional pressures *did* assist in understanding the variation amongst port organizations' strategic responses and EMS standards' implementation. The analysis confirmed that Oliver's (1991) predictive factors adequately correspond to the port cases' conditions and state of affairs, in terms of their strategic response to greening through standards' application. As all three examined ports were proactively engaged in this respect (meaning that the avoid and defy strategies could not be applied), the rest of the proposed strategic responses are confirmed: *acquiesce*, *manipulate*, *compromise*.

- *A **differentiation** from the Oliver's proposals is that the strategies do not appear as solid and pure. In three of the examined port cases a mixture of strategies is evident. Even more, the overall picture of the strategies yielded the important observation that time is a critical issue. In this respect, the study proposes another predictive (institutional) factor:* ***strategic timing.***

To maintain their success, port organizations are required, over time, to undertake appropriate changes in order to respond to the changing conditions in their environment *or* adjust the environment to their advantage. Together with knowledge and prior experience, strategic timing could be considered critical in decisions aimed at organizational competitiveness. The proposed factor reflects the immediate actual situation between the exogenous environment and the internal conditions of the port organization, and *thus*, the response is more clearly highlighted.

Adding the strategic timing factor, seems an adequate prerequisite contributing to appropriately describe the actual situation. For example, it could provide more thorough understanding of the actual cause that brought up the port of Thessaloniki (ThPA) among the early adopters group or even the port of Rotterdam to the opposite group. For example, the new factor perfectly corresponds and explains the pure acquiesce response in the ThPA case. It is the necessary complementary constituent that addresses the actual condition of the port' s acquiesce response.

The *proposed predictive dimensions* related to the factor are: ***choice*** and ***conjuncture***. The *choice* dimension of a strategic timing response is proposed for capturing the preparedness of the port organization to integrate the system approach of an EMS standard in its environmental management. The potential that the port organizations are in a position to deal with this kind of approach, and value the standard in this respect, is important for the efficacy of the standard's implementation. The opposite result is assumed when the PA is shaped by a combination of events. Possible effects at the organizational level may occur by the existence or not (or even change) of valuable resource availability in the external (field) environment that may be influential in the potential value of the EMS standards for the port at a specific time. *Thus*, the *conjuncture* predictive dimension apprehends the ability of the port organization to have valuable connections to exogenous resources in this kind of port performance.

Table 7.1: Strategic timing factor as supplementary proposition in the Oliver (1991) framework

Institutional factor	Predictive dimension	Research Question
		When should the organization react in order to maximize benefits or avoid problems?
Strategic timing (when pressures are an issue for organizational interpretation)	**choice**	Organizational competences and resources *able* to integrate the system approach of an EMS standard.
	conjuncture	Conditions favoring access to valuable exogenous resources.

The four port case studies share a certain and critical similarity. They were all part of the organizational field that affected their strategic behavior towards EMS implementation. However, they differ up to five years in their response to EMS implementation. The observed estimation that reflects their particular response regarding strategic timing, is illustrated in the following Table 7.2

Table 7.2: Case evaluation according to the proposed strategic timing (institutional) factor

Institutional factor	Predictive dimension	DOVER (DHB)	THESSALONIKI (ThPA)	VALENCIA (VPA)	ROTTERDAM (PoR)
Strategic timing	**choice**	high	low	high	high
	conjuncture	high	high	low	low

- ***A viable theoretical framework to understand port greening from an organizational capabilities perspective.***

The proposed capabilities framework was viable in assessing port EMS standards' implementation from an organizational capabilities perspective. What is more, it shed light on individual green port identity creation *uniqueness* that provided diverse strategic responses to institutional demands during EMS standards implementation. It accomplished the goal to build on *and* extend knowledge of port greening by focusing on the individual port *willingness* to solve problems and learn through specific organizational resources and capabilities with the *desire* to abide by *or* not to affront institutional demands.
This *very* framework even succeeded in unveiling inefficiencies as the case study of Thessaloniki port reveals. The main improvement claimed by the early re-actor port (of Thessaloniki) -which *did* implement a formal EMS- was the port's advanced legal compliance and engagement into an incessant concentration to ameliorate its pollution prevention capacity. The pollution prevention capability, that the port is still lacking, is a more complex -and social aspects involving- process *than* compliance, which needs a significant change in the port organizations' culture, human resources,

R&D capacity and resources (Rousso & Fouts, 1997). The exploration of organizational capabilities which enhance the port's early strategic response to the EMS standard application, as well as, its environmental performance, highly supports Hart's (1995) suggestion that, organizational competency in environmental issues within an organization occurs *only when* the organization is primarily skilled at *pollution prevention capability*.
An actually pro-active response requires support from internal organizational competences and capabilities to ensure effective implementation towards strategic goals (Aragon-Correa, et. al, 2003; Hart & Dowell, 2001). *In this respect the research framework also contributes to research efforts to further understand the relationships between environmental practices and performance.*

- ***Reflections for futher research***

This study's results beyond demonstrating that organizational willingness to apply proactive strategic response has to be supported by port environmental capacity building and path dependent organizational capabilities and that capabilities are the moderators enhancing the degree of pro-activeness (Hart, 1995; Sharma & Vredenburg,1998; Teece, et.al.,1997), *highly points the potential of mixed strategies and related path related capabilities as part of response to agencies and institutional dynamics.*

- *Future research could indicate different types of port greening capabilities that may reveal different aspects of the individual port's green identity construction.*

One might go in an opposite approach and focus its research interest at meso-level, based on the argument that, change does not stay constrained within industry boundaries (Davis 2005), and following the research's results that encourage further focus on the green port organizational field and mechanisms within the boundaries of a specific national context.

- *This direction of research could explore to which extent the adoption of EMS standards is shaped by coercive and normative mechanisms or reflects social learning efficiencies rather than institutionalization.*

- ***Future fields of action***

After the end of the period studied (2010) new goals and ambitions have been articulated -such as the 17 Sustainable Development Goals by UN, the Paris Agreement on climate change, e.t.c- each one of them are important aspects directing future fields of action for ports.
However, based on the study's analysis useful insights are provided for those PAs that are willing or are already commited to *societal integration*.

Societal integration is a concept that covers many layers, including CSR of PAs, strategic stakeholder management and environmental management of ports. The concept is extremely crucial in the port-city interface for improving the regional and local planning, in which the port's environmental protection strategy should be integrated and enhanced. Joint initiatives to monitor the environment in the port-city interface should be supported by the port EMS implementation. Analogous reasoning reflects issues of strategic planning regarding port development.

For the Sharma & Vredenburg (1998) proposed capabilities of stakeholder integration, higher-order learning and continuous innovation, the research indicates that EMS standards implementation is a valuable tool for port management in supporting their capacity building, especially, at the port community and the port-city interface level.

- Therefore, -and regarding fields of action for further improvement beyond environmental improvement- the study suggests that ports, aiming to enhance long-term relationships, environmental knowledge assets as well as the competitiveness of their port community, should engage in using EMS application as a tool to build up their stakeholder integration capability both at the port community and the port-city interface level.

7.8 ***Are we living in the new era of what is commonly referred as new-institutionalism?***

This last section's main theme discusses the extent of *why* and *how* the updated developments of new-institutionalism propose a diversified perspective in exploring the green port organizational distinctiveness.
Since the 1990's, this theoretical perspective has provided an emerging paradigm in social sciences that has become one of the dominant organizational approaches, in order to conceptualize and explain how and why organizations conform to institutional demands. Perhaps, its most valuable and characteristic feature is the establishment of the organizational field as an appropriate level of analysis for investigating both the processes and effects. Through the years, the most distinguishing approaches of examining diffusion processes include the 'translation' concept, the inclination to rediscover formerly recognized but immature ideas and the broadening of its line of inquiry, like the Oliver's (1991) framework that incorporated resource-dependence theory (Forgues et.al.,2012).

Recent challenges rechanneled the focus on institutional entrepreneurship and institutional change (Hardy & Maguire, 2008). The theory's update developments are centered on the *embedded agency* -namely the way actors, in extremely institutionalized frameworks, are able to exert reflexivity and fulfill institutional modification (Battilana, et.al., 2009); *institutional work* that examines how individuals' active agency affects institutions (Lawrence, et.al.,2009) or the concept of *institutional logics* that puts forth the suggestion that the innate incongruities (incompatibilities) in (a set of) institutional logics yield the cognitive and cultural resources which could convert identities, organizations but also the very society (Thornton, et.al.,2012; Thornton & Ocasio, 2008). The latter constitutes the core notion of the theoretical perspective of logics regarding institutional change. The institutional logics perspective - that has become a rapidly growing *intellectual domain* in organizational research (Lounsbury & Beckman, 2015)- brings into focus the need to understand institutional complexity based on the conflict and inconsistent logics within organizations (Marquis, et.al. 2013; Tilcsik, 2010).

This PhD research suggests an integrative conceptual framework that is addressing *both,* institutional change -which occurred as an institutional process- *and* (possible) organizational change. It examines the change occurred as institutional when EMS standards are implemented in a particular *"productive (new-institutional) site of analysis"* (Forgues, et.al, 2012), namely the European green port organizational field. The nature of standards is an area into which neo-institutional research has made important contributions. The use of standards brings about primarily legitimated outcomes regardless of whether it is enabling the persuasion of others *or* it is providing help for actual green outcomes. It is not an exaggeration to say that legitimacy is the core institutional logic in the (organizational) field when standards' implementation is supported *or* it is responsible for bringing up organizational change. In this way, it builds on the tradition of work that combines institutional theory with RBV.
Indeed, the study explores its subject of interest by using a methodological perspective that is not currently favored compared, *for instance*, to the fashionable institutional logics; it *does* favor a preference for institutional life which thrives within an organizational field and applauds the value of the resource dependency perspective in Oliver's (1991) typology of institutional factors, in order to understand divergence. Nonetheless, it has been very cautious in safeguarding that it is constantly taken into account what is actually investigated, *namely* the understanding of change at the organization's level. This is basically why the research focused on exploring organizational greening capabilities. Exploring and understanding individual port capabilities, as well as the mechanisms that emerged at both the field and organizational level, is vital for identifying a port's pro-active green strategic response.

The *focus is on understanding organizational variety and on how individual port organizations contribute to the field institutionalization.* When the interest of the analysis focuses on the organization, the peculiarities of the organization have to be particularly taken into consideration. Port organizations are by nature organizations which are primarily characterized by their location and spatial development that foremost affects their local and regional environment. Therefore, any port greening effort are primarily affected by the port's "locality" and what this entails: namely local, national, European (governance) institutional demands for port greening. The Oliver approach is an efficient framework to address how PAs can act strategically responding especially to this demands.

The conceptual framework of the research grew from a ‘premise’ that is built up consecutively from one step to another and draws on how path dependencies that resulted from the extent of the individual port organization’s response at the organizational level are capable to encounter multiple institutional demands and even, redound to the variety of institutional dynamics. The latter is depicted in the research analysis from the investigated phenomenon both at the field and organizational level. The Oliver (1991) framework serves within the research framework almost as ‘sketching a courtyard’ in the center of the organization’s strategic planning site. Functioning precisely as an inner courtyard brings light and private outdoor space deeper into the site, reflecting the effects of agency and (field) institutional dynamics. This helps identify the ways in which the individual port organization is affected and becomes receptive to change. Change at the organizational level is a dynamic process that unfolds based on distinct resources and capabilities. Finally, it is the very own path dependent and multifaceted organizational 'premises', namely the opportunities and constraints of the individual port capabilities and resources that elucidate each port’s green strategic planning. The uniqueness of the locality is particularly captured and explored by both the institutional factors and the dynamic of the individual port organization capabilities.

- *The explicit contribution that this thesis research makes to institutional theory is to enlighten how path-dependencies, mixed strategies, agency and dynamics, are part and parcel of institutional dynamics, which contrasts with the rigidity and static nature of the original theoretical frameworks as presented in the theoretical chapter.*

This clearly indicates a possible future for new institutionalism that strongly recommends as valuable the ‘dredging up’ of new elaborations of the rather old neo-institutional perspectives, whose orders and achievements seem unable to be overshadowed. They still offer a line of research that is worth thriving, viz the mechanisms, factors and foremost the core features of organizational response to greening, the individual competences and capabilities. This research clearly appreciates a resource based ‘display’ in the order of institutional life.

Traditionally the past is the weapon of conservative and even reactionaries. Indeed, this is what the port industry (in Europe) used to be for a long time regarding its greening: a reactionary at the very least. Why should not this reactionary organizational field be interpreted with a relatively old-fashioned but rather suitable institutional approach? The past does not always need to be a monument, although we prefer to tear down such edifices. *It is so even today*!

Epilogue

“In 2017, EcoPorts celebrated its 20th anniversary
with nearly 100 ports from twenty-two different countries in its network.”

The Story of ECoPorts.
Building a worldwide network for sharing experience in port environmental management.
Wooldridge, C. (2017). ECOPORTS publication.

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ANNEXES

ANNEX 1

CASE STUDY 1 : PORT OF DOVER

PORT OF DOVER –

Exploring the "green port" via EMS implementation.
Was the first EU port receiving PERS certification a pioneer, why & how?

ABSTRACT

Dover forms one end of the main ferry links between England and France, being Europe's busiest Ro-Ro freight and passenger ferry port -with more than 100 calls by large ferries every day-, operates two dedicated cruise linear terminals, a deep-sea cargo terminal and a marina. Positioned as one of the leading UK ports, responsibility for the environment was a required priority and Dover proved a leader in effective environmental management. The port of Dover was awarded the Certificate of Verification in a new standard created by the Ecoports Foundation (EPF) for implementing the EPF's Port Environmental Review System (PERS), first in 2003 and for the second time in 2006. This case study examines why and how Dover is indeed a pioneer, as a European port in line with the ESPO Environmental Code of Practice.

CONTENTS

1.0 INTRODUCTION

"Environmental duties need standards, just like navigational safety. Indeed, the two subjects overlap. We will work with the ports industry to develop appropriate standards. We will do so in consultation with the nature agencies and other interests. EC funding has helped conservation and research bodies to establish a joint initiative to promote implementation of the habitats directive by setting up management schemes. The project will develop guidance and good practice for practitioners across Europe, including the UK."

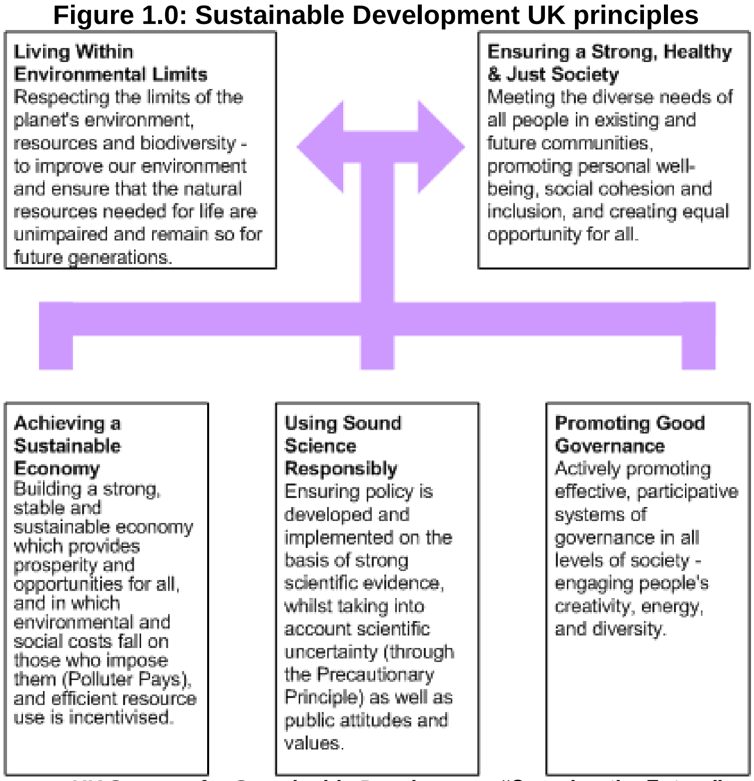
Department for Transport (DfT), "Modern ports: A UK policy, 2000:22

1.1 The UK "green" national context

The UK Government launched its new strategy for Sustainable Development (SD), *"Securing the Future"*, in conjunction with a Strategic Framework, on 7 March 2005. The Strategy emphasizes on the regional level and the new relationship between government and local authorities, highlighting the renewed international push for sustainability from the World Summit to SD in Johannesburg in 2002.

The suggested strategy has a new purpose and principles for SD and new shared priorities agreed across the UK, (*"Securing the Future"*, chapter1).
The UK Government, Scottish Executive, Welsh Assembly Government and the Northern Ireland Administration have agreed upon a set of shared UK principles that provide a basis for SD policy in the UK, (Fig.1.0) - with a more explicit focus on environmental limits. For a policy to be sustainable, it must respect all five principles (see figure). The aim of the UK SD policy is to live within environmental limits and achieve a just society, by means of sustainable economy, good governance, and sound science.

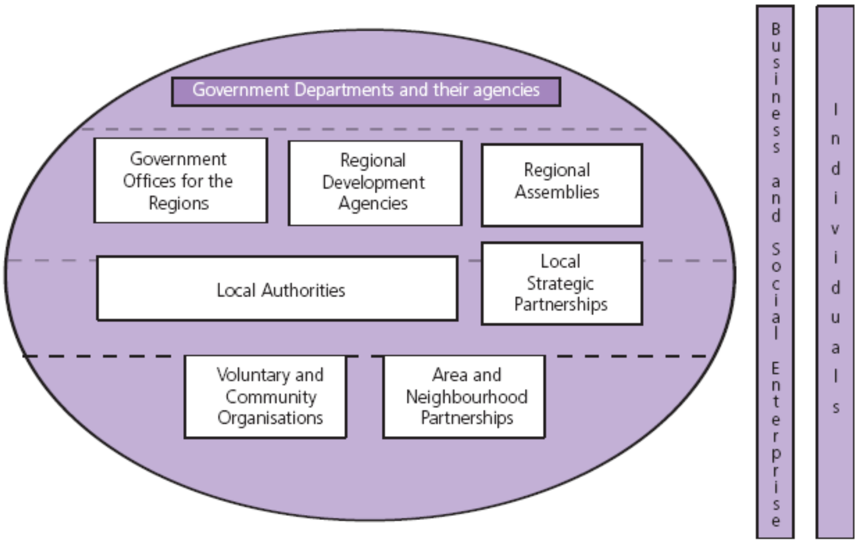
Figure 1.0: Sustainable Development UK principles



Source: UK Strategy for Sustainable Development "Securing the Future"

The new UK SD strategy has identified _four priority areas for immediate action_, recognizing that changing behaviour is a cross cutting theme closely linked to all priorities: sustainable consumption and production, climate change, natural resource protection and sustainable communities. A _set of national indicators_ were outlined in the new strategy, *which is more of an outcome focused*. A baseline assessment of all indicators, *for which data were available*, was published in June 2005, followed by an update in 2008. The UK government had been already committed to reducing the country's greenhouse gas emissions. In its 2003 Energy White Paper, the Government put the goal of moving to a low carbon economy at the heart of its energy strategy and set out a long-term goal of reducing carbon dioxide emissions by some 60% until 2050, with real progress to be shown by 2020. The new strategy further promotes the government's goal of moving and wants to reduce CO_2 emissions to 20% below 1990 levels by 2010. Ensuring that the strategy will be converted into actions, all central Government Departments and their executive agencies produced focused SD action plans based on the strategy, within 2005 (Fig. 1.1).

Fig. 1.1: Converting the new strategy into action



Source: '***Securing the Future'*** , UK Government SD Strategy, Chapter 7, *"Ensuring It Happens".*

A *Sustainable Development Commission* (SDC) was established in 2000 as a UK-wide advisory Non-Departmental Public Body. Its role was to act as the Government's independent advisor and "critical friend" of SD. Since 2000, the Commission has developed its role and increased its influence across Government. More importantly, *Regional Development Agencies* (RDAs) have been set up by Government to transform England's regions through sustainable economic development and to have an influential role in the business community. *Regional Assemblies* scrutinise the work of their RDA and they have been appointed as the regional planning body with a duty to prepare the statutory Regional Spatial Strategies (RSS). They also play a leading role in the work by integrating regional strategies with key players and a wide range of regional expert groups and stakeholders. These high-level frameworks set out objectives and priorities for SD in the region and inform regional strategies, including Sustainable Community Strategies. The UK's approach towards ensuring SD national introduction promotes the four E – Enable; Engage; Exemplify; Encourage. *Government Offices* report progress at regional and sub-regional levels, while the Government monitors and annually reports to the UK Framework Indicators so as to place the Government's performance into context.

Until the end 1990s, the *UK marine environment* was regulated via a patchwork of many different national, EU and international laws and conventions, regulations and agreements intended to protect wildlife and habitats, e.g. *Wildlife and Countryside Act 1981*; *EU Birds and Habitats Directive*, which requires Member States to designate special areas for the protection of certain habitats and wild bird species, including some in marine environments; *1992 OSPAR Convention*, which provides the legal basis for international cooperation for the protection of the marine environment of the North-East Atlantic; *UN Convention on Biological Diversity*, which aims to promote biodiversity and the sustainable use of its components; *UN Convention on the Law of the Sea*, which contains provisions on the protection of the marine environment.

The UK Government and the devolved administrations have began the process of coordinating marine policy, through the first time jointly stated overall vision for the marine environment as *"clean, healthy, safe, productive and biologically diverse oceans and seas"*, in the "*Safeguarding Our Seas: A Strategy for the Conservation and Sustainable Development of our Marine Environment* " in 2002. A major step, towards unifying the patchwork of legislation that governs UK's marine environment, was taken by the introduction of the **UK Marine Bill**. A special issue of integrated environmental policy for the marine environment within the context of SD is that of the Integrated Coastal Zone Management (ICZM). The principles of ICZM are embedded throughout relevant proposals in the Draft Marine Bill published on 3 April 2008, for public consultation. A Government response to the pre-legislative scrutiny by two Parliamentary committees and the public consultation was published on 25 September. The imported historical documents related to the Marine Bill, showing the amount of preparative work are presented in the table 1.0.

Table 1.0: Key Documents related to the Marine Bill

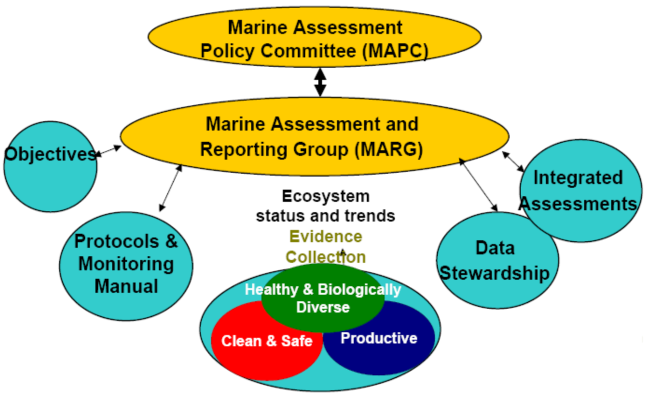
year	Key Documents
2008	Survey to Assess the Impact of Marine Bill Proposals on Marine and Coastal Developers Draft Bill consultation package Factsheets – What does the Marine Bill mean for different sectors? "Protecting our marine environment through the Marine Bill" Coastal Access Paper
2007	A Sea Change, A Marine Bill White Paper – Summary of Responses A Sea Change, A Marine Bill White Paper White Paper Partial Regulatory Impact Assessment
2006	Marine Bill Consultation – Summary of Responses Marine Bill Consultation
2005	Charting Progress: An Integrated Assessment of the Sate of UK Seas Report
2004	"Turning the Tide" – A Royal Commission on Environmental Pollution report
2002	Marine Stewardship Report - "Safeguarding Our Seas: A Strategy for the Conservation and Sustainable Development of our Marine Environment"

Source: Defra, UK – Marine and fisheries, htpp://www.defra.gov.uk/marine/legislation/key-docks.htm

- ***Science and monitoring in UK Marine Environment policy***

In 2002, "Safeguarding Our Seas" committed UK to an ecosystem approach towards the marine environment management. In order that the governmental Department for Environment Food and Rural Affairs (DEFRA) addresses pressing marine issues and sets future priorities –*and even more after 2005-,* in line with the "living within environmental limits" statement in the UK's SD strategy, by improving the marine environment understanding and the impact upon this, it was essential for *Science and Monitoring* to be undertaken. Moreover, so as to satisfy Defra's policy needs, the Government commissioned a number of scientific as well as monitoring activities and initiatives, e.g.*"Turning the Tide" -a Royal Commission on Environmental Pollution report (2004), Integrated Assessments of the State of UK Seas (2005, 2010). The result of the 2004 report was the UK Marine Monitoring and Assessment Strategy (UKMMAS) which has been the UK coordinated and integrated strategic approach to marine monitoring and assessment. The UKMAS structure is presented in the following Fig. 1.2.*

Fig. 1.2: UKMMAS structure



Source: UKMMAS strategy coordinating Marine Monitoring and Assessment, 2005

Following the "Sea of Change" consultation paper (2007), the Draft Marine Bill was launched in April 2008. The UK Government has been committed to introduce a new framework for the seas, based on marine spatial planning which balances conservation, energy and resource needs; to maintain and protect marine ecosystems so that the best value from different uses of marine resources can be obtained; and to improve access to coastal areas. The draft Marine Bill was developed to deliver these commitments and proposes measures designed to improve the country's ability to make long-term strategic decisions about the marine environment and to simplify the systems managing marine resources. Among the many issues covered by the Draft Marine Bill the key areas of interest were: the creation of the Marine Management Organization (MMO); Marine Planning & Licensing; Marine Nature Conservation; Fisheries Management and Marine Enforcement; Environmental Data and Information; and Coastal and Estuary Management.

The UK, as all member states, has a number of obligatory objectives, as a result of the European legislation. In October 2005, the European Commission published a proposal for a *Marine Strategy*

Directive of particular significance. The draft Directive agreed with the Environment Council in December 2006 requires from the EU countries to aim at achieving a good environmental status in the marine area by 2021 at the latest and it contains provisions concerning how this status' definition will be determined. The UK needs to ensure that its marine objectives are enabled in order to meet this requirement and that the programme of work to implement this Directive is as integrated as possible with the country's marine planning system. Moreover, the *Water Framework Directive* (WFD), which requires member states to achieve good ecological and chemical status by 2015 in the coastal and transitional waters out to one nautical mile, is also of key relevance to the UK marine policy. The Marine Bill proposals are framed compatible with the *UK obligations* under the European and international law. The UK Marine Bill aims to contribute to wider initiatives and obligations where possible, for example the UK Government is committed to taking the lead on international action so as to address climate change, as well as to provide greater certainty and streamlined, more transparent licensing arrangements for marine industries, including those developing offshore renewable projects, (Defra, "A Sea Change: A Marine Bill White Paper", 2007).

1.2 The UK "Modern Ports"

- **Type of ports**

The UK economy is the fifth largest in the world according to the International Monetary Fund and the World Bank lists of 2007 (GDP, millions of $), and its ports play a vital role by handling over 95% of UK import and export tonnage. According to the UK Department for Transport (DfT), the UK ports handled 582 million tonnes (Mt) of freight traffic in 2007 (23 million tonnes more than in 1997), and over the ten years since 1997, inward traffic has been increased by 21% (Dft, UK Maritime statistics Report 2007).

There are approximately 1000 ports and terminal facilities in the UK. Of these, over 650 have statutory powers and about 120 are commercially active. In the 2000's, the industry is far more consolidated and much of the trade was concentrated in the largest ports; in 2003, the top 20 ports handled 85 percent of all UK port traffic (Table 1.1), (Baird & Valentine, 2007). Fifteen of the top 20 ports are privately owned, while three are trust ports and two are municipal ports.

Table 1.1: Major Ports of UK, 2003 (in Million Tonnes)

Rank	Port	Million Tonnes	Ownership	Main Focus
1	Grimsby & Immingham	55.9	Private	Dry/wet bulk; RoRo; vehicles
2	Tees port	53.8	Private	Dry/wet bulk; RoRo; vehicles
3	London	51.0	Private (1)	Dry/wet bulk; containers; RoRo
4	Forth	38.8	Private	Wet bulk; containers
5	Southampton	35.8	Private	Wet bulk; containers; vehicles; cruise
6	Milford Haven	32.7	Trust	Wet bulk
7	Liverpool	31.7	Private	Containers; RoRo; wet/dry bulk; passengers
8	Sullom Voe (Shetland)	26.4	Municipal	Wet bulk
9	Felixstowe	22.3	Private (1)	Containers; RoRo
10	Dover	18.8	Trust	RoRo; passengers
11	Medway (Sheerness)	15.6	Private	Vehicles; dry bulk
12	Orkney	14.4	Municipal	Wet bulk
13	Belfast	13.2	Trust	Containers; RoRo; passengers
14	Bristol	11.4	Private (2)	Vehicles; dry bulk
15	Hull	10.5	Private	RoRo; passengers; containers
16	Rivers Hull & Humber	10.0	Private	Wet/dry bulk
17	Clyde	9.2	Private	Wet/dry bulk; containers
18	Port Talbot	7.8	Private	Dry bulk
19	Manchester	6.1	Private	Dry/wet bulk
20	Glensanda	5.3	Private	Dry bulk
	Total top 20	470.7	85%	
	Other UK ports	85.0	15%	
	Total	555.7	100%	

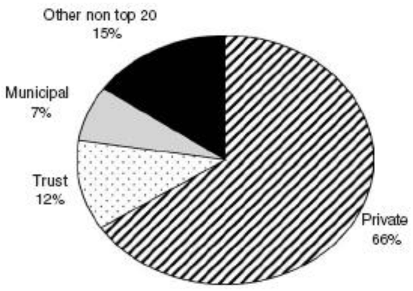
Notes; (1) Public trust is responsible for navigation/pilotage only / (2) Port is leased to private operator by the municipality

Source: DfT (Department for Transport) UK, Maritime Statistics, 2003.

Fig. 1.5 shows that 66% of UK port volumes are controlled by private ports among the top 20, 12% by trusts and 7% by municipal ports; collectively 85% of UK port volumes are handled by these top 20 ports. The remaining 15% of tonnage is handled by a myriad of smaller ports, some of which are also privately owned. This implies that approximately 70% of the UK ports industry by tonnage is today handled by privately owned ports (see Fig. 1.4 for the location of the major UK ports).

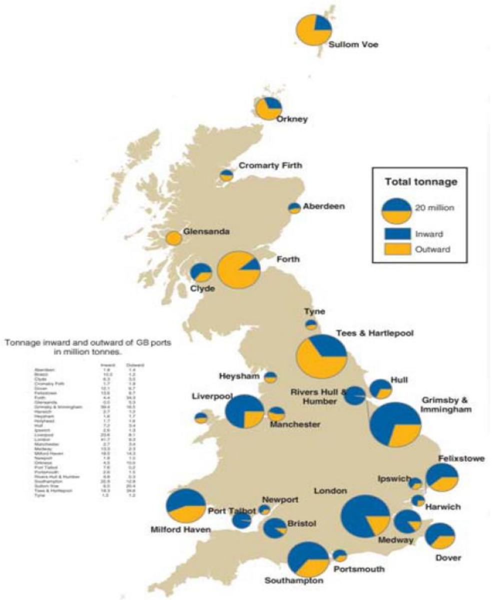
Figure 1.3 : Top 20 UK Ports

(Plus 'Other' Ports, by Share of Tonnage/Ownership Type) (2003)



Source : Baird & Valentine, 2007:71

Figure 1.4 : Traffic through UK ports, 2004



Source : DfT, produced by DfT's GIS Unit, 2004

1. <u>Company Owned or Privatised Ports</u>

This sector accounts for just under two thirds of UK port tonnage. Of the 20 largest ports, 14 are in this group. These ports are free to seek commercial funding for investment, on commercial terms, borrowing from their assets or by issuing shares. According to Goss (1997), there has been no single uniform port policy in the UK since 1945, but instead a movement from central planning to privatization. The UK port privatization process began in 1981 with the closure of the National Ports Council (NPC) -whose main function was to develop a national plan for ports-, followed by the privatisation of the newly formed ABP in 1983 and 1984 and *"the emphasis from this period onwards was on privatisation and increased competition to ensure greater efficiency, with the private sector promoting its own port expansion schemes in line with demand*" (Baird & Valentine, 2007:63).

<u>Associated British Ports</u> (ABP): The British Transport Docks Board was a publicly owned nationalised industry (like British Railways) and subject to the normal constraints on investment and borrowing which applied to all publicly owned industries. It was privatised -starting in 1981- and is now known as *<u>Associated British Ports</u>* (ABP). The group owns and operates 21 ports around the UK, including the major ports of Hull, Immingham and Southampton. In 2004, ABP's proposal for a new deep-water container terminal at Dibden Bay (Southampton) was rejected by government over concerns about its effect upon the environment. In 2006 the Port of Southampton was PERS certified by ECOPORTS.

- *<u>10 out of 21 ports (48%) were PERS certified</u>*, during 2005 to 2006, (Table 1.2).

Table 1.2: Associated British Ports – UK's largest and leading ports group – PERS certified

Port		PERS certified	Port		PERS certified
1.	Ayr	-	11.	Ipswich	-
2.	Barrow	-	12.	King's Lynn	-
3.	Barry	2005	13.	Lowestoft	-
4.	Cardiff	2005	14.	Newport	2005
5.	Fleetwood	-	15.	Plymouth	-
6.	Garston	-	16.	Port Talbot	2005
7.	Goole	2006	17.	Silloth	-
8.	Grimsby	2006	18.	Southampton	2006
9.	Hull	2006	19.	Swansea	2005
10.	Immingham	2006	20.	Teignmouth	-
			21.	Troon	-

Source: ECOPORTS list of PERS certified ports – October 2008.

In 2005, the ABP South Wales Ports of Swansea, Port Talbot, Barry, Cardiff and Newport were the first (among the total of 10 ABP ports) EPF/PERS certified through independently verified accreditation by Lloyd's Register, confirming ABP's commitment to protect the local environments and the ports' efforts in EM. **ABPmer**, ABP's research subsidiary, was instrumental in completing the PERS applications, which required an explicit summary of each port's EM procedures. Various measures, *ranging from* the recycling of waste paper, old mobile phones and used print cartridges to landscaping port brownfield sites, were undertaken and recorded in the applications. According to ABP's Sustainable Development Manager, it *"was a hard work to meet PERS requirements in South Wales, demonstrating that ABP places environmental protection and conservation high on its business agenda"*. In 2006, ABP's South Wales Ports with PERS accreditation were ten, nearly doubling the number of PERS-accredited UK ports.

Some (private) ports such as Manchester and *Felixstowe* have always been privately owned. Since 2006, *Felixstowe* has been the *eleventh UK's private port to be EPF/PERS certified*. The *Port of Larne* in North Ireland has been privately also owned since 1866, and since the 1960's a major link across the Irish Sea. While it went through a modernization phase in the 1990's, today it provides storage and distribution facilities, freight ferry services, Ro-Ro and Lo-Lo and accessory, the Port of Larne Business Park. The North Ireland Port of Larne has been the *twelfth UK's private port to be EPF/ PERS certified* since 2005. At this point it should be noted that in total in the Ireland island -upon the port of Larne- three (3) Ireland ports are EPF/*PERS certified*: the Port of Cork (2006) and the ports of Dublin and Killyberg Harbour Centre (2008).

2. Trust Ports

Historically, *trust ports are largely an English concept* mainly dating at the early stage of the Industrial Revolution which was afterwards applied to other UK parts (i.e. Scotland) as well as to former British colonies (such as India and Pakistan), (Baird & Valentine, 2007:77). Trust ports are independent statutory bodies (each established by its own Act of Parliament), governed by a board of Trustees and charged with promoting port's well- being to meet the needs of users and stakeholders. Any trading surplus is ploughed back into improving the port facilities. It is a "form of port ownership quite unusual" (Baird, 1995) -*neither public nor private*. Prior to the trust port privatisations, trust ports were a key category of port administration/ ownership in the UK and the *trust port sector* was considerably larger while the company owned sector proportionately smaller. Trust ports now account for one quarter of the industry by tonnage. Only 20 trust ports have an annual turnover above £1million and eight others have an annual turnover of more than £500.000,(DETR, *"Modern ports"*, 2000). A number of trust ports are important in specific markets, like the port of Dover.

The Port of Dover is an important market specific trust port, handling almost 60% of the UK's international seaborne passenger traffic (14.6 million passengers, in 2002), and 28% of international road goods vehicles carried by ferry, (DETR, "Modern ports", 2000). *Dover was notably in favour of anti-privatisation*, arguing that it sees no benefit from a change in ownership for what is regarded as an already efficient operation and with the ferry terminals already privately operated. In a report on the Port of Dover by management consultants Deloitte & Touche, it was concluded that privatisation would not be in the long-term interests of the port or its users, (Baird & Valentine, 2007:77). The Port of Dover was the first European port to be PERS certified, under the EPF/Ecoports scheme, in 2003 and 2006, followed by six other trust ports and a few years later by the Port of London Authority (see Table 1.3).

Table 1.3: UK's Trust Ports - PERS certified

	Port	PERS certified
1.	Dover Harbour Board	2003 (1st) - 2006 (2nd)
2.	Harwich Haven Authority	2003 (1st) - 2006 (2nd)
3.	Port of Tyne	2003 (1st) - 2007 (2nd)
4.	Aberdeen Harbour	2003 (1st) - 2007 (2nd)
5.	Fowey Harbour Commissioners	2005
6.	Port of London Authority	2005
7.	Port of Peterhead	2008

Source: ECOPORTS list of PERS certified ports – October 2008.

Trust ports review: The Government stopped the compulsory privatisation of Tyne in 1997 and commissioned a wide-ranging review of the trust sector. One of the “Modern Ports” initiatives was to review the structure, governance and accountability of the trust port sector, recommending that trust ports should be made more open and accountable, (Baird & Valentine, 2007). The Government has therefore developed agreed national standards, published in January 2000 as “*Modernising Trust Ports: “A Guide to Good Governance”,* (DETR, 2000). All trust ports are expected to plan in order to meet these standards by auditing their position, (DETR, *“Modern ports”*, 2000).

3. *Municipal Ports*

A few commercially significant ports, plus the amount of the two hundred minor facilities in the Scottish Highlands and Islands, are *municipally owned*. These operated, by local authorities, benefit their local communities, (DETR, “Modern ports”, 2000). A similar to the trust port sector review of *municipal ports* completed in 2005, aimed partly to examine financing arrangements but also to assess whether the municipal structures are compatible with efficient ports capable of competing with trust and privatised ports - an issue that was pointed also in “Modern Ports” (2000), modern management section. In 2006, DfT published the review’s conclusions highlighting themes such as: accountability and decision-making; business planning; management and performance review; and financing. The “*way forward*” section suggested that “municipal ports should consider adopting the recommendations made in *Modernising Trust Ports: A Guide to Good Governane,* in terms of board composition, appointment, performance and accountability” (DfT, 2006).

- **UK port policy: Overall legislative and operational level**

Until the 2000’s the main legislative Acts applied to UK ports are presented in the following table:

Table 1.4: The main legislative Acts (until the 2000’s) applied to UK ports

POLICY DOCUMENT		Year
	Dock-workers Act (Regulation of Employment	1946
period 1964-1980	**Harbours Act**	**1964**
period 1980-2000	Pilotage Act	1987
	Abolition of National Dock Labour Scheme (NDSL)	1989
	Ports Act	**1991**
	Transport and Works Act	1992
	Integrated Transport White Paper	**1998**

Historically, the UK Government used to take a more interventionist role in relation to the ports industry. Established in 1964, the National Ports Council (NPC), attempted to coordinate investment and in order to avoid the risk of unnecessary investment its approval was required before major projects could go ahead, although in practice the NPC was seldom able to prevent a port investment project from going ahead.

Government under the Harbours Act: During the (1964-1980) period ports were eligible to apply for loans from the Government under the Harbours Act, *thus* these loans carried interest at commercial rates and were repayable over a fixed period. Such loans are no longer available and if ports need to borrow they have to raise funds from financial markets, (ESPO, 2005).

The UK port policy in the 1980’s: In the early 1980’s the UK decided the abolition of the National Ports Council, labour deregulation (abolition of the National Dock Labour Scheme, NDSL), privatisation and increased competition. The UK ports are not state funded or managed and they retain strategic independence from the government. The Government policy is to regulate the sector where appropriate and to remain separate from commercial and managerial decision, (ESPO, 2005)

- Modern Ports : A UK port Policy in the 2000’s

The most important UK port policy developments evolved in the 2000’s, are presented in Table 1.5. The UK Government’s non-interventionist policy approach was confirmed in its 2000 ports policy paper “*Modern Ports: A UK Policy*” (DETR, 2000), the ‘daughter’ Integrated Transport White Paper (ITWP) on ports (1998), and the first UK ports policy paper in 30 years, (ESPO, 2005). While a number of initiatives arose from this work -such as a project appraisal framework for ports or environmental best practice and improved statistics-, there was to be no Government funding for ports (unlike virtually all other transport modes). The Government’s policy for ports is mainly there to facilitate and to help the ports industry "to help itself", focusing especially on guidance as opposed to direct intervention (ESPO, 2005). In sum, the "Modern ports" policy paper deals solely with the first -*for many years*- comprehensive UK's port policy, highlighting three key aims: 1) UK and regional competitiveness; 2) high nationally agreed safety standards; and 3) best environmental practice, while it encourages ports to seek alternative proposals when there are likely to be adverse effects on the environment, (Huggett, 2002).

Table 1.5: Documents for Government plans and objectives for UK ports in the 00's

period	POLICY DOCUMENT and related reports	year
2000-today	DfT, "Transport Ten Year Plan"	2000
	Ministry for Shipping, Port Marine Safety Code	2000
	DTER, **Modern Ports: A UK policy**	2000
	DTER, "Trust Port Review: Modernising Trust Ports – A Guide to Good Governance"	2000
	DTLR, "Recent developments and prospects at UK container ports"	2001
	House of Commons Transport Committee, "Inquiry into Ports"	2003
	DfT, "A Project Appraisal Framework for ports"	2003
	DfT, **"White Paper: The Future of Transport – a network for 2030"**	2004
	DfT , *Port environmental information,* a series of reports organised by themes, by port environmental information working group	2005
	DfT, DCLG,WAG, "opportunities for ports in local authority ownwership"	2006
	DfT, "Focus on ports"	2006
	The Eddington, Stern and Baker Reports, examine transport policy, climate change and planning system	2006
	DfT, Ports Policy Review, interim report	2007
	House of Commons Transport Committee, "Transport in England and Wales"	2007
	DfT,**The Draft Marine Bill** (in a Green Paper legislative programme)	2008

The *White Paper: "The future of Transport–network for 2030"* (2004) sets out the UK Government's strategic transport policies and investments plans for the transport sector in the future, with a special focus on ports; and it is again stated that the UK government wants to support sustainable port development. The paper provides a strategy for the next 30 years based on three (3) central schemes: 1)sustained investment; 2)improvements in transport management; and 3)planning ahead. Whilst making best use of the available port infrastructure it aims to minimise the external effects of new port development on communities and the environment.

- *The Importance of the Marine Bill in the port industry*

In 2008, the Draft Marine Bill, looked at how the new marine planning and licensing proposals might work alongside existing planning and decision making structures on land with the Environment Agency. The Marine Bill proposals offer a real opportunity for UK Marine planning, particularly for the coastal regulators and communities new opportunities to have a say in the way the marine environment is managed, and conversely for marine management to give proper consideration to land planning. *Modernising marine management*, a new Marine Management Organisation (MMO), a centre of excellence in marine regulation and enforcement is proposed to be created which will provide a consistent approach towards delivering improved data, offering advice and licensing marine developments. The MMO will operate from a network of coastal offices and it will deliver a modernised stream-lined licensing system.

- *Responsibilities of the Port Authority (PA), port management (Operational level)*

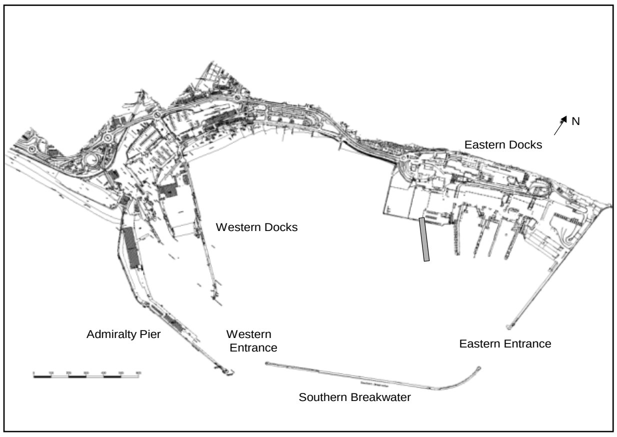
As harbour authorities were formed under special Acts of Parliament, this can by implication impose a duty on the entity to establish and maintain the service in question, (ESPO, 2005). The main responsibilities and functions of PAs can be described as follows: 1) provide and maintain harbour facilities; 2) ensure safe navigation within harbour water by providing lighting and buoys, removing wrecks and maintaining approach channels of sufficient depth through dredging; 3) regulate vessel movements and berthing in the harbour; 4) licensing construction works within the harbour; 5) provision of a pilotage service and other harbour operations such as cargo handling. *Private ports* are responsible to their shareholders, *trust ports* to a range of stakeholders and *municipal ports* to their local communities via their local council.

The investment decision-making: As previously outlined, the government takes a "hands-off" approach towards port management and investment decisions in the UK. Decisions on investment are made by individual harbour authorities and are approved by their board based on the commercial viability of the proposal. New developments normally require a Harbour Revision Order (HRO). The PA applies to the Secretary of State for the Order. Objections are then invited, and if they are not withdrawn a Public Inquiry is held. In the UK, the Planning Inspectorate, an agency of the Department for Communities and Local Government, routinely holds public inquiries into a range of major and lesser land-use development, including transport proposals. The Inspector who conducts the Inquiry submits a report to the Secretary of State in the light of which the Secretary of State decides whether or not to make the Order. Applications for a HRO have to be supported by an environmental impact assessment and a special assessment if a Natura 2000 protection site is involved. Environmental issues usually feature prominently at Public Inquiry, (ESPO, 2005).

1.3 Port of Dover – the port profile

Dover is one of the world's largest international ferry ports, located at the closest point to Continental Europe and is a vital link for trade and tourist transport to both Kent and the UK. Kent has four major ports: Port of London, Thamesport, Medway Ports and Port of Dover. The port of Dover (Fig. 1.5) is a leading Ro-Ro port, handled 2.4 million road goods vehicles and unaccompanied trailer units, 2% higher than in 2006, (Dft, Maritime Statistics, 2007).

Figure 1.5: Port of Dover Layout



Source: Dover Harbour Board (DHB)

Dover is *one of the most successful of the trust ports* in the UK, but one of only a few that could be classified as being of national significance, (Potter, 1990). The port, a statutory corporation which was originally established by Royal Charter in 1606, is governed by its own unique Act of Parliament, and controlled by an independent board, the *Dover Harbour Board* (DHB), the owner of the land. Its legal position (as a trust port) and statutory corporation was originally established by Royal Charter in 1606. The present constitution of the harbour authority was created and accompanied by statute. The terminals are operated by private companies (e.g. Brett Hall Aggregates – Dunkirk Jetty) and the PA. The Dover Harbour Board (DHB) carries out cargo handling with stevedoring provided by private Companies (e.g. George Hammond Plc). DHB has a long trading relationship with its mainland European counterparts and this has enabled it to operate profitably. However, its main trading partner, the Port of Calais, currently suffers from congestion and this subsequently has a knock-on effect at Dover, (Baird & Valentine, 2007:77). The port location and the port area are presented to the following table 1.6.

Table 1.6: Port Location and the Port Area

Area of Port's land (km^2)	947 km^2 including the Port Zone
Port Jurisdiction limit onshore	1 mile Police jurisdiction
Area of Port's navigable water	14.966 km^2
Port Jurisdiction limit offshore	1 nautical mile
Geographic setting of Port	Engineered Coastline in South East Kent
Length, largest vessel	300.0m
Draught, largest vessel	10.0m
Tidal range	6.0m
Strom surge tide	0.39m below datum to 8.22m above datum
Use of surrounding land	Agricultural, Conservation / Protected areas, Forestry / Woodland, Nature, Recreational, Open water (lakes, rivers) and Urban City
Coastal and Marine Characteristics	Boulders, Cliffs, Rocky foreshore, Seawalls / Coastal defence, Offshore banks, Rivers, Sandy beach and Shingle beaches

Source: Port of Dover Environmental Office, "Waste Management Plan", 2007.

Port Business: The Port of Dover (DHB) is self-promoted as a “Short-Sea friendly port”, occupying a unique strategic position on the shortest and most efficient sea route from UK and Ireland to the European continent. The main business areas in the port include (see table 1.6): UK’S busiest Ro-Ro, for freight and passengers; cruise operations, with two dedicated terminals and a very successful marina; as well as general cargo, including fresh produce imports and bulk-handling business, including aggregates and grain exports (see table1.7).

Table 1.7: The Port of Dover – Main Commercial activities

Aggregates, (sand, gravel)	235.000 tonnes (2007 data)
Ro-Ro; RHVs	1.980.662 RHV’s
Marinas / Leisure	8.900 Yacht Nights (2007 data)
Cruise	132 Ships and 212.496 Passengers (2007 data)

Source: Port of Dover, DHB, 2007

DHB is the largest international passenger ferry port in Northern Europe (14.3 million passengers in 2007, see table 1.8), accounting for 50% of all Cross Channel passenger traffic. The ferry business is Dover’s core activity accounting for 80% of total revenue. In 2005, the port handled 13.4 million passengers, 2.7million cars and coaches and 2.1 million freight vehicles (DHB, 2007).

Table 1.8: Dover Ferry Operators

OPERATOR	ROUTE	SHIPS	DAILY RETURN SAILINGS
P & O Ferries	Dover-Calais	5 multi-purpose &1 freight	Up to 30
Seafrance	Dover-Calais	5 multi -purpose &1 freight	Up to 23
Norfolkline	Dover-Dunkerque	3 multi- purpose	Up to 10
Speedferries	Dover-Boulogne	1 Speedcat	Up to 5

Source: Port of Dover Handbook 2006-2007

Beside this significant activity, Dover is one of the busiest freight ports in Northern Europe (2.4 million units in 2007) and it is among the top ten UK ports in terms of tonnage (see table 1.6) upgrading its position (being nine in the rank) in 2007, with a tonnage of 25.1 million tonnes (see table 1.7). The main cargoes in the port are fresh produce, aggregate and grain, (see, fig1.6). The Port of Dover comprises of the Eastern Docks (see, fig1.5), Western Docks and the Marina (accommodating 10,000 visitor nights per annum).

Table 1.9: The Port of Dover in numbers from 2003-20007

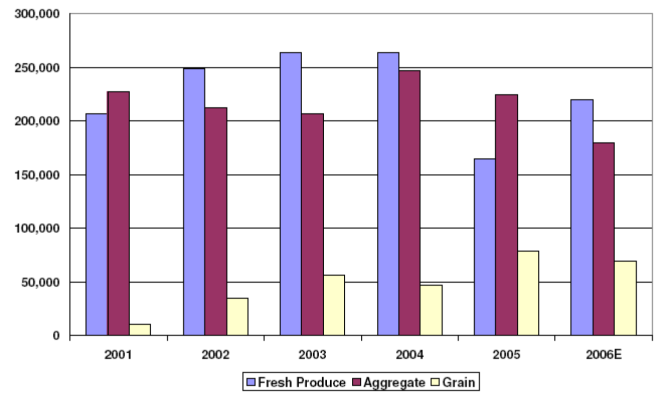
per year	2003	2004	2005	2006	2007
Tonnage (1)	18,261	20,170	21,145	23,805	25,114
Main freight units (2)	1.786	1.982	2.047	2.325	2.364
Passengers	14.681.003	14.333.663	13.348.829	13.797.874	14.287.318

(1) in million tonnes; (2) in thousand units, includes containers, road good vehicles unaccompanied trailers, rail wagons, ship-borne port to trailers and ship-borne barges only.

Source: DfT, Transport Statistics Report, Maritime Statistics 2007 / Port of Dover, Traffic Statistics

Fig. 1.6: PORT OF DOVER - DOVER CARGO TERMINAL in the Eastern Docks

DHB General Cargo Tonnage 2001-2006

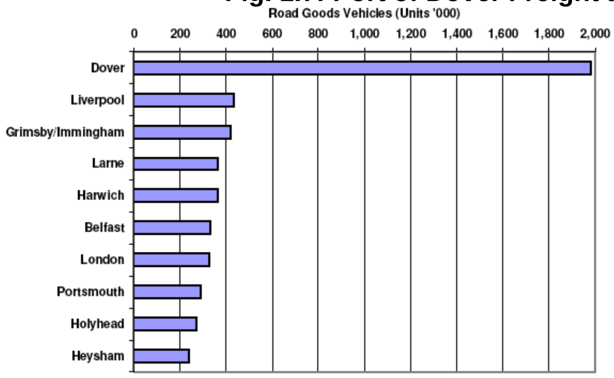


Source: Dover Harbour Board, (DHB), 2007

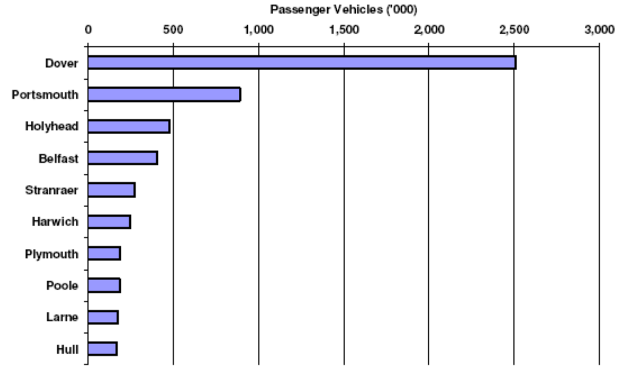
Ease of access and proximity to major markets have allowed DHB to build up a significant position in the UK’s imported fresh produce sector. *Fresh produce* is handled in the specialist Dover Cargo Terminal (DCT), one of the UK’s best fresh produce terminals of its kind, With two temperature controlled sheds providing 7.500m^2 of space and a full range of storage conditions, (-0ºC/+15ºC). Dover also has, two *cruise liner terminals* handling between 138,000 and 152,000 passengers per annum, second only to Southampton in the UK market. These two final key trades–the import of

fresh produce and the cruise ship market– were mainly developed in the early 1990s as part of a diversification strategy to offset competition from the Channel Tunnel (DHB, 2006).
A significant issue is the traffic related to the port operation. With freight and tourist traffic continuing to grow (see fig.1.7), the congestion on local roads and in the port is always a major factor in the development of the port (DHB, Environmental Bulletin 2006). The port monitor and control shipping movements through a *Vessel Traffic Management System* (VTMS) recently upgraded to allow for easier and faster exchange of information and to ensure safety in navigation in a full compliance with the IMO's security code.

Fig. 1.7: Port of Dover Freight and Passenger Vehicle Traffic, 2004



UK Freight Vehicle Traffic by Port 2004



UK Passenger Vehicle Traffic by Port 2004

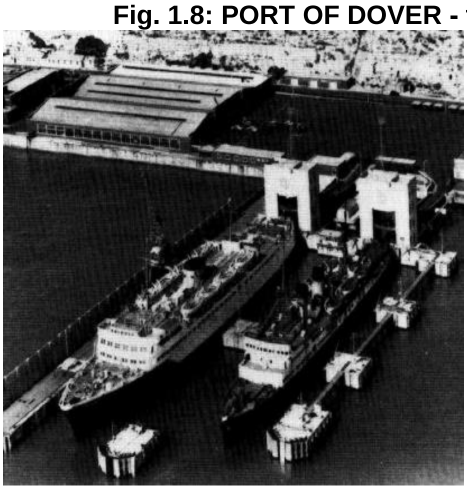
Source: DfT, "Focus on Ports", 2006

DHB employs directly about 6.700 people and supports 24.000 people in employment in the South East – 14.000 of these in the Dover district, (DHB, 2006). The Port is an active partner in regional projects working together with the local authorities, the Regional Development Agency and the Regional Assembly. The PA is also a partner in a number of trans-national projects supported by European funding.

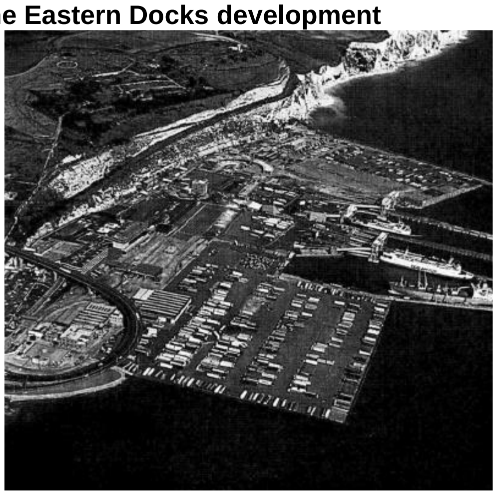
1.4 The port's reaction to changes in the port sector

The port of Dover development : To meet the unprecedented growth of traffic through Dover, a port whose immediate backcloth is formed by the famous White Cliffs of Dover, a great deal of engineering work has had to be carried out while maintaining port operations round the clock on a relatively small area of land. This has led to the port's need to become very "land efficient" in shore operations and to adapt to rapidly changing generations of roll-on, roll-off (Ro-Ro) ferry ships with very different berth-fits and mixes of traffic, (Potter, 1990). Fig. 1.8 and Fig. 1.9 illustrate the dramatic physical changes which have taken place in the Eastern Docks since 1950:

Fig. 1.8: PORT OF DOVER - the Eastern Docks development



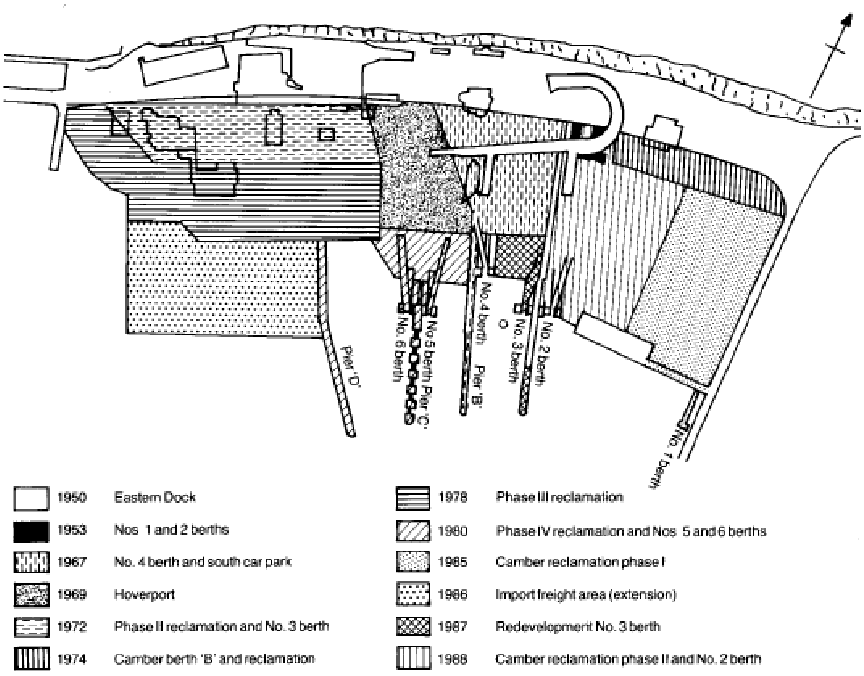
No1 and 2 berths at Eastern Docks, 1953



Eastern Docks, 1990

Source: Potter, "Port of Dover-its development, commerce and prospects", 1990.

Fig.1.9 : Physical changes at Eastern Docks since 1950



Source: Potter, "Port of Dover-its development, commerce and prospects", 1990

Potter (1990) points *"that the development of Dover's port facilities was led by market pressures through the introduction of political and technological change, and was driven by actual rather than forecast levels of traffic"*, (Potter, 1990:303). Furthermore *"as port development (from the early '80s), caught up with shipping trends, the accent gradually changed to forward planning and consideration of the likely impact of longer-term market forces on the shape and volume of Ro-Ro traffic"*, (Potter, 1990:305). The degree of technological change and the industry's perception of what is needed is demonstrated by a review of the port's more important projects (totalling well over €100 million at 1990 prices) carried out since 1976, (see following table 1.10).

Table 1.10: Review of the Dover's port capital projects until 1990

year	project	cost-£million
1976-77	New hover port	6
1976-77	Eastern Docks-customs, immigration, freight handling facilities	5
1982-84	Airport-type passenger terminal	9,2
1984	Tug haven construction – (2) Voith-Schneider tugs supplied	4,2
1985-86	New building facilities	3
1987	Computerized import freight entry system	1,5
1985-89	Elevated roadways for inward and outward traffic (fig.1.12)	11
1978-89	(3) berths demolition-(5)new Ro-Ro berths build-(2) Ro-Ro berths modified	18
1987-88	Tidal ferry berth construction	12
1977-90	(5) trances of reclamation totalling 20 hectares (fig. 1.11)	25

Source: extracted from Potter, "Port of Dover-its development, commerce and prospects", 1990.

Until 1990, the programme of capital expenditure reflected both the growth of business at Dover and the PA's desire to have a fully efficient port-handling system in position which would pay in full before the advent of the single European market in 1992 and the subsequent operation of the Channel Tunnel, (Potter, 1990). When the Channel tunnel opened in 1994, the cross channel ferry ports were concerned that they all sought to diversify into other business. In reality, the smallest ports were hit hard but Dover's trade continued to grow and the port built new berths to handle the increase, (Clarke, 2008). DHB, even after the Channel Tunnel existence, continues taking advantage of its proximity to Europe and has invested constantly and substantially in the harbour's development and upgrading, such as: the construction of two new Ro-Ro berths (8&9), started in 2002 and completed in 2005; the elevated roadway extension, a new dock exit road, a new passenger facility at the Eastern Dock (see Fig.1.10), and the supply of two harbour mobile cranes;

additional berths at Granville and Wellington Dock, which entered service in 2005; refurbishment of the seafront.

Fig: 1.10: Developments at Eastern Docks

Elevated roadway at Eastern Docks, 1989 **Two of the new generation berths at Eastern Docks**

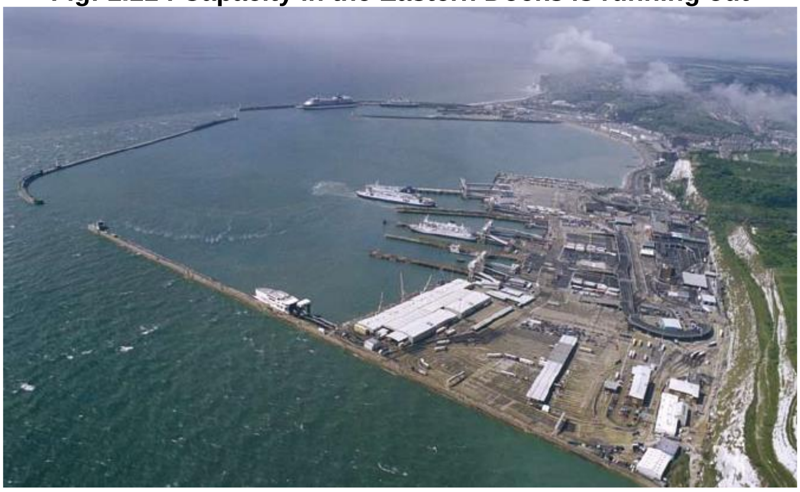
Port of Dover 30year Master Plan

In 2004, the PA decided that it was getting close to the end of incremental expansion and commissioned the Halcrow Group Ltd, to develop a 30-year master plan for the port. Halcrow was appointed to prepare a master plan to look at ways of maximizing the harbour's potential capacity and if necessary to propose new capacity outside the existing harbours 'walls', (Mannion, 2003). The master plan was developed in a staged approach.

Phase 1 in 2003 included traffic forecasts and assessments of potential port capacities. It estimated the ways the port could meet the expected traffic growth (Mannion, 2003), taking into account issues such as the European enlargement, and economic policies together with predictions in respect of gross national products, expected legislation and predicted congestions (DHB, 2004). The Dover ferry operation effectively forms a marine 'bridge' with the main trade of freight vehicles (trucks with the drivers on board), although private cars and coaches with passengers are also significant parts of the business.
The ferry operation: The majority of the ferries use berths in the Eastern Docks, within restricted manoeuvring space. The ARENA simulation model was developed to examine the movements of ferries in the whole harbour, which indicated a maximum safe limit of approximately 100 ferry calls a day into the Eastern Docks. The traffic through Dover is subject to frequent short-term fluctuations but issues such as European integration and possible UK road initiatives will have a long-term influence. The land side space in the Eastern Docks is very restricted and has to accommodate security facilities as well as check in and marshalling areas.

The first phase report published in July 2003 indicated how each trade sector could develop, concluding that varying degrees of growth could be expected in all sectors of the market served by the port. The report concluded that the Eastern Docks will reach capacity after the completion of berths 8 and 9 in 2005, (fig.1.11).

Fig: 1.11 : Capacity in the Eastern Docks is running out



Source: Dover Harbour Board (DHB)

Master Plan – Zoning Report 2005

Phase 2 began in 2004 preparing an incremental development plan, focused on maximising use of the existing harbour (both Eastern and Western Docks). It analyzed investment return and prioritised conflicting options. Phase 2, was first published in July 2005, setting out the likely development of the port as the basis for public consultation. It was finalized in November 2005 after completing the following three stages: 1. development options based on prioritisation of trade and review of port traffic forecasts; 2. capacity study of Eastern Docks, development options based on port trade growth; and 3. development of a feasible zoning plan covering both the Eastern - Western Docks.

Eastern Docks: Based on a developed timetable for 2034, the existing berth capacity of the Eastern Docks has been estimated as sufficient to cope with an increase in marine traffic. The overall capacity of the Eastern Docks has been determined by their ability to get ships to the berths and the road traffic in and out of the port, thus development for additional berths in the Eastern Docks has been excluded.

Western Docks: It was considered that several of the possible schemes for the Western Docks were expensive with the controversial commercial added value to be market defined. For example, developments resulting in the displacement of the aggregate facility in favour of cruise or other cargo berths have appeared not to be financially viable. Alterations to the port's entrance either by extending or removing the existing entrances and creating a single one have been also estimated not to be financially feasible, with the only benefit the reduction in wave exposure of the Western Docks development options; and the crucial disadvantage of negative effects on the ferry trade of the Eastern Docks, specifically in terms of congestion and delays.

Outside the Port: The costs to develop berths outside the existing port are approximated very high and with no reasonable financial return. The conclusions pointed that in the future, such a development may be possible, but certainly not until the capacity of the existing port has been maximised.

Phase 3, the *Zoning Plan Final Report*, followed by further public consultation, was published in November 2005. The conclusions of the report are presented in the table 1.10 below, and the main proposals for the Eastern and Western Docks are illustrated according to trade category in the port, plus proposals for upgrading the port's performance and actions to be taken.

Table 1.10: The Halcrow Report conclusions: Port of Dover30years Master Plan – Zoning Report

Ferry trade	Fast Ferry operations will probably be displaced from their sole use of the Hoverport, facilities could be elsewhere developed.
Cargo trade	Additional cargo operations would require suitable guarantees and long-term commitments to justify further investment; The aggregates trade should continue on its existing facility so long as possible.
Cruises	Cruise terminals probably provide sufficient capacity for the next 30 years.
Marina	The marina operation will be affected by the West Docks development – need of discussion about the alternative marina facilities.
Eastern Docks	**Western Docks**
▪ The present operation of Dover Harbour is focused on the Eastern Docks putting great pressure on the traffic flows along Townwall Street (city of Dover). ▪ Restrictions on marine access and road infrastructure mean that the Eastern Docks will reach capacity sometime around 2020. The exact date will depend on a large range of variables such as traffic growth, fleet configuration, operator behaviour, regulatory controls and safety regulations. ▪ There are a number of detailed measures which can be taken to improve current levels of service and possibly delay the date at which capacity is reached in the Eastern Docks.	▪ The Western Docks offers the most opportunities for rationalisation and further intensification of use, provided heritage and conservation issues are addressed, (see fig: 1.14). ▪ The Dover Harbour Board should start planning for the development of four (4) new ferry berths in the Western Docks; ▪ The Western Harbour development must be planned around the road access, ensuring that road safety and congestion are not compromised;
▪ Dover Harbour Board should actively pursue the option to develop holding or buffer areas on the two main approach routes to the docks. This will allow the traffic flows to be controlled, reducing congestion. ▪ The planning should take into consideration that the Western Docks development will raise a number of environmental issues and affect some listed structures and that discussion of mitigation and compensatory actions should start as soon as possible; ▪ A programme of stakeholder and public consultation is needed to ensure that all accept the development path and agree the steps needed to achieve it.	

Source: Halcrow Group Ltd, "Port of Dover 30year Master Plan – Zoning Report", 2005

2.0 COPING WITH ENVIRONMENTAL ISSUES IN THE PORT AREA

According to the ESPO Environmental Code of Practice (2003) the port area's (land & sea) the environmental problems are identified as: port development; dredging and disposal of dredged material; soil contamination; noise; port waste; water quality; air quality; biodiversity conservation. The way the port has been coped with its port area environmental issues from 2000-2010 is presented below.

2.1 Port Development in Dover – Terminal 2, Dover Western Dock

"The development will be vital to the port's future and provide a framework to ensure it is handed on to future generations with a strategic vision",

DHB, "Planning for the Next Generation-Overview of Proposals", March 2006

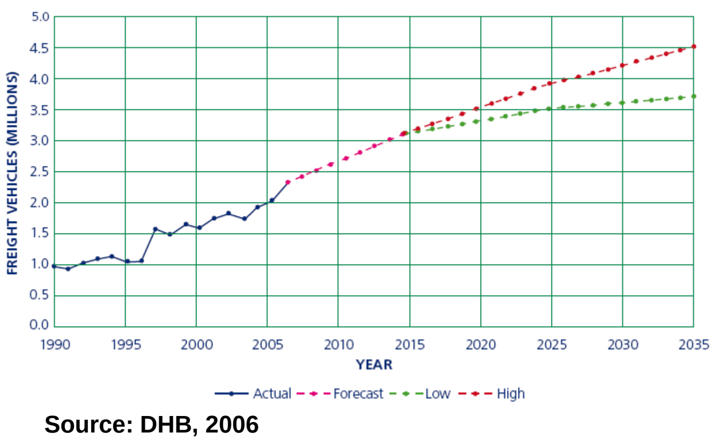
The planning assessment of the Halcrow Report (see previous section) has clearly indicated that encroachment into areas outside the current port boundary would be undesirable, particularly in terms of environmental protection of the important habitats to both the east and west of the port, and *that* this issue has been clearly identified by the relevant local authorities as likely to be unacceptable, (Halcrow, 2005:38).

Fig: 2.1: Dover Western Docks earmarked for redevelopment

Source: Dover Harbour Board (DHB)

Moving forward, the port has drawn up a 30-year plan for the future, including investment in a new terminal with four (4) ferry berths and a brand new marina. In March 2006, the DHB published its 1st consultation document "*Planning for the Next Generation-Overview of Proposals*", outlining the Board's proposals. Based on traffic forecast (see fig: 2.2) and the consultants forecast calculated in 2004, as well as the critical capacity constraints in and out of port area (see fig: 2.3), aiming to ensure its success in the ferry sector the board's proposals are presented below in fig: 2.4 and table: 2.1.

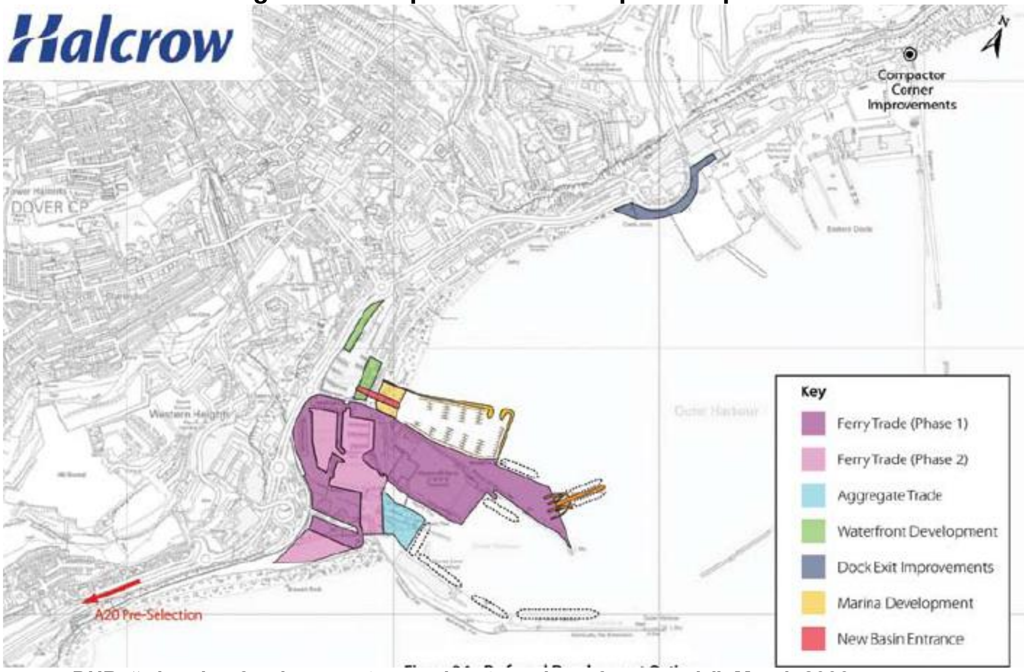
Fig. 2.2: Traffic forecast



Source: DHB, 2006

Fig. 2.3: Critical capacity constraints

Fig. 2.4 : DHB preferred development options



Source: DHB, "*Planning for the Next Generation-Overview of Proposals*", March 2006

Table 2.1: Dover Harbour Board (DHB) - Overview of proposals

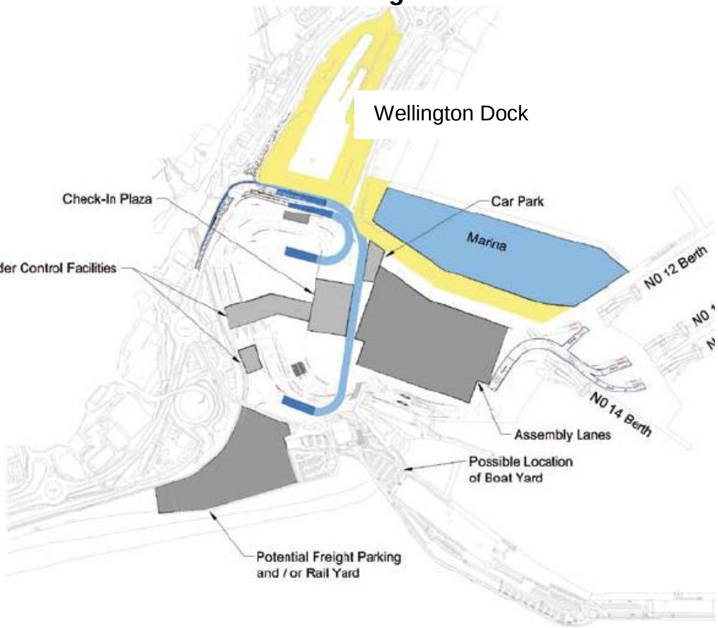
<table>
<tr><th colspan="2">Western Docks Ferry Terminal</th><th>Eastern Docks Ferry Terminal</th></tr>
<tr><td colspan="2">the development plan:</td><td>short term improvements:</td></tr>
<tr><td colspan="2">▪ <u>New ferry terminal in the Western Docks</u> with direct road access to the A20/M20 providing a location for up to <u>four new ferry berths</u>;
▪ One major investment rather a phased development;
▪ Modification of existing facilities in the dock;
▪ <u>New Marina Development</u>;
▪ Regeneration of seafront between Eastern-Western Docks</td><td>▪ Revising the A20 dock exit reducing congestion on the roundabout at the Terminal's entrance.
▪ Lane width and weighbridge improvements inside Eastern Docks.
▪ Extending the ticket check-in plaza (if required).
▪ Upgrading Berth 5 to accommodate larger vessels (if required).</td></tr>
<tr><td>Traffic Regulation</td><td colspan="2">▪ <u>Buffer zone concept</u>: a port buffer zone for trucks using the A20 with the possibility of a second for traffic arriving at controlling the flow of freight traffic into the port.</td></tr>
<tr><td>Cruise and Cargo</td><td colspan="2">▪ No new investment in the moment;
▪ DHB shall not hesitate to invest in both sectors in case of sound business.</td></tr>
</table>

Source: DHB, "*Planning for the Next Generation-Overview of Proposals*", March 2006

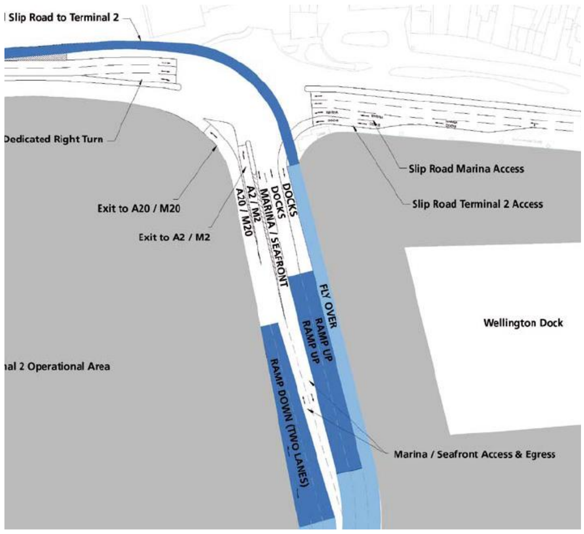
In sum, the "*Planning for the Next Generation-Overview of Proposals*" presented two main development proposals that the Board is hoping to accomplish in the future. These are: a second ferry terminal at the Western Docks (Terminal 2) and some means of regulating port traffic on the outskirts of Dover.

The *2nd Round Consultation Document* in January 2007 provided the public domain with more detailed information as a result of further studies undertaken within a time period of 12 months. These studies have mainly looked at the effect of Terminal 2 on the harbour's maritime regime (wave climate, tidal flow, navigation and sedimentation), the prospects of establishing a traffic management regime outside Dover (including virtual or physical Buffer Zones), and the prospects for connecting Terminal 2 to the main highway network and the future for marina facilities, (DHB, 2007). In addition, consideration has been given to how possible regeneration benefits- which might arise from Terminal 2- can be locked in, and how non-ferry port activities can also be developed. Before HRW commenced work, the port's operations management carried out a consultation with ferry operators' masters and fleet managers. The output from the various models and studies was sufficiently advanced for more detailed consultations with port users to be commenced, (DHB, 2007). Fig: 2.5 below, presents an initial view of the broad layout of Terminal 2 and the A20 access.

Fig. 2.5: Indicative TERMINAL 2 - LAYOUT PLAN



Yellow area relates to regeneration development



TERMINAL 2 – A20 ACCESS

Source: DHB, 2nd Round Consultation Document, 2007

The second round of consultation provided more detail of the location and scope of the proposed new Terminal and also made available an outline of the opportunity to bestow "Regeneration Development" of the seafront based on proposals to relocate the marina and develop the area around the Wellington Dock (see Fig.2.6).

Fig. 2.6: Potential Regeneration Development

Source: DHB, 2nd Round Consultation Document, 2007

Traffic Related Environmental Issues: The effects of port-bound traffic on the environment of Dover are well documented in a number of reports produced by Dover District Council. The DHB's long term objective is to develop a strategic solution to delivering traffic to the port which minimises the impact on the urban fabric of the town, and in addition, the traffic strategy needs to deliver vehicles to the port in a reliable way with minimal congestion, (DHB, 2007). According to DHB the Terminal 2 development should lead to a noticeable reduction in standing freight traffic along Townwall Street, as a significant proportion of traffic using the primary A20 route to the port will turn into the Western Docks before it reaches the city centre, thus resulting in an improvement to air quality.

Initial meetings have been held with the Highways Agency to discuss the study-area and the possible issues to be addressed; consequently, Halcrow Group Ltd has carried out a study to assess the viability and feasibility of connecting the new ferry Terminal 2 to the A20 trunk road, (DHB, 2007). A VISSIM traffic simulation model has been developed in partnership with the Highways Agency, concerning the *sharing of the traffic simulation model* in such a way that both parties can use it in order to examine the various proposals' traffic implications within the port and along the A20, and with the aim to assess the future transport strategy for the port regarding Terminal 2 and traffic regulation. The assessed scenarios included both 'with' and 'without' the use of traffic regulating Buffer Zones and the maximisation of *pre*- and *post*- check-in assembly space

within Terminal 2 in order to assist the ability of regulating the traffic flow. It is expected that both parties will have a clear understanding of the effect of adding Terminal 2 to the highway network.
The main purpose of the *3^{d} Round Consultation Document*, published in May 2008, was to provide information about the emerging findings of the Environmental Impact Assessment (EIA) - elaborated with regard to the proposed new Terminal 2. Apart from its purpose to identify and quantify the proposal's impact (positive or adverse) and to suggest the possible mitigations in order to reduce the effect of any adverse impacts, the EIA is one of the important supporting documents that will accompany an application for the consent to construct Terminal 2 under the Harbour Revision Order (HRO) process. Although subject to on-going consultation, the DHB was willing to be in a position to submit an application for an HRO by the end of 2008, (DHB, 2008).
The scheme for Terminal 2 remained fundamentally similar (with a short breakwater adding 100m to the length of the Admiralty Pier) proposed to improve wave climate in the harbour, (see fig:2.7).

Fig. 2.7: Terminal 2 - Marine structures & landside layout arrangements

Source: DHB, 3^{d} Round Consultation Document, 2008

Although it remains subject to further consideration, -since the visual impact of the alternative access options has been a major consideration-, the access arrangements have sought to safeguard that they are sized in such a way as to ensure the operational viability of Terminal 2. Nevertheless, the Board commitment has made sure that the visual impact of the proposals is to be mitigated by "the use of good design and sympathetic materials", (DHB, 2008).

Fig. 2.8: New developments at Dover & Calais

Proposed new ferry berths at Dover ***Proposed new ferry berths at Calais***

Source DHB, 3^{d} Round Consultation Document, 2008

"The developments at Dover and Calais truly represent an international project designed to improve the Trans-European Network connection that is vital to our interests as a trading nation", (DHB, 2008).

DHB considered any corresponding development at the Port of Calais, as evidently there would be little point in developing ferry facilities *if* there were not any corresponding developments on the Continental side of the Channel. The Port of Calais has been also engaged in a master planning exercise and it is expected to develop ferry facilities in a similar way and timescale as Dover.

The EIA process: In 1988 the EC Directive on *"the effects of certain public and private projects on the environment"* came into effect. The Directive -referred as the EIA Directive- was amended in 1997. For developments that are subject to certain approvals and consents, this Directive is transposed into the UK law through a number of relevant Regulations. Dover Terminal 2 Development Plan includes project infrastructure, buildings, roads, port installations and a marina complex, which are types of activities specifically mentioned in the text of the Directive, within Annex II. In addition, the following pieces of UK national regulations specify the requirement for an EIA to be undertaken: 1) Harbour Works (Environmental Impact Assessment) Regulations 1999 (as amended) for a HRO under the Harbour Works Act 1964; and 2) Marine Works (EIA) Regulations 2007 for consent under the Food and Environment Protection Act 1985, (DHB, 2008).
The EIA is required by the aforementioned legislation, but it is also part of the application process for a variety of other permissions needed (see box 2.1) for the redevelopment of Terminal 2.

Box 2.1: Terminal 2 redevelopment - Application & EIA process

<u>Application Process</u>	**<u>The EIA process</u>** **EIA**
▪ A Harbour Revision Order (HRO) in accordance with Section 14 of the Harbours Act 1964 for the majority of the landside and seaward works. ▪ A licence under the Food and Environment Protection Act 1985 (FEPA), Part II (as amended) to build on the seabed and to dispose of dredged material. ▪ Listed Building Consent for any works that may affect listed buildings or structures. ▪ Assessment under the Conservation (Natural Habitats) Regulations 1994. ▪ Consent under the Coast Protection Act 1949 and discharge consents under the Water Resources Act (1991) during construction and for the operation of the surface water drainage system on the quays after construction.	• **Consultation** • **Primary Data Collection** • **Specialist studies** • **Impact Assessment** • **Mitigation/Compensation Measures** • **Residual Impacts** • **Monitoring** • **Environmental Statement**

Source: DHB, 3d Round Consultation Document, 2008

<u>Environmental parameters</u>: The EIA identified a number of environmental parameters in order to fully assess the potential impacts of the development of Terminal 2 on the people, the landscape, as well as Dover's historic and natural environment. The environmental parameters selected by the EIA for the Dover Terminal 2 Development are: coastal processes; air, soil, water and sediment quality; marine and terrestrial ecology; fisheries; ornithology; noise and vibration; tourism and recreation; landscape and visual impact; historic environment; sustainability and socio economics parameters.

<u>Stakeholder management</u>: The application process involves a liaison with different government departments and statutory bodies, as the licences listed above may need to be sought from a different regulatory body in order to ensure that they have all of the information that they need to be able to grant the consent or licence. The EIA process forms a framework for much of that consultation and its Environmental Statement should address all of the issues which are requested by the government advisors and regulators, (DHB, 2008).
Consultation, as the first stage of the Terminal 2-EIA process was managed through a Stakeholder Management Plan, (DHB, 2008). This plan recognised that different groups of people should be consulted in different ways to ensure that everyone has a chance to comment on the proposals. To this end, the Stakeholder Management Plan has identified a number of key groups and set out the approach that each group should be consulted:

Box 2.2: Stakeholder Management Plan – key groups identification

Regulators group:	for legal remit in consents and licences e.g. Environment Agency.
	for engagement with bodies that may contribute to the project and to address technical issues
Stakeholder groups:	e.g. Dover District Council, Kent County Council and English Heritage.
Existing forums:	to maintain clear communication to wider stakeholders e.g. Port Consultative Committee.
Topic groups:	additional smaller, more focused groups with particular interests,
	e.g. historic environment topic group meeting.
Wider public:	to inform the local public through exhibitions, newsletters and brochures.

Source: DHB, 3rd Round Consultation Document, 2008

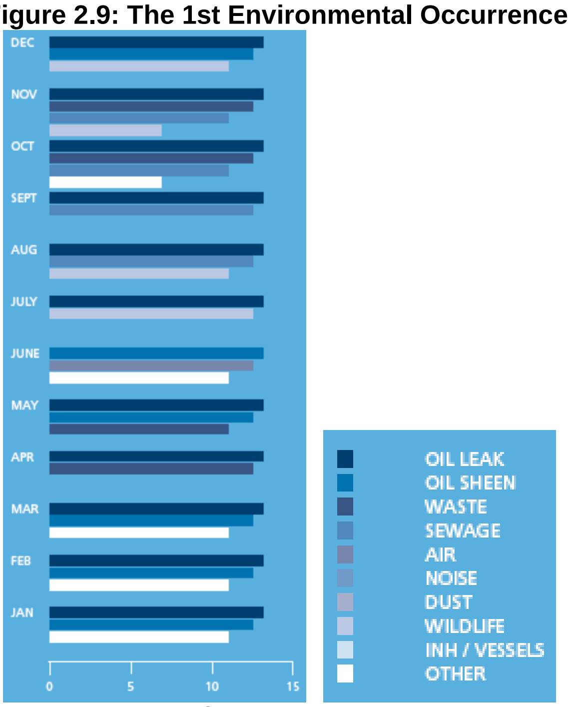
Furthermore, the EIA process presented in terms of stages and it was suggested to be *iterative*, so feedback loops to be at time, (DHB, 2008), for example: *"it may be that the findings of a study suggest that an alternative design for a particular parameter would be more environmentally benign for that aspect. It would then be necessary to look at the effects on other aspects from that change in design"*, (DHB, 2008).

In the 2000s port development was indeed a priority issue for the port of Dover. Apart from this important issue with environmental implications, DHB has fully endorsed the principles of the European Sea Ports Organization Environmental Code of Practice, (DHB, Environmental Policy, 2008) and is committed to "green" business practices by implementing an Environmental Policy to minimize the environmental impact of port operations and by maintaining a good environmental management and monitoring system. While the port had been already EPF/PERS certified, in 2004 an important component of the port EMS introduced which records of "all significant environmental occurrences to monitor performance", will be reported to the DHB on a monthly basis, (DHB, Environmental Bulletin, '05, '06,'07). The DHB's Environmental Occurrence reporting (see:21) is a source for identifying the environmental problems that the port faces. The following sections (2.2-2.8) present the most significant environmental issues in Dover as they occurred through the Environmental Occurrence Reporting System (2004-2010).

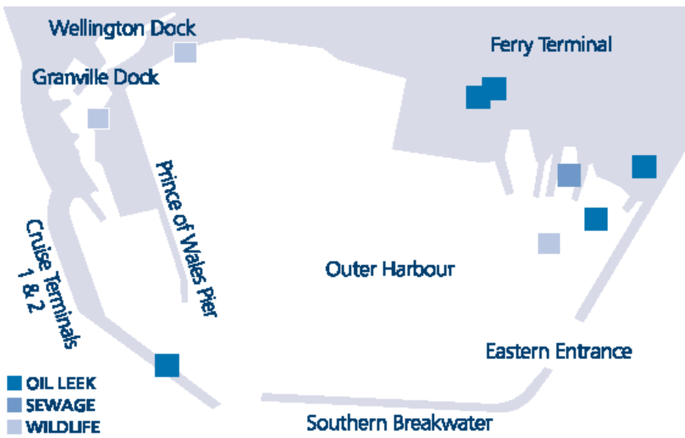
2.2 Soil and water contamination

The first reported Environmental Occurrence in 2004; and a typical month of environmental occurrence in the Port of Dover identified <u>oil leak</u>, <u>oil sheen</u>, <u>waste</u> and <u>sewage</u>, as priorities of the port's environmental issues. An overview of the 05's-07's Environmental Occurrences can also be seen in the following graph (Fig:2.9). The most critical year appears 2006 with a total of 106 Environmental Occurrences, (17 of which were major incidents). In line with all the reports from '04-0'7 most occurrences arose from <u>oil spills</u> or <u>sheens</u> and were reported by operational staff.

Figure 2.9: The 1st Environmental Occurrence in 2004; a typical month of environmental occurrence

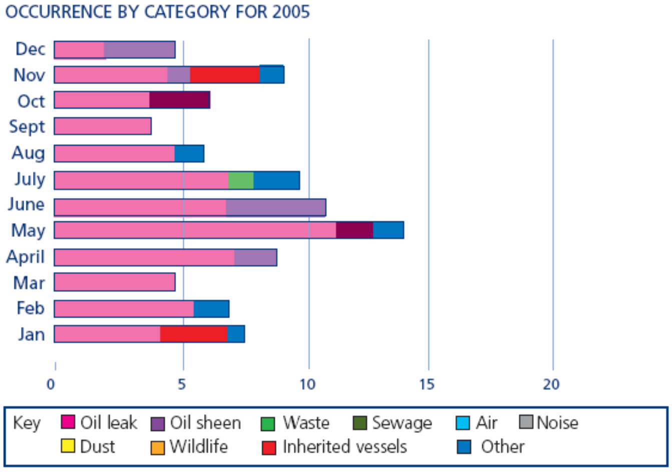


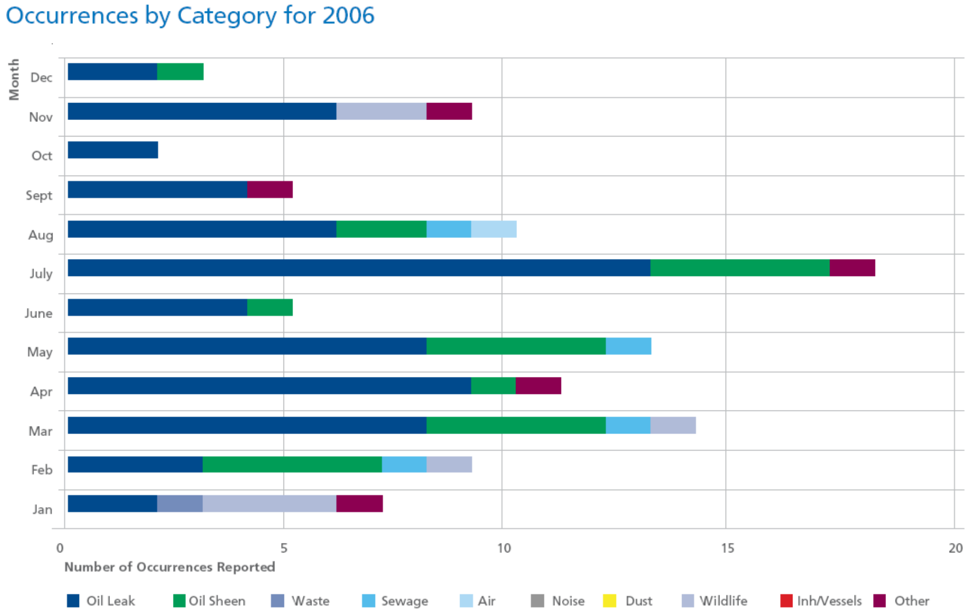
Source: DHB, Performance Report 2004.

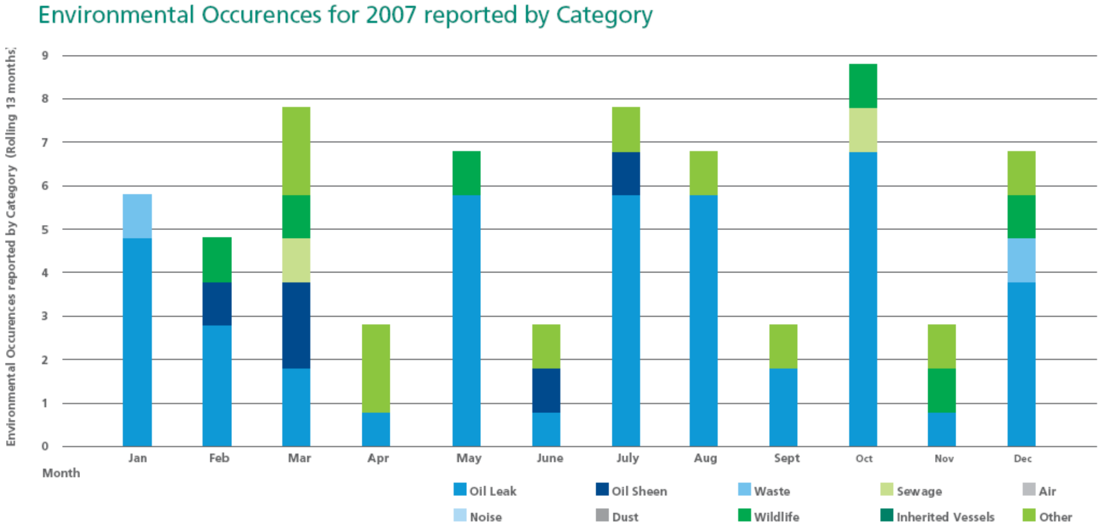


A typical month of environmental occurrence in the Port of Dover

Fig. 2.10: Port of Dover - Environmental Occurrences in 2005-2006-2007







Source: Dover Harbour Board – Environmental Bulletin 2005; 2006; 2007.

In sum, based on the environmental occurrences reports most environmental problems until 2010 had arisen from landside oil spills, predominantly from minor diesel spillages from vehicles passing through the port. Landside oil spill procedures are prepared by the port's Environmental Office and are practised alongside the statutory Oil Spill Contingency Plan (see section 3.1) which is also available on the Port of Dover website.

2.3 Port Waste and sewage

The Merchant Shipping (Port Waste Reception Facilities) 2003 Regulations came into force in 2004. These regulations initiated the beginning of a new method in waste disposal for ships and include the ships' requirement to complete a Waste Notification Form 24 hours prior to their entrance into the port so as to announce their intentions for waste disposal. This system was implemented by the Port of Dover and was trialed on cruise vessels throughout the summer of 2004. These regulations also prompted a thorough review of the Ships Waste Management Plan which was completed and approved by the MCA in October 2004 (see the following section 3.2), (DHB, 2004).

To deal with inherited waste from visiting vessels, the Port of Dover provides a facility for its cruise and cargo vessels so that they can offload scrap metal, crushed glass, wooden pallets and toner cartridges, (DHB, Environmental Bulletin, 2005).

2.4 Air quality

Like in many other ports and port-cities the port traffic has increased and the effects on the city have risen to such an extent that the interaction between the two is now a major issue.

- The air quality of the port and its immediate surrounding remains a sensitive local issue even today with most emissions originating from port-related traffic. Particularly the road network to the port is prone to congestion thus affecting the city's environment and it constitutes an issue to the local community, both in congestion and air pollution terms.

A well-defined position, positively arguing for the new development of Terminal2 (T2) in the Western Docks, is the *congestion* reduction in the Eastern Docks and the town which would result into an air-quality improvement. Information from various technical assessments and studies formed the basis for the preparation of the Transport Assessment needed to support the Harbour Revision Order application for the T2 development. To progress the development of the Transport Assessment, regular meetings and discussions were held with transport officers from both Kent County Council (KCC) and Dover District Council (DDC), emphasizing that air-quality is as important as the port itself, (DHB, 2008). Furthermore, the *buffer zone concept* in the A20/Townwall Street was based on the simple idea that it would provide the opportunity to monitor and regulate the flow of freight vehicles off the highway prior to their arrival at the port. This would significantly reduce queuing throughout the town, which will be even more important with ferry terminals on both sides of the harbour, (DHB, 2006); nevertheless, it was not approved as viable (see attached table A /air quality). Finally, it is expected that Terminal 2 will be able to provide a small internal buffer zone which will contribute to the overall position, (DHB, 2008).

On the other hand, the increase in *shipping activity* at the Western Docks may negatively affect air quality although this is expected to be tempered by the increasing use of low sulphur fuels for shipping. In June 2002, the Port of Dover Eastern Docks was designated as an Air Quality Management Area (AQMA) by Dover District Council. Subsequently 2 monitoring stations were set up at Langdon Cliff and East Cliff in order to monitor Sulphur Dioxide levels. Whilst some elevated levels of Sulphur Dioxide were recorded at both these monitoring stations, it has been noted that excesses are largely dependent on meteorological conditions where atmospheric temperature, humidity and wind direction are factors which influence the dispersion of sulphur particles. In August 2006, all the Port of Dover's ferry operators switched over to using low sulphur fuel (<1.5%) in line with the EC Directive 2005/33 which came into force on the 11 August 2007.

In August 2007, the North Sea and the English Channel were designated as a SECA (Sulphur oxide Emission Control Area) under EU Directive 2005/33. When a vessel approaches SECA, the fuel must be changed over to the 1.5% sulphur content fuel oils, with all original fuel being used /consumed before the vessel actually enters the area, (DHB, 2006).

In November 2006, the East Cliff monitoring station was closed and relocated to a site within the eastern docks. Nitrogen Dioxide emissions from both shipping movements and freight (HGV's) are being monitored in order to identify the relationship with excesses of Sulphur Dioxide. Regular air quality monitoring using the Ringleman Scale continues to take place by the DHB, (DHB, Environmental Bulletin, 2007).

- Air-quality remains a key issue for the port following the designation of the Air Quality Management Area (AQMA) in 2002 for Sulphur Dioxide (SO_2) and a similar designation regarding Nitrogen Dioxide (NO_2).

In 2005 the Dover District Council (DDC) published its final Air Quality Action Plan. Since then, annual progress reports have been produced publishing the monitoring results. The results show that there has been a dramatic improvement in air quality within the AQMA since low sulphur fuel (1.5% sulphur) became a requirement for ferry operations in 2006.

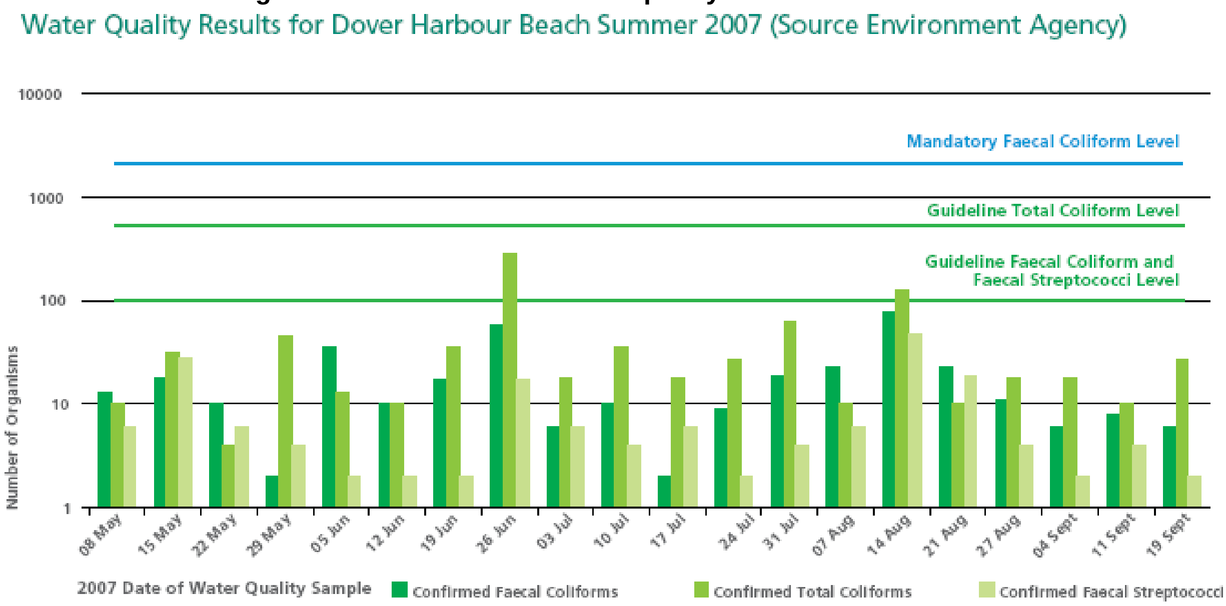
In April 2010, an amendment to the Merchant Shipping (Prevention of Air Pollution from Ships) Regulation 2008 came into force requiring all vessels in port, for more than two hours, to burn 0.1% sulphur fuels. In the port of Dover due to quick turnarounds this will have little impact on the ferry operations, but it will have an effect on the cruise and cargo vessels (DHB Environmental Bulletin, 2010). Since July 2010, new IMO legislation has been requiring a 1% sulphur limit for fuel used within the North Sea and the English Channel Sulphur Emissions Control Area, which is expected to lead to further improvements in the air quality locally (DHB Environmental Bulletin, 2010).

2.5 Water quality

"It is important to make sure that the port is not polluting the water or that another source is polluting the water in the harbour", (DHB, *"Why do we measure water quality?"*).

The water quality in Dover Harbour is measured to make sure that the water is safe for the people who come into contact with it. It is measured by the DHB Environment Office, an outside consultant and the Environment Agency. The following water quality indicators are surveyed biannually in the harbour by an external consultant: dissolved oxygen, total suspended solids, temperature, salinity and pH, as well as bacterial levels (including testing for the presence of Salmonella). The consultants also measure the coliform, and Enterococci levels, which are compared with the EU Bathing Water quality standards (see Fig. 2.11).

Fig. 2.11: Port of Dover – Water quality results Summer 2007



Source: DHB, Environmental Bulletin 2007.

In addition, the DHB's Environmental Office also carries out monitoring using Quanti-Tray® defined substrate technology across the port area in the winter, again in the summer and weekly on the beach throughout the bathing water season, (February and August), to test for the following *water quality indicators*: dissolved oxygen, total suspended solids, temperature, salinity, pH, the presence of Salmonella and Coliform, Enterococci and E-coli levels (DHB, Environmental Bulletin 2010). Total Coliforms, Enterococci and E-coli (see box2.3) are microbiological parameters used as an indication of pollution by pathogen containing material i.e. faeces. Different micro- organisms have different advantages as indicators due to their reactions to environmental conditions and varying presence within human and non-human pollution sources.

Box 2.3: What do the results tell us?

- **Total Coliforms** are bacteria found in faecal matter but can also be found in a variety of non- sanitary significant sources such as soil. It is therefore used as a conservative risk management tool.
- **Faecal coliforms** are a subset of the coliform bacteria group that are thermo-tolerant. Most of the thermo tolerant coliforms are linked with faecal contamination therefore giving a more absolute but not definite indication of the presence of pathogens.
- **E-coli** is the pathogen that the coliform tests are used to indicate. Its presence gives a high certainty of faecal contamination but does not allow the source to be identified.
- **Salmonella** is also a pathogen but is only tested on a qualitative not quantitative basis i.e. present/not present.
- **Faecal streptococc**i are found abundantly in the faeces of warm blooded animals. Different species excrete varying proportions of faecal coliforms to faecal streptococci which allows the source of the pollution to be identifiable. An FC:FS ratio of greater than 4 indicates fresh human faeces and less than 0.6 indicates animal faeces. However, these results must be viewed sceptically as the death rate of faecal streptococci once released from the gut is greater than that of Faecal Coliforms. This ratio should not be used at all if the Faecal Streptococci counts are less than 100/100ml. It is also worth noting that some species of streptococci are associated with insects.
- **Enterococc**i is a subset of faecal streptococci, used as a more specific indicator of sanitary quality.
- The physio-chemical parameters that are most indicative of sewage pollution are ammonia and suspended solids.

Source: DHB, *"Why do we measure water quality?"*

Compliance with EU Bathing Water standards is voluntary for the port as the area is not classified as a 'bathing water area'. However, due to the nature of activities on the beach, it is desirable to meet the standards featured in the 'Good Beach Guide' by the Marine Conservation Society. The water quality in the rest of the port is also good and, in many areas, compliant with the mandatory levels of the Bathing Water Directive.

Marine Ecology

Algal monitoring: There are 10 certain sites across the ports which are checked quarterly per year by photographic monitoring of the abundance and types of algae present, as the regular algal monitoring can quickly reveal problems with the environment. Any changes to algal status of the season, compared to the previous season is noted and investigated. If a sudden increase or decrease in algae is detected, it's an evidence of an imbalance in the ecosystem. An exceeding amount of algae can have a negative effect on the environment's health as it will remove too much oxygen from the water reducing the harbour's ability to sustain life. An increase in algae could be caused by an increase in nutrients in the water from pollution or it could be instigated by a different pollutant that reduced the population of the grazers on the algae. In 2010, the port's algal monitoring sites were showing similar levels of abundance and diversity as in the previous years, (DHB, Environmental Bulletin 2010).

Benthic Fauna Monitoring and Trawling: Regular benthic fauna monitoring and trawling within the port, enables the Environmental Office to monitor signs of environmental disturbance and if necessary to take remedial action. Sediment sampling and benthic fauna analysis are carried out four times annually starting in 2006. As species found in the port area are a product of the environmental conditions and because of the fact that new legislation has moved towards habitat based objective to show a healthy environment, the port of Dover has included in its monitoring system of various pollutants the *"need to monitor their impact on the ecology"*, (DHB, *"Why do we monitor the species?"*). Monitoring is undertaken on a quarterly basis throughout the year; the technique uses mud grab sampling which is exactly the same as the dredging mud grabbing. There are ten (10) monitoring sites around the port, two of which are just off Shakespeare Beach and Langdon Bay. The results have shown that the activities within the harbour do not have a detrimental effect on the density and variety of benthic fauna, (DHB, 2006).

The Environmental Office has undertaken quarterly monitoring within the port's confines, aiming beam trawling to provide valuable information about the presence of marine macro fauna. Trawling is also carried out four times a year to show the variation during each season, towing a 10m beam trawl by the port survey vessel 'Diana'. Trawling was conducted in February, May, August and November of 2006 and 2007. In August 2006 and 2007 studies commenced to investigate the data held within the trawling database. The results from the species, sediment type and tidal information were all integrated in the Environmental Database to give indications of population changes, environmental disturbances and the role of scavengers, detritus and filter feeders. Information has been collected since the monitoring began back in 1992 enabling a thorough analysis of the impacts on the environment created by port development. The results so far show that a good stable population of fish species exist, (DHB, 2006) and species diversity in the Outer Harbour following the construction of Berths 8 & 9 in 2005 and the Reclaim Area were able to recover to pre-construction levels within 2 years, (DHB, 2007). Much of the species are representative of *"an ecosystem which is naturally resilient to the impacts of dredging and other harbour operations"*, (DHB, Environmental Bulletin 2010).

2.6 Dredging and disposal of dredged material

Soil and sediment contamination is a negative factor able to produce environmental impact connected to dredging operations and furthermore to the disposal of the dredged material. Trawling monitoring in 2006 and 2007 produced positive results for the port environmental condition after the Berth 8 & 9 development, where dredging operations took place extensively. To avoid potential impacts during the T2 development, a Conceptual Side Model for soil contamination was produced, (see attached Table A). The management response to dredging is reflected on monthly bathymetric charts, volumes, target contaminants, (Paipai, 1999:41), although environmental reports do not refer to any particular effects of dredging or of problematic dredged material disposal.

2.7 Noise

Noise pollution has become a progressively significant environmental issue for many ports. In the 'ESPO/EPF Port Environmental Review 2009', ports identified noise as the latest top environmental priority of the sector. In the port of Dover as in many ports noise is generated by ship traffic, road traffic and cargo operations.

The port monitors noise to ensure compliance with current standards and regulations and the Environmental Office carries out quarterly noise monitoring. In 2004, DHB's Environmental Bulletin, in line with the port's draft Green Policy, referred that ten minute readings were taken quarterly throughout the year, with the average maximum and minimum readings varying between 60 to 91dba depending on the location and current activities within the area.

Although the port has long established a robust monitoring system on the wide range of natural and artificially created habitats within and immediately outside the port, the DHB reports did not refer to specific noise monitoring data. Noise problems related to the port are mainly traffic implications. Environmentally-related assessments, particularly related to noise, were undertaken, at the Terminal2 new proposals -not as part of the port's monitoring system. Since 2004, the port's Environmental Occurrence Reporting System has supported the work carried out by the Environmental office. The systems' monthly reports did not reveal any significant noise incidents in the port area. Paipai, (1999:40) informs that since the mid 1990's, the port's main management response to noise reflected on the production of environmental noise maps. The EPF NoMEPorts research project (2005-2008) contributed to the definition of a common harmonized noise management approach and noise mapping by producing a Good Practice Guide on Port Area Noise Mapping and Management (NoMEPorts, 2008), available to all EPF member ports.

2.8 Biodiversity & Conservation

The Halcrow Zoning Report identified the constraints preventing the development of any future port expansion beyond the existing port boundaries, -the cliffs and the town's building development are referred as such. The coastline from Port of Dover to Kingsdown is of national importance (due to its geology, geomorphology and varied flora and fauna, including many rare species). The Shakespeare Cliffs behind the Eastern Docks, are designated as sites of *Special Scientific Interest* (SSI), providing the habitat for rare species and migrating birds (Halcrow, 2005:13).

The port's management response to habitat and ecology reflects the involvement of the Kent Biodiversity Action Plan and Habitat Atlas, (Paipai, 1999:40) thus, the port has developed:

Ornithological surveys: involving monitoring bird activity within the Port of Dover;

Winter Bird *and* *Breeding Bird Surveys*: which are conducted throughout the Eastern *and* the Western Docks counting birds within the Port's limits and those which are within 50 metres radius off the port limits. The surveys involve counting and mapping all birds present -including any breeding activity during the Breeding Bird Survey. Winter Bird Surveys are conducted twice a month between October and February; Breeding Bird Surveys are also conducted bi-monthly,

between March and May exclusively. Flight paths are also noted for birds in transit. The PA is concerned because “mapping the location of each bird sighting raises awareness of bird activity and may affect future developments”, (Port of Dover, *“How do we monitor bird activity?”*).
Nests and breeding activity over time creates baseline data used to help detect changes in the abundance, distribution, and overall productivity of bird populations, aiming to develop conservation guidelines or implement management techniques. Moreover, working towards this the port aims to schedule planned developments in order to create minimal impact throughout the breeding season by using the data collected from the bird surveys.
Sub-littoral surveys: Environmental consultants continue carrying out biannual surveys of the beaches at Langdon Bay and Shakespeare cliffs. Surveys are undertaken at a spring low water tide where the full extent of the foreshore can be examined, from the extreme low water mark with submerged channels to the upper most part of the beach at the base of the cliffs, where chalk boring algae predominates. The 11^{th} and 12^{th} surveys of marine biodiversity on the foreshores were undertaken in February and November 2007. The surveys identified that the two beaches biodiversity has not changed considerably since monitoring began there, and the port’s activities appear not to have significant environmental impacts on the surrounding area, (DHB, 2007). DHB aims to conserve the port’s natural environment both in terms of physical and biological properties. Habitat variety, species richness and species abundance at both sites continue to be categorised as very good, (DHB, 2007).

3.0 RECURRING THE PROBLEMS : THE PORT MANAGEMENT EFFORTS

On Monday 19th May 2008, at its Annual Consultative Meeting, the Port of Dover reported that it’s getting more successful every year. Forty-thousand extra freight movements in 2007 pushed the port to a new high record of 2.36 million and tourist car journeys -increased by seven per cent to more than 2.8 million, the highest since 1999. For the sixth year running, the port authority’s turnover augmented with revenues reaching £57.7 million, an increase of £1 million over 2006. Profit before tax significantly rose to £20.6 million as a result of improved efficiency and increased investment income, (Port of Dover, Annual Consultative Meeting, 2008).
Since the port’s Green Policy in 2004, the DHB’s Environmental Report (2007) was more extensive compared to the previous year, providing detailed information of the green accomplishments - particularly the green management used for the port’s “greening”. The port management efforts tackling environmental issues in the port are in sum presented in the following table 3.1.

Table 3.1: “Green” management efforts tackling environmental issues in the Dover port area

Tasks	Action	Responsible post	Timescale
	Oil spill contingency planning		
Tasks	**Action**	**Responsible post**	**Timescale**
O1	**Oil spill contingency training program**	Initiated by port’s Environmental Office	2006
O2	**Oil spill contingency plan**	Produced by: port’s Environmental Office Authorised by: Harbour Master Approved by: Maritime Coastguard Agency	Issue Date: November 2008
	Waste management		
W1	**Port of Dover Waste Management Plan**	Produced by: port’s Environmental Office Authorised by: Harbour Master Approved by: Maritime Coastguard Agency	Issue Date: December 2007
W2	**Recycling campaign**		
	Environmental Management System (EMS)		
Tasks	**Action**	**Responsible post**	**Timescale**
P1	**Port Environmental Review System (PERS)**	port’s Environmental Office	1^{st} PERS certification 2003 2^{nd} PERS certification 2006
I1	**ISO 14001 Environmental Certification**	port’s Environmental Office	1^{st} ISO 14001 certification 2008
EOR1	**Environmental Occurrence Reporting**	port’s Environmental Office	Since 2004
SDM	**Self-Diagnosis Methodology**	port’s Environmental Office	Since 1998
EM1	**Environmental Monitoring programme**	port’s Environmental Office	Since 1992
	Energy and Water Policy		
E1	**Energy Consumption**	Partnership with Carbon Trust	Since 2005
CF1	**A carbon footprint for the Port of Dover**	CarbonPlan consultancy	Initiated 2007

3.1 Oil spill contingency planning

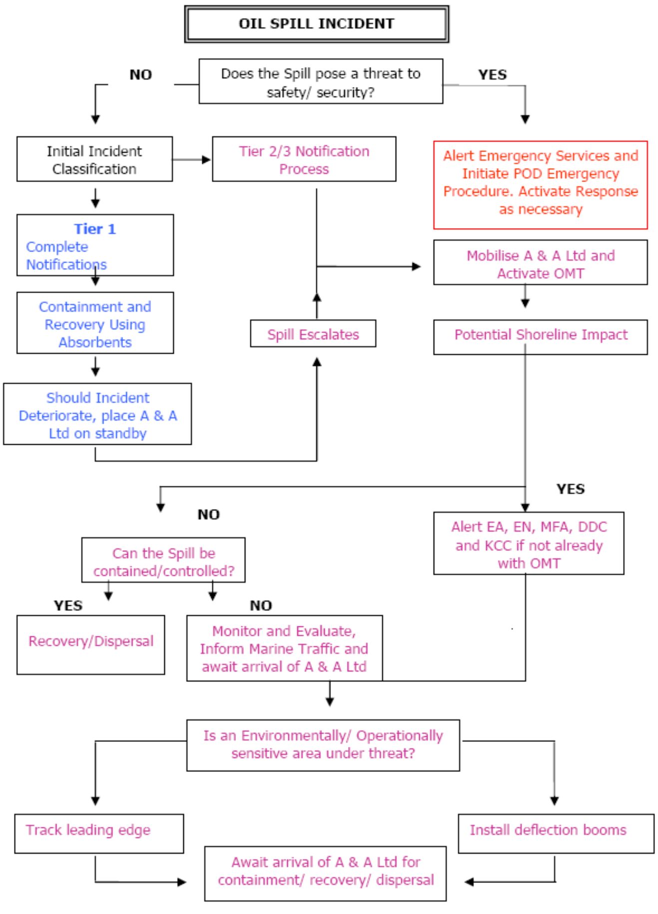
Throughout 2006 and 2007, the Environmental Office completed oil spill response training for all Port of Dover operational staff working on land and water in the Eastern and Western Docks, aspiring that after these training sessions, staff members could respond to a spill, co-ordinate the clean-up operation and gather all the relevant information in order to complete an Environmental Occurrence Report. Whilst the training programme could not reduce the number of incidents, it was expected that it could minimise the impact of any resulting pollution upon the environment. The DHB Oil Spill Contingency Plan comprises the planned emergency response to a marine or shoreline spill.

Table 3.2: Oil spill contingency plan - Revision History

Date	Part	Brief Details
07/08/98	Initial Plan	Written and Approved by MCA
18/12/01	Plan	Whole Plan Reviewed
01/06/05	Plan	Revised
2007/2008	Plan	Whole Plan Reviewed & Updated

Source: Port of Dover - Oil spill contingency plan, November 2008

In November 2005, the Port of Dover was required to meet the Control of Pollution (Oil storage) Regulations 2001, (DHB, Environmental Bulletin, 2005). In November 2008 Dover issued its latest reviewed and updated Oil spill contingency plan, (see table 3.2).



Source: Port of Dover - Oil spill contingency plan, November 2008

The purpose of the plan was threefold, 1) to guide port personnel through the procedure of managing an oil spill within the port; 2) to mitigate the impacts of an oil pollution incident; and 3) to facilitate those involved in the response of a pollution incident to hastily broadcast information to the implicated parties and to ensure the optimal deployment of available equipment. The plan is specifically detailed to enable DHB to respond to a Tier 1 marine based oil spill pollution incident within the Port of Dover, and to assist external parties with a Tier 2 or 3 incidents within the port's 1 mile jurisdiction. Furthermore, the Port of Dover has the right to plan for Hazardous and Noxious Substances and resulting from this there is a contract with Veolia waste contractors.

According to the plan DHB has the responsibility to respond to an oil spill within the port regardless of its classification (see table: 3.3). The Maritime and Coastguard Agency is the competent national authority designed to oversee all matters pertaining to the Oil Pollution Preparedness, Response Operation (OPRC) Shipping Convention under the Merchant Shipping Act 1995 as well as the Merchant Shipping and Maritime Security Act 1997. In the case of an oil spill incident within the DHBs jurisdiction, it is the Harbour Master's responsibility to co-ordinate the oil spill response.

Table 3.3: Oil spill classification in the UK

Tier 1	A small operational spill (0.2m 3) when events can be controlled immediately (within 30 minutes of initial notification) by on-site resources, without recourse to outside intervention.
Tier 2	A medium sized spill (0.2m3 – 50m3) beyond the capability of Dover Harbour Board that would require the assistance of outside contractors.
Tier 3	A large sized spill (50m3) beyond the capability of local and regional resources, this would be dealt with using the assistance of outside contractors and outside agencies

Source: Port of Dover - Oil spill contingency plan, November 2008

The plan also incorporates detailed procedures for the waste disposal under the relevant UK legislation and identifies the responsible oil spill management team (see table: 3.4).

Table 3.4: Oil Spill Management Team

Oil spill Management Team- Chaired by Harbour Master	
Tier 1	**Tier 2 - 3**
Dover Harbour Master Emergency planning Co-ordinator Public Relations Manager Environmental Officer Port safety Officer	Kent County Council Dover District Council MFA English Nature MCA/SOSREP Environment Agency Tier 2 Contractor Salvor Vessels Agent Emergency services ITOPF / P&I Club

Source: Port of Dover - Oil spill contingency plan, November 2008

The UK has obligations under the Safety of Life at Sea Convention (SOLAS) to provide shelter for maritime casualties which may require use of waters within a port as a place of refuge. Maritime & Coastguard Agency (MCA) and SOSREP are responsible for discharging this SOLAS obligation and it is the Port of Dover's responsibility as a PA to work with the MCA and SOSREP. The role of SOSREP was formally introduced in 1999 and it has the power to oversee, control and intervene in any salvage operations in UK waters involving vessels or fixed platforms where there is a significant risk of pollution. Ultimately, it will be the responsibility of SOSREP to take control of a vessel in distress and bring it into the Port of Dover.

Oil pollution incidents that take place outside DHB's controlled waters can be inherited (i.e. spills influenced by wind and tide are sent in the direction of the port). With regards to an inherited incident there would be a direct response from the port with its own resources and DHB would be under the strict guidance of the MCA and SOSREP.

Apart from appointing training, health and safety action and reporting procedures to all members of the Oil Spill Management Team (see table: 3.4) the Dover's oil spill contingency plan also introduces -in sum- the potential environmental risk after a major oil spill occurs around a particular sensitive area within the port's jurisdiction, suggesting some immediate action to be proceeded with the aims presented in box: 3.1.

Box 3.1: Environmental Impact Assessment scope

- Collect baseline data in the early stages of an incident for comparison 'before and after impact'.
- Quantify the nature and extent of short, medium and long term impacts in programmes.
  that are co-ordinated, value for money, 'fit for purpose' and where appropriate cost-recoverable.
- Meet government, public and media expectations for robust information on the short, medium and long term environmental impacts of pollution incidents.
- Provide agencies with sufficient information about the condition of important wildlife and conservation features to satisfy the statutory reporting duties of conservation agencies and to inform Government.

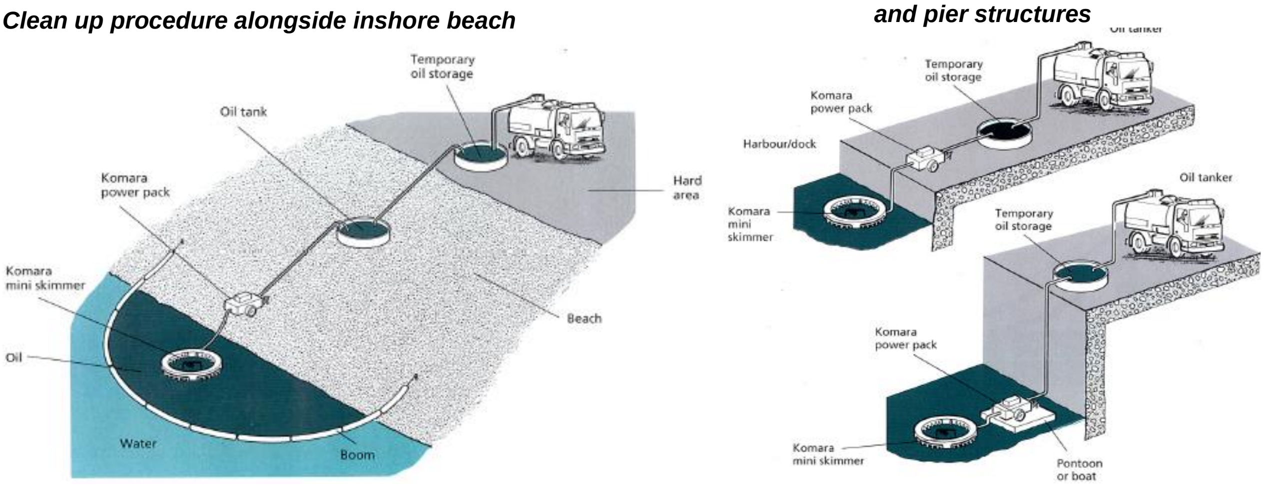
Source: Port of Dover - Oil spill contingency plan, November 2008

Response and clean up: If the oil is contained inshore, the following Fig:3.1 is an example of a possible beach cleaning set-up which could be initiated on Shakespeare or Dover beach and a set-up which is suitable for alongside pier structures.

Fig.3.1: Recovery of oil from inshore water

Clean up procedure alongside inshore beach

Clean up procedure alongside jetty and pier structures



Source: Port of Dover - Oil spill contingency plan, November 2008

The clean-up operation, which produces large amounts of oily waste materials and water, often far exceeds the original oil spillage. The plan confronts spilled oil as it should be recovered (whenever possible) for recycling and re-use, and indicates that all oily waste -such as absorbent materials, personal protective equipment, and oiled sand and shingle- must be handled and disposed as hazardous waste in the proper manner, in line with the port's waste management plan.

DHB has also worked closely with other port users to provide a co-ordinated response to any incident of soil and water contamination which occurred within the port. "*To clarify these relationships and improve the efficiency of response, a documented set of landside oil spill procedures was developed in July 2010 and published to all the organisations involved*", (DHB, Environmental Bulletin, '10).

3.2 Waste management

Since 2004, consultation between the port authority and port users (ferry operators, terminal operators and ships' agents), including policy makers (the Environment Agency and DEFRA) has formed the keystone of the port waste management planning process and was turned into the 2007 plan's revised version (see table:3.5).

Table 3.5: Dover's Waste Management Plan – Record of amendments

Date	Description	Inserted by
07/08/1998	Initial plan written and approved by the MCA	DHB Assistant Hydrographer, Marine Operations
18/12/2001	Plan reviewed and approved by the MCA	DHB, DHM, Marine Operations
01/10/2004	Plan rewritten	**DHB Environmental Officer**
15/11/2004	Plan approved by the MCA	MCA
20/12/2007	Plan reviewed, rewritten and submitted to the MCA for approval	**DHB Environmental Officer**

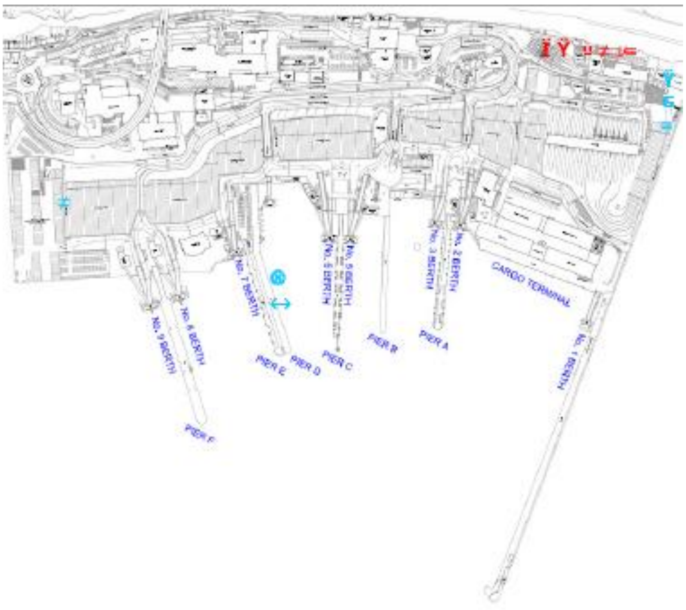
Source: Port of Dover, Waste Management Plan, 2007

Under the new waste regulations, -EC Directive 2000/59/EC Merchant Shipping and Fishing Vessels (Port Waste Reception Facilities) Regulations 2003 (SI2003/1809)-, there have been three main elements added: 1) the requirement that vessels before entering should notify the port of the waste on board and the amounts to be offloaded/retained upon arrival; 2) the requirement for the vessels to offload all ship generated wastes to the port/terminal reception facilities, unless the port was previously notified that the ship will be retaining waste on board; 3) the requirement for vessels to pay the mandatory fee for the provision of port waste reception facilities.

As aforementioned consultation took place in 2004 with the port users ensuring that the provision of waste reception facilities meet their requirements and do not cause undue delay to ships. All subsequent changes to the plan have been agreed upon with port users. As part of the revision process of this waste management plan, the DHB Environmental Officer also contacted all ships agents and operators and requested up to date information on their waste facilities, contractors, storage and disposal sites.

Fig. 3.2: Port of Dover Terminal and Quayside Facilities - business sectors.

Eastern Docks Ferry Berths

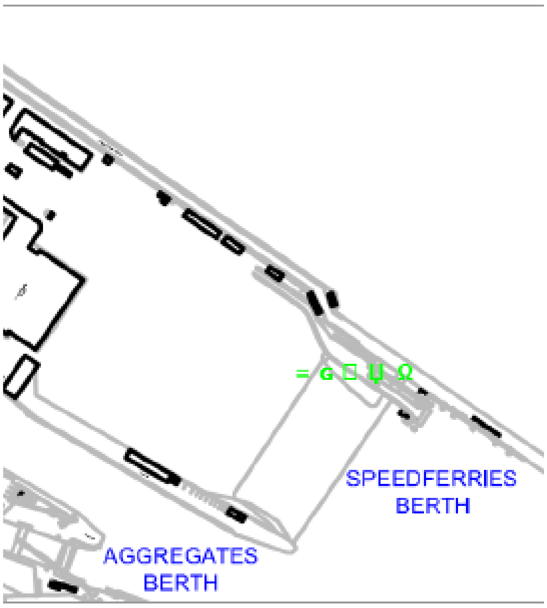


Key

P&O Waste Storage Facilities
- ⊗ Glass sulu bin
- ↔ Clinical Waste
- = Solid Hazardous waste
- Ÿ Waste electrical equipment
- ≠ Liquid Waste oil
- G General Waste

DHB Waste Storage Facilities
- Ï Fluorescent Tubes
- Ÿ Waste electrical equipment
- ‼ Batteries
- ≠ Liquid Waste oil
- = Solid Hazardous waste
- µ Scrap Metal

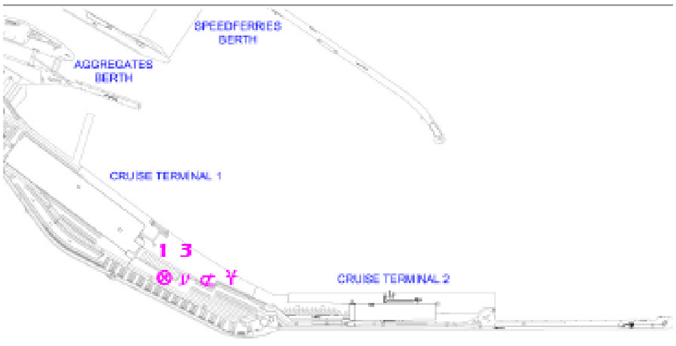
Western Docks Fast Ferry Berths



Key

Speedferries Waste Storage Facilities
- = Solid Hazardous waste
- G General Waste
- ☐ Paper and Cardboard sulu bin
- Џ Plastic
- Ω EU Food Waste

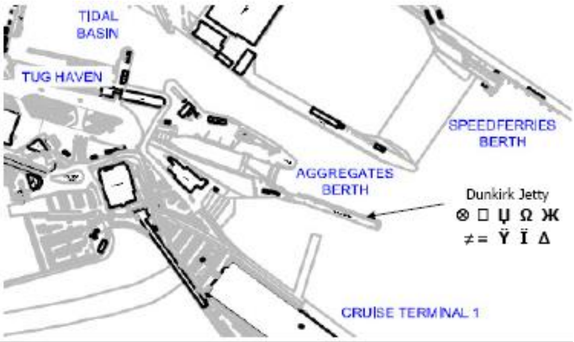
Cruise and Grain Ship Terminal



Key

DHB Waste Storage Facilities for Cruise Ships
- 1 Category 1 Waste Skips No 1-19
- 3 Category 3 Waste Skip
- ⊗ Glass Skip
- µ Scrap Metal Skip
- ⊄ Ink Cartridges
- ¥ Grain and their sweepings

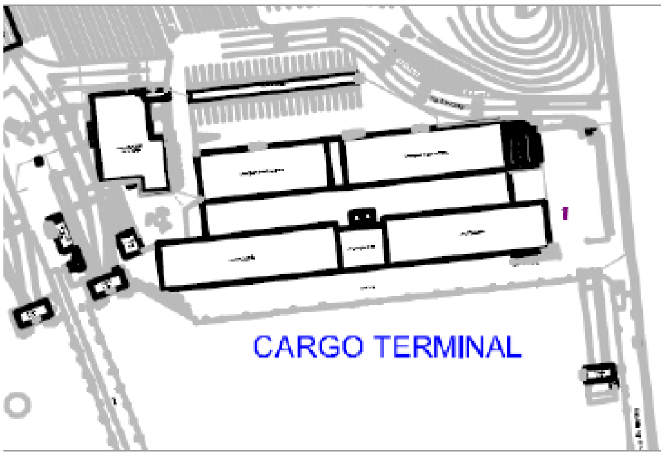
Aggregate Terminal



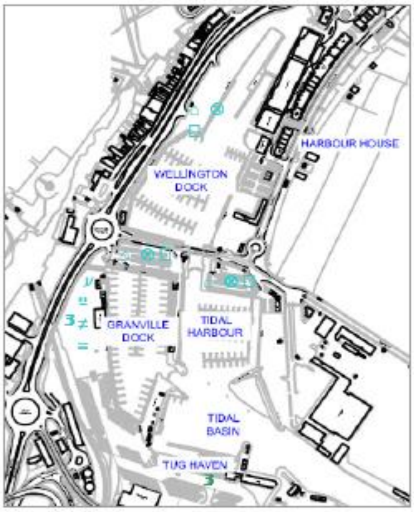
Key

Brett Hall Aggregates Waste Reception Facilities
- ⊗ Glass sulu bin
- ☐ Paper and Cardboard sulu bin
- Џ Plastic
- Ω EU Food Waste
- Ж Mixed Industrial and Commercial Wastes
- ≠ Liquid Waste oil
- = Solid Hazardous waste
- Ÿ Waste electrical equipment
- Ï Fluorescent Tubes
- Δ Scrap Steel Skip

Cargo Terminal **Dover Marina**



Key
DHB Waste Reception Facilities for Cargo Vessels
1 Category 1 Waste Skips No 1-19



Key
DHB Waste Storage Facilities at the Marina
3 Category 3 Waste Skip
Glass Skip
Liquid Waste oil
Solid Hazardous waste
Liquid Hazardous waste
Scrap Metal
Batteries
Tin cans sulu bin
Glass sulu bin
Paper and Cardboard sulu bin

Source: Port of Dover, Waste Management Plan, 2007

Following the consultation process in 2004, a DHB's internal-planning meeting decided that the Plan's format and content should be reviewed: changes to the regulations; types of waste handled at Dover; and business sectors. The Port of Dover Waste Management Plan is monitored on a daily basis by the Environmental Officer and Quality Controller for DHB, aiming to ensure that the proper collection of information takes place with regard to waste types, volumes, storage facilities and disposal routes. All information is stored on the DHB waste management database.

DHB expects that DEFRA and the SVS will carry out random spot checks on the facility to ensure that the plan's requirements are met. The Port of Dover Waste Management Plan is to be reviewed by the environmental and operations advisors for DHB every 2-3 years, ensuring that the plan is in line with the existing facilities and that it meets the legislative requirements.
"Whilst this plan outlines more general information on policy and procedure within the Port of Dover, specific sections have been compiled according to traffic type for ease of reference. Consequently, this work fulfils a dual-purpose function as a statutory report to Central Government and a working document of practical use for mariners, operators and port users", (DHB Waste Management Plan, 2007:9). The Dover's Waste Management Plan (2007) extensively refers to the provisions for the waste reception facilities at the port of Dover, incorporating methods of recording their actual use; and procedures for recording whether waste will be received in Dover as well as the amounts of prescribed wastes received in the port. Moreover, the Plan introduces DHB procedures for: monitoring Ships' Waste Declarations; updating the Waste Charging Lists; and reviewing the Port of Dover Waste Management Plan.

o *Port Recycling and Waste minimization Policy*

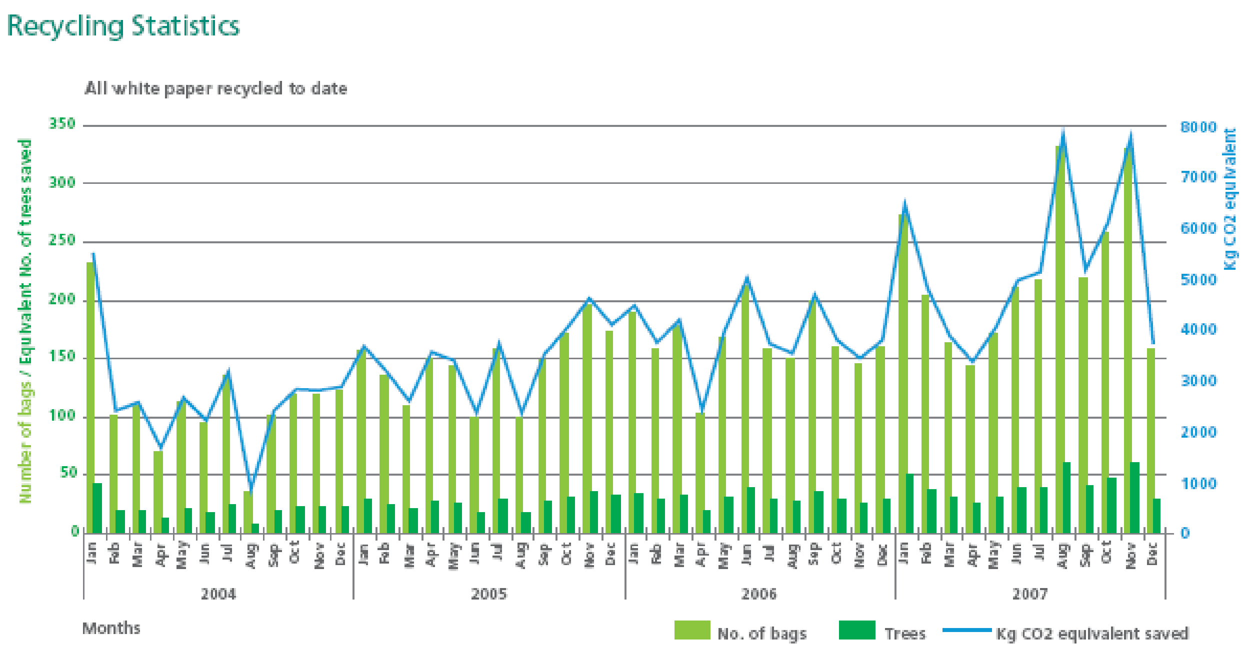
Developing a **Waste minimisation Policy**, the DHB introduced waste recycling schemes within its jurisdiction-as part of the Port's Waste Management Plan- with the intention, the plan to be possibly extended so as to receive ship borne waste wherever practicable.
This Waste minimization Policy (2007:16) points that the use of compactors at the port estate serves in reducing the volume of certain types of garbage. Since several ship operators have implemented on-board schemes in order to reduce or recycle many wastes of various types, the use of incinerators and compactors, particularly in modern tonnage including cruise ships and ferries, reduces the demand for garbage reception at regular port-calls. Ship operators (for example ferry companies) segregate certain materials such as glass and (compacted) cardboard for recycling. The policy further points that within the provision of oil water separators on board,

many vessels serve to reduce the quantity of waste or unusable oil delivered ashore as waste products, instead of treat them as waste water that can be legally discharged at sea when oil concentrations are within legal limits. Residual oil can be salvaged and recycled for further use.
The Port of Dover is practising recycling schemes since 2003; after 2007 with its Port Recycling and Waste minimization Policy has developed a more integrated approach towards waste minimization. *"Staff at the Port of Dover have played an active part in reducing the amount of port waste which is generated for landfill",* (DHB, Environmental Bulletin, 2007).
The Port of Dover has established a port wide recycling campaign with recycling stations located at Eastern and Western Docks as well as at the Harbour House. Recycling stations for general office waste such as newspapers, magazines and glass are located at the Marina, Harbour House and the Eastern Docks in order to encourage employees and visitors alike to recycle. A collection service for white paper is also in operation across all Dover Harbour Board buildings. The success of this service has attracted interest from the Board premises' tenants who have also signed up to this scheme. Starting in 2003, (until 2006, see table 3.6), the Board and its tenants recycled 4.347 bags, providing carbon savings form white paper recycling *thus* saving a total of 924 trees, 1,13millions litres of water and 1179,7KWh of Electricity, which prevents 1.881Kg of carbon dioxide and 3.773Kg of nitrogen dioxide from being released into the atmosphere. The Recycling Statics graph bellow shows that there is an upward trend across the Board with white paper recycling.

Table 3.6: White Paper Recycling Statistics

	2003	2004	2005	2006
Bags Collected	139	866	1,336	2007
Weight (kg)	1,390	8,660	13,360	20,070
Trees	25	154	238	357
Water (Gallons)	9,563	59,581	91,917	138,082
Water (Litres)	36,197	225,513	347,905	522,639
Electricity (KWh)	5,745	35,792	55,217	82,949
Carbon Dioxide (lbs)	27	170	262	393
Nitrogen (lbs)	55	340	525	789
Newspaper	1,877	11,691	18,036	27,095
100 page Hardback books	655	4,079	6,293	9,453

Source: Port of Dover, 2008



Source: DHB, Environmental Bulletin, 2007

Other office waste that is recycled includes plastics, redundant computers and monitors and toner/ink cartridges. Waste oil is collected from the Eastern and Western Docks storage tanks by a registered hazardous waste contractor. The oil is refined for re-use. Furthermore, a registered waste contractor deals with paint tins, batteries and plastics; and recyclable waste must be sorted prior to offloading and labelled accordingly.

3.3 Port of Dover Energy and Water Policy

In February 2006, DB confirmed its commitment to reducing its carbon emissions and published an Energy and Water Policy for the Port of Dover. In pursuit of its commitment to responsible energy and water management this policy's goals are (DHB, Environmental Bulletin 2006):

- Energy efficient building methods by complying with UK building regulations, adopting EU initiatives and evaluating other opportunities from technology development.
- Considering water and energy efficiency investments in new developments also in vehicles and machinery.
- Promoting recycling and energy awareness throughout the port and its employees.
- Consulting and advising from government organisations and caring for the Carbon Trust's recommendations.
- Set reduction targets, monitor progress and negotiate competitive energy and water contracts.
- Delivering efficient, safe and measurable water supply in accordance with best practice that meets the staff and customers' needs in compliance with Health and Safety Executive (and other) regulations.

As a result of the Kyoto agreement and the need to reduce emissions and move to a low carbon economy, the UK Government has introduced schemes and funding by the Carbon Trust (2001).
In July 2005, the Port of Dover entered into partnership with the Carbon Trust and Energy Management Solutions to investigate the energy consumption across all areas of the ports' buildings and operations.
Following the Carbon Trust audit, in January 2006, and the identification of action areas involving carbon dioxide emissions, lighting and consumption, training was held by Energy Management Solutions who are affiliated with the Carbon Trust. In total, 28 meetings took place in 2006 and countless 'problem areas and wasteful equipment' were identified across all areas, (DHB, 2007). The various campaigns and initiatives which took place from 2006 to 2007, across the Port of Dover are presented in the following table 3.7

Table 3.7: Port of Dover Energy Conservation Campaigns 2006, 2007.

Timetable	Campaign
March – June 2006	Traffic light system on light switches. Turning lights off
June – October 2006	Turning monitors off
October 2006 – March 2007	Turning heating down/off and preventing draughts
March – July 2007	Turning off all non-essential office equipment
July – October 2007	Turn off PCs which are on CITRIX system and turn off strip lights
October 2007 – February 2008	Turn off fan heaters

Source: DHB, Environmental Bulletin 2007

DHB's Energy Information Systems

Prior to setting up its energy management programme in 2006, DHB had made significant progress regarding its metering system and had installed additional meters across the port in order to monitor and report on electricity consumption. Live/online 30-minute meter readings are available to the management team via the energy supplier's website. The port's Heating Ventilation and Air Conditioning (HVAC) systems are monitored and managed via the improved Buildings Energy Management System (BEMS). BEMS has minimized operational wastage by controlling building temperature to meet operational needs.
The port has a good coverage of detailed energy data and uses a web-based Advanced Monitoring and Targeting System that can plot the consumption straight from the meters or BEMS. The system can be used to improve understanding of the variables' influence that could affect consumption. Comparison graphs provide information about the implemented energy-saving measures. The efforts at monitoring and metering have led to a much better understanding of the port's energy consumption issues, (DHB Environmental Bulletin, 2008). *"The data allows the management team to clearly identify inefficiencies and therefore focus on the development of solutions to give the best results in the most cost-effective ways"* (Case, 2011).
In November 2006, an Energy Focus Group was formulated to provide a focus on technological support in order to help the Board reduce overall energy consumption and become less reliant on external sources of energy supply. In collaboration with the Group the DHB's initial energy conservation initiatives were (DHB, Environmental Bulletin 2007):

- Commissioned work from the Energy Savings Trust undertaking a 'Green Fleet Review'

- Launching a 'Green Travel Plan' for the Port of Dover.
- Establishing a carbon footprint for the activities within its estate.
- Organising a 'Green Week' for February 2008, by the Environmental Office.

Since then, the port's Staff has been an integral part of the energy conservation campaigns (DHB, Environmental Bulletin, 2009). The Staff Involvement was structured in 2 groups as seen in table 3.8) the Energy Monitors and 2) the Energy Focus Group.

Table 3.8: DHB Staff Involvement in Energy Conservation

year	Staff Involvement	Goal	Campaigns
2005–onward	**Energy Monitors**	An active membership of 20 staff covering the whole port area with the role to: • encourage their colleagues to reduce energy consumption; • take note of any inefficiencies in their area; • act as a point of contact for ideas and observations from colleagues.	Quarterly campaigns in energy reduction
2006–onward	**Energy Focus Group**	Staff members with a technical knowledge in electricity, mechanics, buildings and estates. • build on formers group outcome, • technological support on energy consumption reduction	

Source: DHB, Environmental Bulletin 2010

Staff involvement has noticeably improved since the first energy awareness initiatives in 2006. After almost five years of efforts, the Energy Monitors group incorporates staff from different parts of the port area as well as major port tenants. *"The energy monitors encourage people in their working area to behave in an energy efficient manner, come up with energy saving ideas and report any maintenance issues that could be wasting energy"*, (Case, 2011).

Since the Carbon Trust's first audit in 2005, DHB has made significant progress regarding infrastructure improvements that have delivered results. In order to achieve optimum savings, numerous equipment trials were invested (see table 3.9), and it is steadily making reductions in its carbon emissions. Changes have been made to the high mast lighting across the Eastern Docks, boilers have been replaced for new energy-efficient models, LED light bulbs are now in use on backlit road signs and advertising boards so that they now consume half the electricity that they previously did. The bulbs in the navigation lights at the Eastern entrance have been changed so that they are now consuming 240watts of electricity compared to the previous 6,000watts. Halogen heaters have been installed in many of the operational areas in order to increase heating efficiency of large spaces.

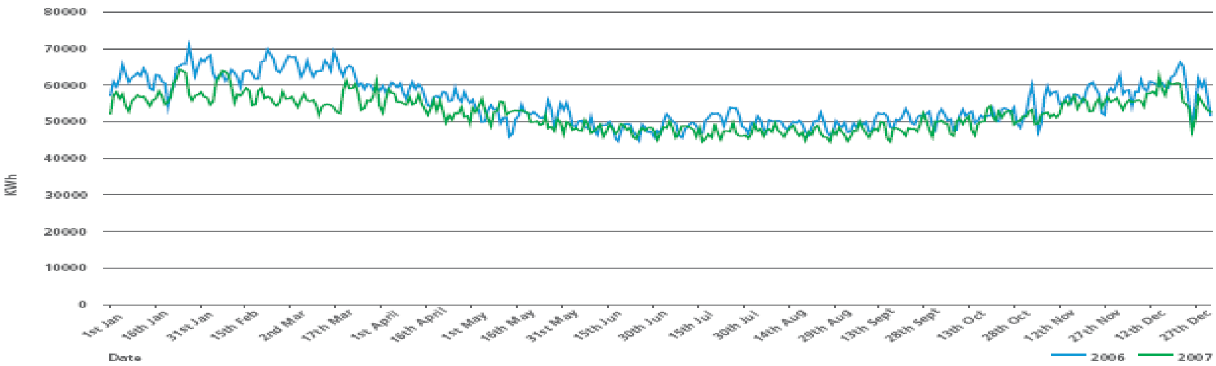
Table 3.9: DHB Examples of trials and subsequent energy savings modifications across the port

Western Docks	Eastern Docks
• New energy efficient lamps have reduced energy consumption in the pier lighting system, with further improvements planned. • Recent improvements to the circuitry in Cruise Terminal One have enabled specific areas of the terminal to be illuminated, rather than the whole building.	• New 36 watt LEDs are now being used in the port signal lights and have led to a saving of 4,220 KWh per annum which equates to 1,815 kg of carbon dioxide. • All 20 advertising signs in the Eastern Docks have been fitted with light sensors which turn the lights off during the day. This has reduced their running costs. • Recent modifications to the high mast lighting system mean that brightness is maintained but the voltage has been reduced. • The lights on the ferry berths have been switched to a 40 minute timer switch. This means that the lights are on only for the required amount of time while the ferry is in the berth. • The heating in the AMSA sheds has been converted from 'space' to 'people' heating.

Source: DHB, Environmental Bulletin 2007

One of the most successful projects has been a complete renovation of high mast lighting across the Eastern Docks, the ro-ro ferry terminal which brought increased light output with a smaller number of lamps. Each lamp was properly fitted that lights could cover the maximum area of the ground. This resulted in numerical reduction of the high masts required to lighten the docks. The energy savings since 2006 was carbon savings of over 300tn per year as well as noticeably reduction light pollution.

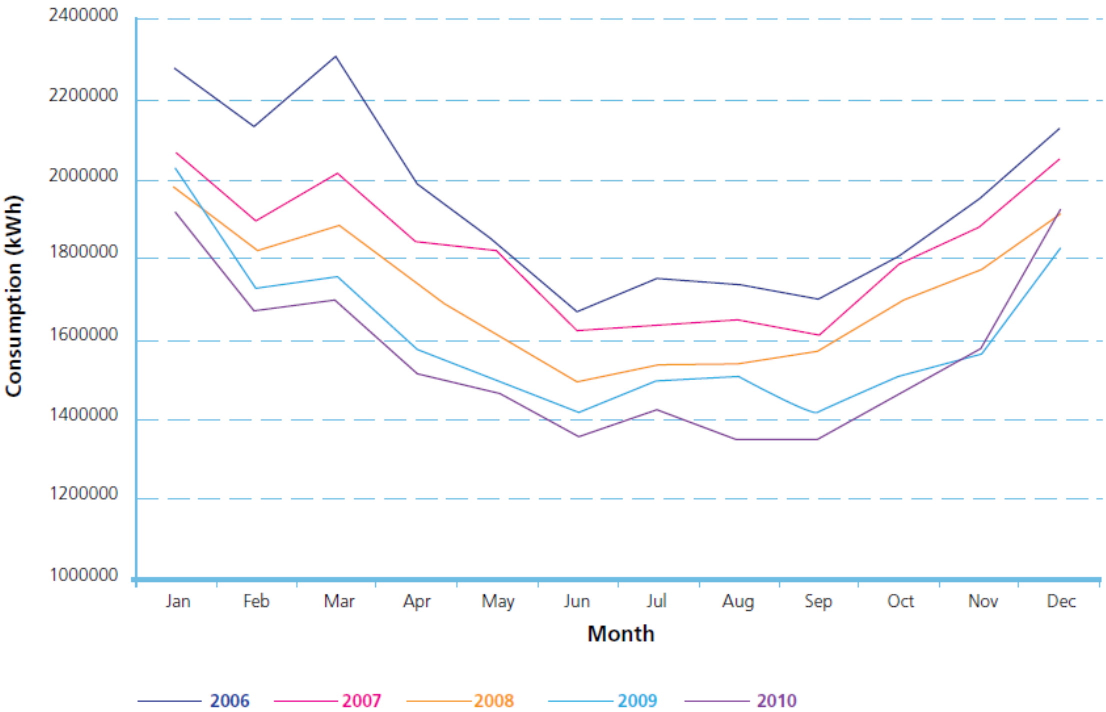
Fig. 3.3: Comparison of 2006/07 daily electricity consumption in the Eastern Docks



Source: DHB, Environmental Bulletin 2007

In terms of actual electricity consumption, savings of over 5% were made over the first two years of effort, which equates to £160,000 saved, (DHB, 2007). The progress in daily electricity consumption which has been made so far since 2005 can be seen in the fig. 3.4.

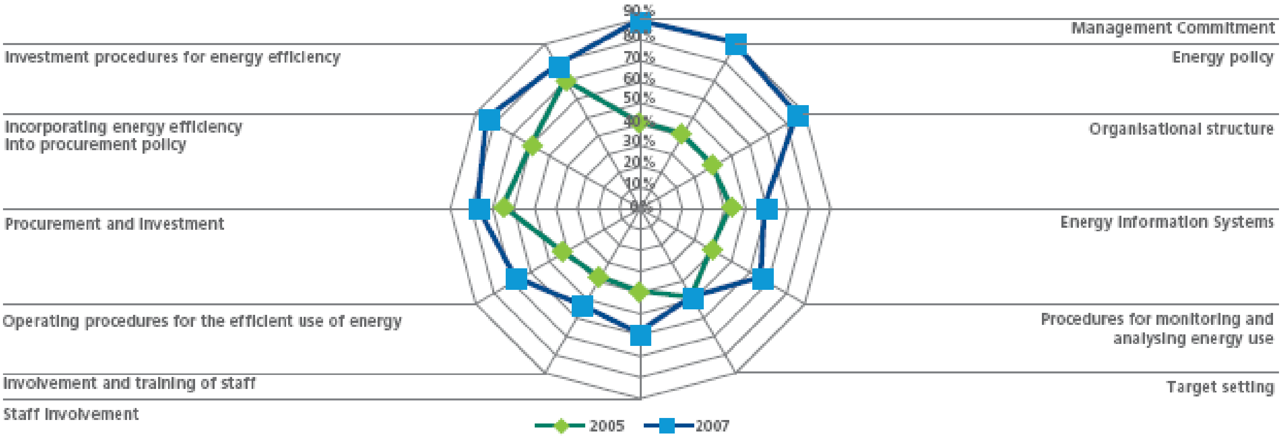
Fig. 3.4: Electricity Consumption at the Port of Dover 2006-2010.



Source: DHB, Environmental Bulletin 2010; Case, 2011

A graphical representation of DHB's energy management progress can also be seen below with the 2005 figures in green and the 2007 figures in blue. Improvements can be seen in all areas, with ameliorations still necessary in certain areas such as target setting, fig. 3.5.

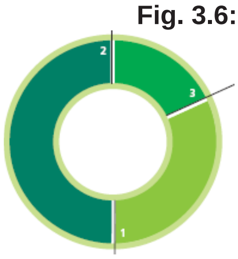
Fig. 3.5: DHB, Energy Management Strengths and Weaknesses



Source: DHB, Environmental Bulletin 2007*A carbon footprint for the port of Dover*

In 2007, the port's Environmental Office working with the CarbonPlan -a private consultancy firm-, developed a comprehensive carbon emissions footprint for DHB and the activities that it controls within the Port of Dover. The CarbonPlan has developed a proprietary carbon calculator to align with the financial data. A carbon footprint was established based on the categories of the Board's financial cost centres i.e. public transport costs, flights, refuse services, stationery, equipment etc., assuming that all the Board's expenses are for items and services within its responsibility. The aspects that were to be included in the Board's carbon footprint aligned with the Greenhouse Gas. The boundaries of the Greenhouse Gas Protocol were defined under scope 1, 2,3 (see fig. 3.6).

Fig. 3.6: DHB's carbon footprint as per the calculations from the CarbonPlan



Scope 1:	Emissions created on site by direct energy use i.e. burning gas, fuel and heating oil.	35%
Scope 2:	Emissions caused through electricity production and distribution i.e. lighting, equipment, heating.	48%
Scope 3:	Emissions generated from the supply chain i.e. purchasing of paper etc.	17%

Source: DHB, Environmental Bulletin 2007

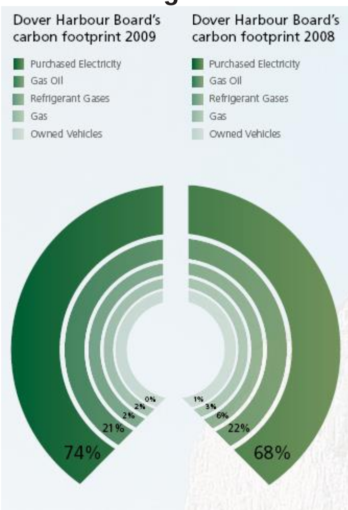
In September 2007, DHB reviewed and updated its Environmental Policy and set a priority to reduce its carbon footprint, (DHB, 2007). In line with the beginning of the Carbon Reduction Commitment coming into force in April 2010, DHB decided to apply for the Carbon Trust Standard in order to streamline the existing reporting requirements (DHB, Environmental Bulletin 2009). To achieve the Carbon Trust Standard, 3 years' worth of Carbon Foot-printing Data are required and a reduction in carbon output of 2.5% per year must be shown.

Now, DHB has carbon foot-printing data from 2006 in accordance with the guidelines from DEFRA. This guideline was used to extract the elements required for external reporting in line with the Carbon Reduction Commitment and the Carbon Trust Standard. The main lines of the port's Energy and Water policy are (Port of Dover Environmental Policy, 22 July 2008):

- Commitment towards climate change by determining its carbon footprint, and over time, work to reduce it.
- Reduce the Boards' Carbon Footprint, through regular campaigns and infrastructure maintenance, as well as ensure where practical, energy-efficient design was incorporated in future developments. Research into the possibilities of renewable energy resources will continue.

Between 2008 and 2009 carbon emissions decreased by 13%, which equates to a saving of over 2060tn of CO2, (DHB, Environmental Bulletin, 2009) (see fig.3.7). Reductions were made in every emissions' source within our scope 1 and 2 footprint. Between 2009 and 2010, the port's overall carbon footprint remained unchanged, (DHB, Environmental Bulletin, 2010).

Fig. 3.7: DHB's carbon footprint within scope 1 and 2 for 2008-2009



Carbon footprint 2008/2009 (Total kg CO_2 output)

Unit	2009	Footprint Kg per unit (CO_2)	2008	Footprint Kg per unit (CO_2)
South East Degree Days	2,011	6,603.14	2,049	7,487.66
Port Area	923,000m²	14.39	923,000m²	16.62
Employees	345	38,489.58	550	27,894.94
Total Turnover £K	58,475.00	0.23	60,774.00	0.25
Total Cost £K	46,689.00	0.28	47,031.00	0.33
Profit After Tax £K	7,443.00	1.78	10,020.00	1.53
Traffic Volume (PCUs)	9,920.21	1.34	10,047.25	1.53
Cruise Ships	136	97,639.00	144	106,543.20

Source: DHB, Environmental Bulletin 2009

In September 2010, following an independent assessment, the Port of Dover was awarded the Carbon Trust Standard, reducing its carbon emissions by 13.2% over the 3-year assessment period (DHB, 2010). With the merit of carbon emissions' reduction by 2.5% per annum in over three years' data, this standard provides evidence that the port is managing carbon: 1) in an appropriate manner through effective governance procedures, 2) accurate carbon accounting and 3) carbon management programmes (DHB, Environmental Bulletin 2010).

Renewable energy in the Port of Dover

In the 2005 report, the Carbon Trust suggested that the Board should explore the possible use of renewable energy in the port. In 2007, the Environmental Office and Technical Services department undertook the project 'Options for Renewable Energy in the Port of Dover' investigating how the four main types of renewable energy, wind, solar, wave and tide could be applied within the Port of Dover; the potential amount of energy that would be produced; and furthermore, if the weather conditions in Dover are adequate to generate a significant and economic amount of electricity. Sites for wind and solar power were considered and issues such as most common wind direction, angles of rooftops, aspect and aesthetic issues. The report presented other possibilities for renewable energy within the port and whether these options were economical, including research into geothermal heat pumps; the possible use of hydro technology; and micro wind power, (DHB, 2007). DHB also made contact with two companies that produce 'kinetic road ramps', which are currently marketed in the form of water/turbine energy generating machines and hydraulic energy generating machines. These ramps are undulated and electricity is generated as vehicles pass over the ramp. The ramps generate the most electricity when heavy slow-moving vehicles pass over them (ideal in a port environment).

In 2007, DHB proceeded with the phase 2 of investigations with 'Wind Direct' for the construction and implementation of wind turbines at the Port of Dover, exploring an initial site assessment- a site scoping study. Further phases will involve planning; engineering aspects; and the construction and commissioning of the work. DHB may be eligible for Interreg PACE funding for this project.

Programmes and projects in the Dover's port community

Since 2009, DHB has been working in partnership with tenants in order to deliver the most effective results in its carbon footprint. In the Cargo Terminal area where, DHB worked together with terminal operator George Hammond PLC, on improving the efficiency of the temperature controlled stores; an area in which palletized fruit is stored before being sent to British and European fresh produce markets. A high-energy intensive port operation, affecting energy consumption as much as the quality of the infrastructure and the refrigerant units working together, involved: 1) detailed analysis of energy consumption and identifying efficiency improvements, 2) sharing ideas and implementing energy-saving practices (Case, 2011). With 101tn of CO2 equivalents saved per annum the project was a considerable success (DHB, Environmental Bulletin 2010).

The DHB and REG Bio-Power partnership has installed a Combined Heat and Power (CHP) plant in the Eastern Docks. The CHP plant produces on site electricity which is used to heat local port buildings with no extra energy requirement, running on LF100 fuel which is essentially filtered, -used cooking oil. Cooking oil as a waste product, which needs much less energy to process than biodiesel, is an extremely low carbon fuel. The plant has been in use since March 2010 and has produced 615,051 kWh of green electricity and 105 kWh of carbon-free heat (DHB, Environmental Bulletin 2010).

3.4 Dover's Environmental Management System (EMS) initiation

In the early 1990s, DHB decided to integrate environmental issues into its management and activity programme, (Paipai, 1999). According to Paipai (1999:37) the main reasons for the port acting towards this direction were:

- Growing awareness of new and rapidly evolving legislation, specifically aimed at protecting the coastal and marine environment;
- A protocol involved in obtaining dredging licenses; and
- A series of port developments including berth extensions, reclamations and terminal developments requiring some environmental consideration and information.

Dredging (beside the issue of compliance with regulations) to maintain or get the required licenses incorporated the need to evaluate both short and long-term effects. The port needs to be accurate during the activities (correct tonnage- no upsets of areas that do not have to be dredged) and reduce the costs through efficiency and accuracy with respect to the location, (De Leffe, et.al., 2003)

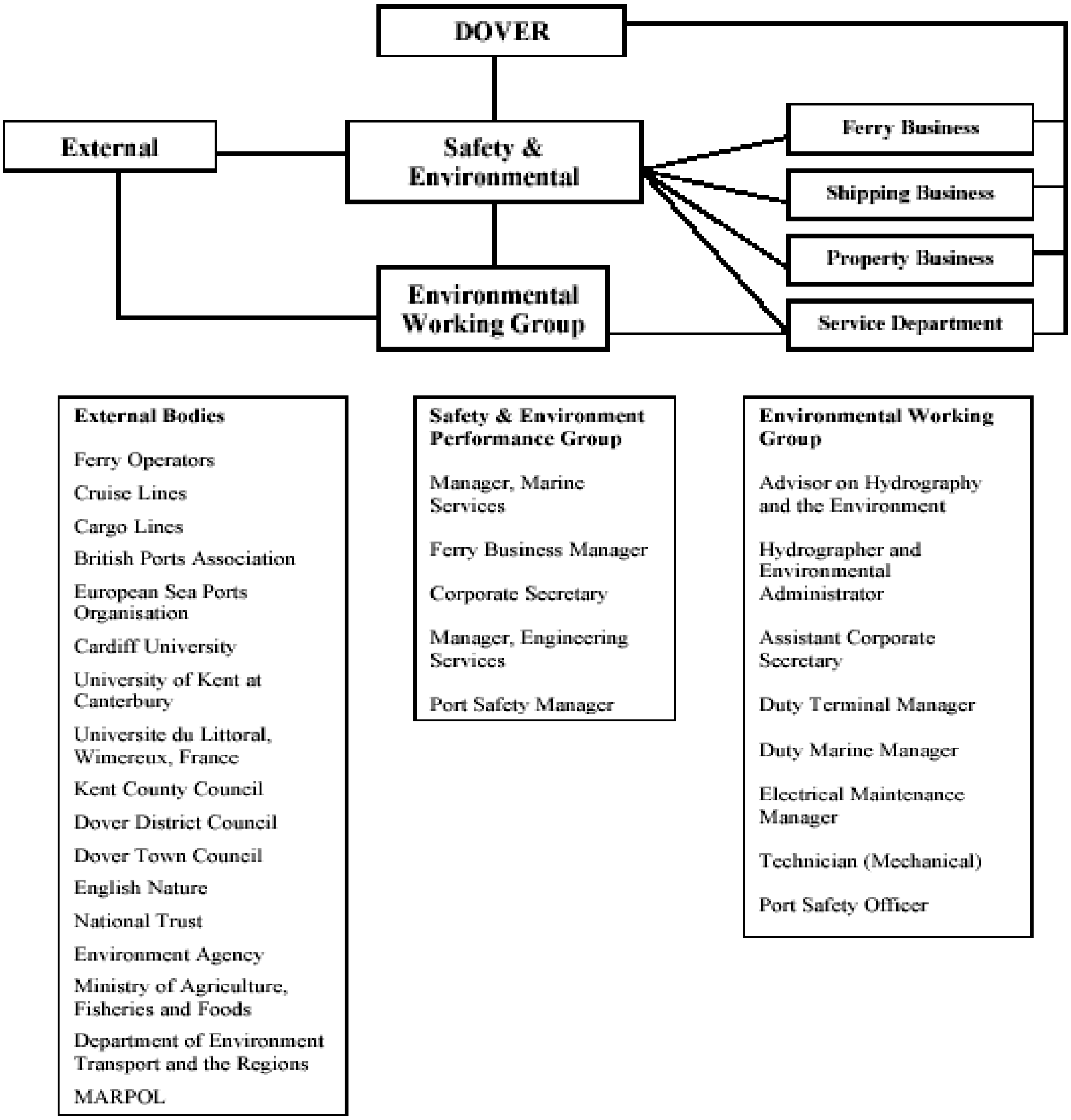
- Applying environmental management practice in Dover

Triggered by the evolved domestic legislation on marine protection, the DHB's surveys on environmental issues began in 1993, when an assessment study of the port's marine environment was initiated. The port intended (already at that time) to establish a baseline data providing obtainable environmental information to the port management with the aim to develop its first environmental management programme. Since that time the port has been committed to the environmental monitoring which takes place on a regular basis throughout the port area.
In addition, the port management decided to implement environmental management on a *"phased development approach, rather than to adopt a rigorously formatted, comprehensive model",* (Paipai, 1999:37). Based on that decision, and as the preliminary hydrographic and environmental programmes became integrated through the process-based interrelation, the results mainly reflected the cost-benefit of collaborative surveys. *"The port's environmental programme has evolved from preliminary and selective baseline surveys to a comprehensive annual programme of monitoring and reporting that stands scrutiny at international level. The tangible deliveries include a suite of publications focusing on environmental issues, a dedicated computerized database and an annual Environmental Review which publishes environmental performance indicators"*, (DHB & Cardiff University-personal communication,1999).
Environmental initiatives in Dover enhanced the *in-house capabilities* beyond the long established hydrographic capability. The port was experienced in monitoring and promulgating data related to bathymetry, wind, wave, tide and currents – all of which are relevant and indeed fundamental to improving environmental quality and protecting habitats. *"The skills required to survey, monitor, analyze and map/chart hydrographic information easily led themselves to taking on the environmental parameters related to air, water and sediment quality"*, (Paipai, 1999:38).

- DHB's Environmental policy

The initial structure of the DHB's EM organization is shown in Fig. 3.8. The status of environmental issues at that time is reflected by the DHB's decision to issue its Annual Environmental Review in conjunction with the Annual Accounts and Performance Reviews. The Port of Dover 1st Environmental Review -published back in 1998- provided an overview of the port's environmental performance during 1997 and established specific targets to ensure that progress could be monitored effectively, (DHB, 1998).

Figure 3.8: DHB's Environmental Management and Organisational Structure (1998)



Source: Paipai, "Guidelines for port Environmental management", 1999:38

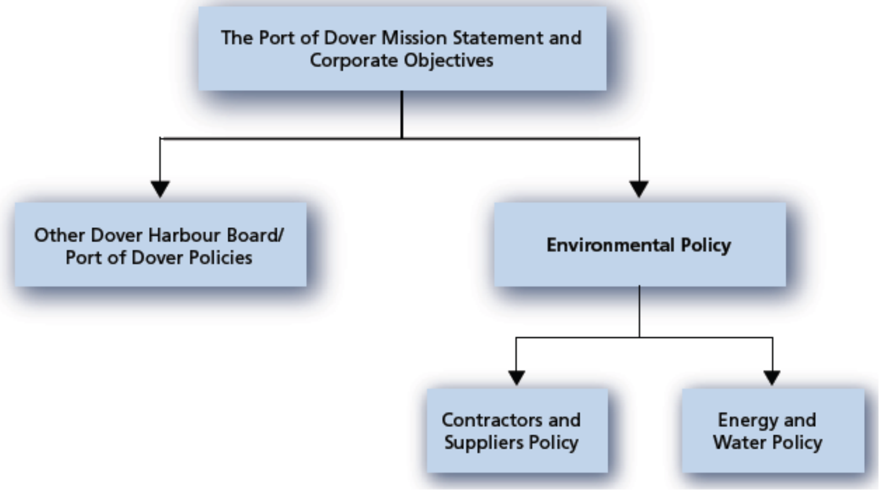
In its initial Environmental Policy Statement, the Port of Dover was committed to ensuring the best practicable protection of the environment under its jurisdiction. The port endorsed the ESPO's Environmental Code of Practice principles and was pledged to work towards a cleaner environment through the implementation of effective management strategies, in co-operation with relevant authorities and consultation with user and interest groups (DHB 1st Environmental Review, 1998). In 2004, a *Draft Green Policy* was developed, having a sustainability theme, suggesting wherever feasible, and implementing the best practice environmental option. This policy aimed to be applied to all staff, and *shows recognition of some aspects of port activities where serious environmental impacts could become a reality*. The policy illustrates the DHB's continuing commitment to the environment and introduces a policy framework setting further targets and objectives for the forthcoming years.

In line with the initial environmental statement (almost 10years ago), according to the port's *Environmental Policy*, the board and management are committed *"to continuous improvement in the environmental performance of the organization*". By implementing this policy, management aims to ensure that "*the principles contained within the ESPO's Environmental Code of Practice are endorsed*" and "*the requirements of all applicable environmental legislation are met*", (DHB Environmental Bulletin, 2005, 2006).

The DHB Environmental Policy Statement, which has been in place since 2002, is annually reviewed by the Board. The port's updated environmental policy in 2010 continued to promote monitoring as an essential part of the port's established Environmental Management System (EMS). Updated reporting systems, regular monitoring programmes and data analysis to assess the impacts of port activities and the effectiveness of the EMS were the management tools for the environmental policy implementation (DHB, Environmental Bulletin, 2010).

By the end of the decade, DHB's commitment to environmental performance is demonstrated through a *network of environmental policies*. The main overarching 'Environmental Policy' takes into account the significant environmental aspects and impacts resulting from operations within the Port of Dover. Where highly significant aspects have been identified, the Environment Office has created separate policies which more precisely detail the commitment to reduce the environmental impacts associated with this activity. The interactions between the different policies are shown below. (DHB, Environmental Bulletin, 2010).

Fig. 3.9: DHB's different environmental policies interaction



Source: DHB, Environmental Bulletin, 2010

- DHB's Environmental Monitoring programme

Already back in the 1990's the DHB recognized that the *"setting up of a rigorous, systematic and scientific programme of repeated monitoring and surveying is one of the most profound statements of commitment that a PA can make in support of the environmental imperative"*, (Paipai, 1999:40). The port's commissioned studies provided with significant environmental information and made it possible for the DHB to assess EM needs. The *environmental information provided for decision-making* included: 1) a body of knowledge to support research into specific issues and port development projects; 2) port specific detail that could be submitted as proof of environmental quality in the case of any legal action; and 3) a data base from which to assess environmental performance and evaluate the cost-benefit of such activities, (Paipai, 1999:38).

Paipai (1999:39) points that the environmental information available to DHB's decision-making provided the *"potential to be forewarned of any environmental problems"* and *"demonstrated effort and investment for purposes of public relations, marketing and investment".* The initial DHB's environmental programme prioritized its goals of regular reporting in correspondence with activities (Table 3.10), as much as its management responses (Table 3.11)

Table 3.10: DHB's Environmental Programme Reporting System

Environmental Quality	
Navigable water:	Ammonia, pH, Salinity, Total Coliforms, Faecal Coliforms, Faecal Streptococci, Salmonella, Dissolved Oxygen.
Seabed sediments:	Cadmium, chromium, copper, mercury, lead, zinc, organics.
Biology:	Benthic fauna, benthic invertebrates, littoral fauna and flora, Terrestrial fauna and flora, plankton, nutrients, habitats.
Air - particulates:	Diesel exhausts, grain handling.
Air - gases:	CO, CO2, NO2, N2O.
Odour:	Reporting system established.
Noise:	Environmental noise map produced.
Light pollution:	Compliance with Guidance Notes for Reduction of Light Pollution.

Resource Conservation	
Fuel Oil:	Degree day system oil consumed: climatic conditions.
Oil - Vessels:	Consumption monitored.
Petrol- Vessels:	Monitored by budget cost.
Gas:	Metered at point of intake.
Water:	Consumption metered, leakage reduction, wastewater monitored.
Electricity:	Consumption monitored, energy efficient lamps, PCB's, dry cells.
Alternative energy:	Feasibility - solar, wind, tide, wave, LPG, degree day system.

Source: Paipai, "Guidelines for port environmental management", 1999:40-41

Table 3.11: DHB's Environmental Programme Management Response

Management Response	
Waste Management:	Compactor, skips, clinical waste, recycling.
Waste Management:	Port Waste Management Plan - DETR.
Dredging:	Monthly bathymetric charts, volumes, target contaminants.
Development:	Reclamation, environmental impact assessment.
Landscaping:	Aesthetic improvements and habitat quality.
Community:	Sea angling, beaches, cycle water, water sports, nature reserve.
Habitats and Ecology:	Kent Biodiversity Action Plan, Habitat Atlas.
Coastal Zone Management:	DETR, MAFF, English Nature, Heritage Coast.
Shipping:	Oil Pollution Plan, Waste Management Plan.
Training, Education, Research:	Seminars, University students, collaborative research, DETR, ESPO, BPA, Cardiff University, Kent University, ECO-Information.

Source: Paipai, "Guidelines for port environmental management", 1999:40-41

Environmental Occurrence Reporting

During 2004, a new Environmental Occurrence Reporting System came into operation in the port of Dover. All incidents of environmental significance are logged on the occurrence reporting system, a computerised environmental incident reporting system, available to all the staff in the Port of Dover, via the Intranet, 24 hours a day. This structured reporting system is an initiative contribution of the port within its overall EMS "*enabling feedback and solutions to be sought by relevant staff and managers, as rapid remedial action can be initiated,* (DHB, 2006). The system allows the Environmental Office to produce monthly statistics (DHB, Environmental Bulletin, 2008) which are used as an in-house measure of environmental performance and improvement. Thus, its use allows re-evaluation of EMS procedures and further identification of potential environmental impacts.

4.0 EMS IMPLEMENTATION TOWARDS PERS AND ISO 14001 CERTIFICATION

4.1 PERS CERTIFIED 2003 (1st), 2006(2nd)

- *SELF DIAGNOSIS METHODOLOGY*

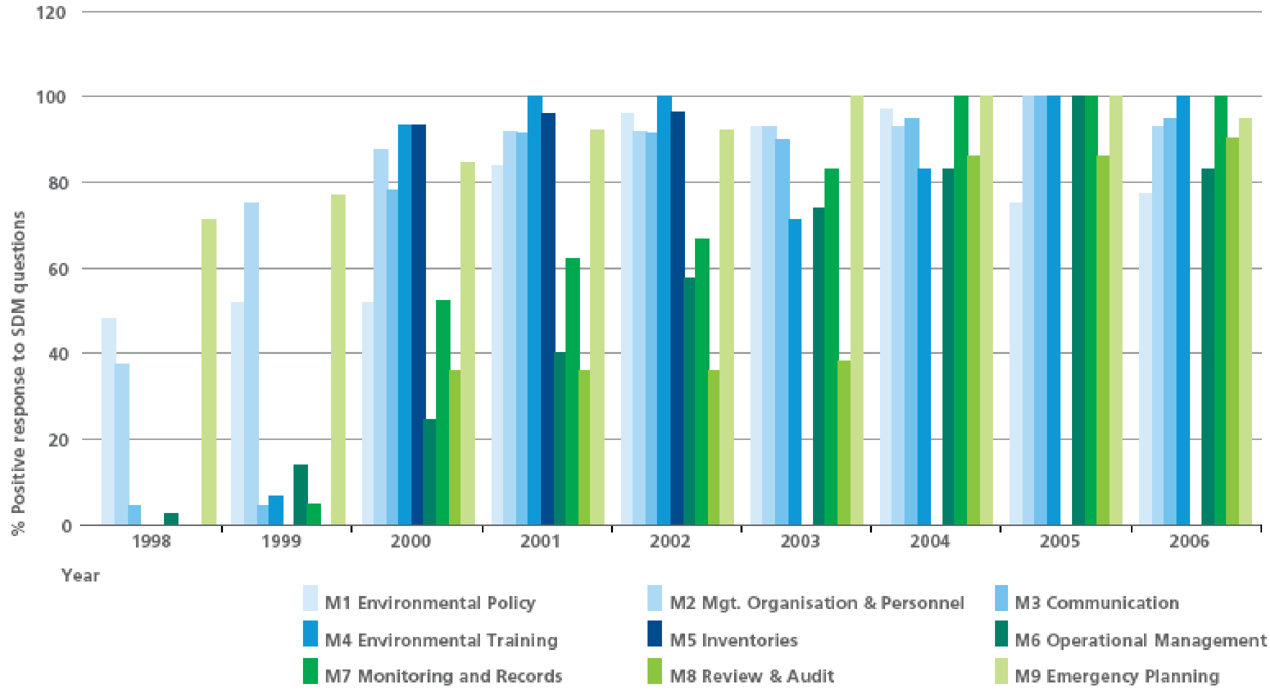
"The Self-Diagnosis Methodology (SDM) is an environmental self-auditing tool. It can be used to establish exactly the position and status of a port's environmental management programme for the initial development and implementation of an EMS, and/or as a periodic auditing tool to establish performance over time, either against the port's own baseline or in relation to European benchmarks."

ESPO Environmental Code of Practice, 2003

The SDM was a product of the Eco-information EU project. The methodology has been designed to allow port managers to regularly review their environmental management practice and to identify their environmental priorities at the first step in an environmental review. The initial SDM'98 examined EM together with key aspects (compliance, port development, incident control, current actions) of the environmental issues targeted by the Eco-information project, (Kourbeti, 2003). The SDM'98 system (and its following updates), was aligned to PERS and aimed to be the first step towards ISO14001 accreditation, (ESPO, 2003).

The Port of Dover as part of the British Ports Association (BPA) and primary partner in the Eco-information project was among the 50 frontier ports in Europe and UK that completed the SDM'98. Since that time, the port has remained one of the most proactive ports in Europe in terms of collaboration with the EcoPorts Foundation (EPF) on R&D activities related to EMS implementation. The use of this EPF tool was classified "as a priority issue" by the port Environmental Office already established in 1998(Jenkins, 2003). The 1998-2006 results (fig. 4.1) are estimated as 100% compliant with PERS and 95% compliant with EMAS and ISO14001 standards. Results from the 2006 audit showed that the port achieved a significant improvement in all responses, notably attaining 100% for the management of the organisation and personnel, communication, environmental training, operational management, environmental monitoring and recording, as well as emergency planning, (DHB Environmental Report, 2007:15).

Fig 4.1: DHB SDM results 1998-2006



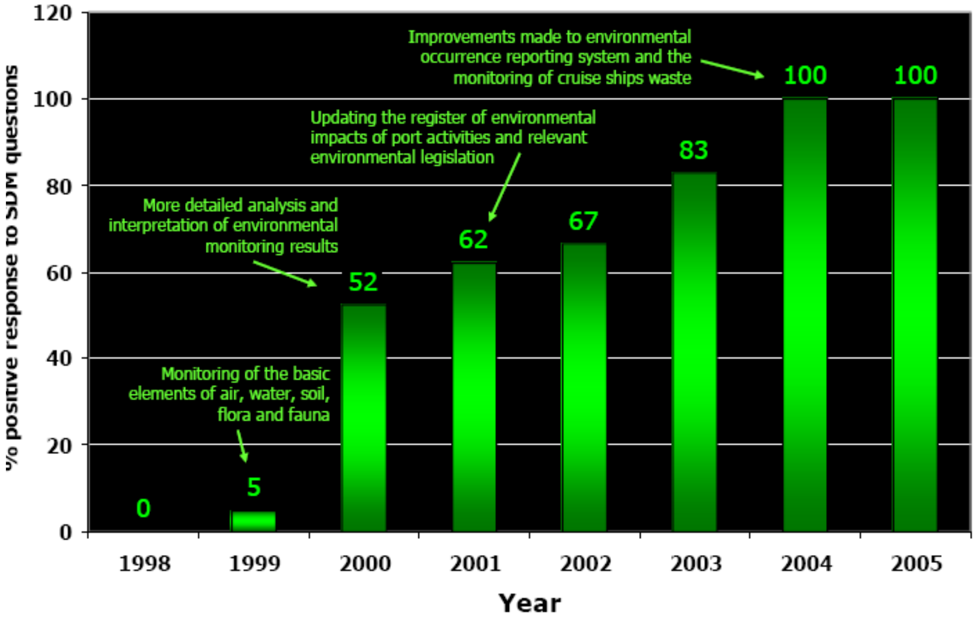
Source: DHB, Environmental Report, 2007:16

The port used the SDM annually from 1998 to 2008 to measure its environmental performance. DHB was committed to performing the annual SDM checklist aspiring to assess its performance as "green port". The experience of these years has shown that SDM has been considered "a useful checklist to check the year-to-year progress", (Jenkins, 2003), while the use of the methodology *"highlighted priorities for progress and identified areas that required attention"*, (Marsh, 2006).
The yearly SDM implementation also allowed participation in the EPF's European benchmark. Both of Dovers' Environmental Officers have assessed the tool as a robust benchmark tool. SDM was estimated as "a performance indicator, internally and in comparison, with other European ports", (Jenkins, 2003); showed "*where your own port stands in comparison with other EU ports*", (Marsh, 2006). For the port's management team, it was "*an ongoing demonstration of commitment to environmental responsibilities" and a proof of a "proactive membership of the EPF" network,* (DHB Environmental Report, 2007:15).

The SDM tool assisted the DHB Environmental Office in "*setting up the port's environmental reporting system"*, (Marsh, 2006), thus implementing the most essential and unique component of the port's EMS. According to the Environmental officer the SDM assisted in:
1. establishing acomprehensive examination of monitoring results,
2. assessing and updating the environmental impact of particular port operations as well as new plans for port development;
3. updating relevant environmental legislation;
4. implementing the port's occurrence reporting system, (see below fig.4.2.)

A powerful positive result for Dover upon setting up a thorough reporting system occurred with the integration of the Environmental Occurrence Reporting system along with the port's EMS (see fig 4.2). This reporting system enabled the Environmental Office to produce monthly statistics which provide an evaluation measure of environmental performance and improvement, (Marsh, 2006).

Fig. 4.2: Port of Dover SDM, M7 – Monitoring and Records



Source: Marsh, *"The Port of Dover. The implementation of SDM and PERS in the Port of Dover*", presented in Genoa Conference 14th-15th December 2006, Genoa, Italy.

The SDM system is aligned with the Ports Environmental Review System (PERS) and considered the first step in its efforts towards reaching an ISO14001 implementation. Dover utilized its SDM 'skill'. Information used in SDM, was also used for PERS implementation saving time, (Jenkins, 2003). Furthermore, according to Marsh (2006), the Dover's SDM multiple implementations fulfilled the EPF objective of each port to apply in a non-prescriptive way the main requirements of an EMS standard like ISO 14001 or EMAS.

- *PERS CERTIFICATON*

The port of Dover has been working with the EcoPorts Foundation (EPF) since 1998 to implement its Environmental Management System (EMS), and apart from maintaining its status as a leading port regarding the longest SDM records (from the baseline year SDM98), it remained until 2010 one of the most pro-active ports in Europe in terms of collaboration with EPF on R&D activities related to environmental management programmes.

The EcoPorts Foundation developed PERS as a standard for all European ports to manage their environments through a voluntary, self-regulating EMS, endorsed by the European Seaports Organisation (ESPO). Dover became the first European port to be accredited for PERS certification in January 2003. Following the *1st PERS certification in 2003* by Lloyd's Register, the port continued to develop and upgrade its environmental management tools and EMS. A detailed review of PERS commenced in early 2005 and reaffirmed its compliance with the procedures established in January 2004, (DHB, Environmental Bulletin, 2005). At the end of 2005, the final draft of the PERS document was completed by the environment office for re-accreditation under the EPF and Lloyd's Register. Dover was the first EU port to be reaccredited by Lloyd's Register, receiving *PERS re-certification in 2006*. PERS is based on the components of both ISO14001 and the Eco-Management and Audit Scheme, allowing for an easy transition to these systems. In 2006, DHB investigated the possibility of becoming ISO14001 accredited, while it was previously planned to be recertified under the EcoPorts PERS standard in July 2006. In January 2007, DHB investigated cost benefits and consumed time to obtain ISO14001.

Box 4.1: Port of Dover PERS implementation – certification

Steps towards PERS certification	
Implementation - audits	certification
PERS implementation in December 2002 Reviewed December 2004 Internal Audit 2005 PERS implementation in December 2005	1st PERS certification 2003 2nd PERS certification 2006

Source: Marsh, (2006).

In the initial phase of the PERS I implementation (box 4.1) the port's Environmental Office appreciated "*its daily use as a port manual; its flexibility; the easy implementation; the similarities with Health & Safety management systems; the help in understanding activities and operations in the port area"*, (Jenkins, 2003), while due to its 1st PERS Certification, the port of Dover won a national environmental award in 2003 for the best environmental contribution by industry. After the second PERS implementation, the system was still considered by the port's Environmental Office as a "useful document, board wide available now to all port personnel", (Marsh, 2006)
In 2006, while DHB was celebrating the 400th anniversary of the Royal Charter signing that gave it the responsibility of administering the harbour at Dover, the port's Environmental Office received recognition at the *"Environment Awards for Kent Business 2006", thus* achieving a "Highly Commended" national certificate. This certificate is awarded to Kent businesses which continue to limit their impact on the local environment and which pursue good environmental practice. The port Dover was rewarded for its "*unique EMS, detailed environmental monitoring and energy saving and recycling campaigns*", (DHB, 2007).
In 2007, DHB performed a gap analysis in order to indicate to which extent the PA's response complies with requirements of the standards specified by the EU's Eco-Management and Audit Scheme (EMAS), and ISO14001, (DHB, 2007); and furthermore, it commenced work towards ISO14001 certification aiming to achieve this international standard in 2008, considering this action to be *the next step after PERS.*

- *Environmental Performance Indicators*

Based on the initial Environmental Monitoring System and SDM results, *Performance Indicators* were produced in Dover under the PERS scheme implementation in 2002, in order to facilitate the monitoring of the port's environmental performance. The following table 4.1 illustrates the Port of Dover's performance indicators, under the PERS scheme:

Table 4.1: Port of Dover's performance indicators under the PERS scheme

Environmental Management indicators		**Review**
Annual result of the SDM	Target – Upper Quartile	Yearly
Environmental Occurrence Reports	Target – Received / Acted Upon	Quarterly
Environmental Quality Indicators		**Review**
Seawater Quality	Target – Compliance with the EC Bathing Water Directive	Twice/year
Air quality	Target – Compliance with the Health & Safety Executive's Air Quality Standard	Quarterly
Noise quality	Target – Compliance with the Noise at Work Regulations	Quarterly
Environmental Energy Indicators		**Review**
Water consumption	Target – Reduce consumption in relation to usage	Quarterly
Electricity Consumption	Target – Reduce consumption in relation to usage	Quarterly
Waste Disposal	Target – % Recycled	Quarterly

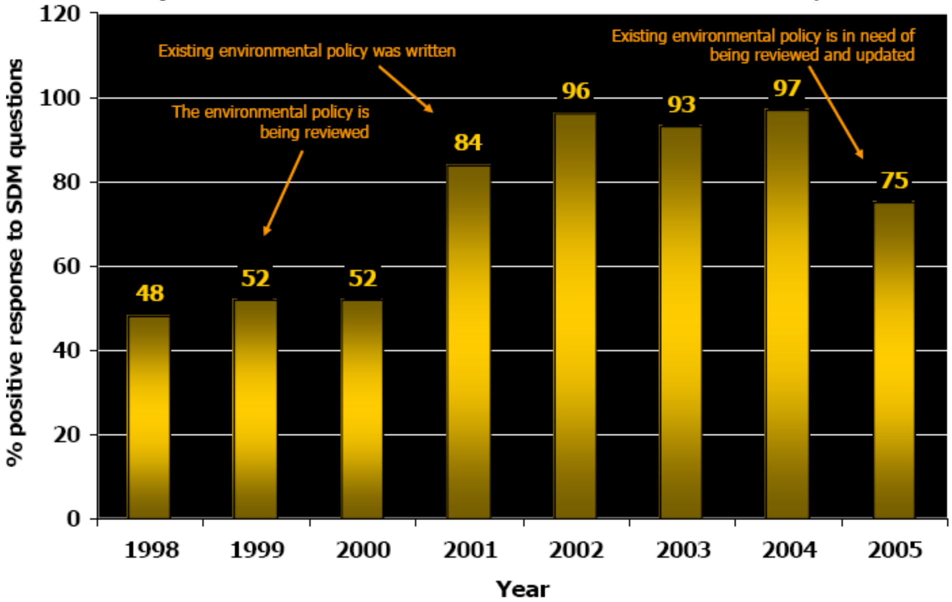
Source: Port of Dover, PERS application 2002; subject: The Register of Activities and Effects.

- *Environmental Policy*

The use of the EPF tools initiated the first DHB's Environmental Statement. The port's first Environmental Policy was revised in 1999 make the most of the SDM process. In 2002, due to PERS application, the port's Environmental Policy was updated so as to illustrate the port's management and its enhanced commitment in order to comply with environmental legislation and environmental good practice (DHB, PERS application 2002; subject Environmental Policy). Since the PERS EMS standard implementation, the port has incorporated into its EM a framework for setting environmental objects and targets. In 2005, during the preparation phase of the second PERS, the application identified that the policy should be updated, while the port's Draft Green Port Policy was published in 2004. Both EPF tools SDM and PERS standard significantly contributed to revising and updating the port's Environmental Policy, (see fig. 4.3 below).
Among others, the revised Environmental Policy of 2006 has incorporated in its statement: 1) co-work with the local authority in the preparation of an air quality management plan to reduce sulphur emissions; 2) communication with relevant authorities, having regular consultation with user and interest groups, reducing resource consumption by all port users, including suppliers, advising shipping operators to conform to all regulations on materials and wastes landed ashore; 3) communication of the environmental policy to all staff; 4) endeavour to integrate environmental considerations into all aspects of the Board's business activity by EMS; 5) work to prevent

environmental incidents and maintain a high level of preparedness to reduce the effects of occurrences within the harbour with specific references to oil pollution, emissions from ships and water quality; and 6) continually improve environmental performance related to all the activities carried out within the port by setting performance indicators on a quarterly basis (DHB Environmental Policy, 2006).

Fig. 4.3: Port of Dover SDM, M1 – Environmental Policy



Source: Marsh, *"The Port of Dover. The implementation of SDM and PERS in the Port of Dover"*, presented in Genoa Conference 14th-15th December 2006, Genoa, Italy.

It was a thorough upgrading of targets and the overall scope of the port's Environmental Policy. Since the 2nd PERS certification in 2006, the environmental objectives and targets, set for the years ahead or evaluated for the previous years, are labelled and reported in five thematic areas: 1)Environmental Management; 2)Environmental Resources Indicators; 3)Environmental Pollution Control; 4) Environmental Quality; and 5) Environmental Communication (DHB Environmental Report, 2007).

4.2 ISO 14001 CERTIFIED 2008 (1st) **/ [2011**(2nd)]

- *ISO 14001 Certification*

> *"This Environmental Management System is more rigorous than the existing PERS system and once implemented, would enable the Harbour Board to become more widely acknowledged amongst its customers and competitors"*, **DHB, Environmental Bulletin, 2007**.

BS EN ISO 14001 is an accredited EMS which meets British, European and International Standards providing a control framework of components and requirements for an EMS. The standard implementation could be assessed by a third party. DHB approved and implemented measures necessary to become ISO 14001 accredited, and audits had been arranged for 2008. The port of Dover was officially *ISO 14001 certified* by BUREAU VERITAS (BVQI) in October 2008. DHB's ISO 14001 certification was valid until October 2011 subjected to the demonstration of continuous improvement in the form of external audits and reporting, (DHB, 2008). DHB maintained its certification of ISO 14001 by undergoing and passing two internal and two external audits in 2009 and in 2010 respectively. The EMS audits improved and expanded reporting, monitoring and data analysis tool with the main target *"to maintain best practice when accommodating changes in operational requirements and legislation"*, (DHB, Environmental Bulletin, 2010). The audits involved a review of relevant documentation, inspections across the port site and interviews with staff members. The port was *ISO 14001 recertified in 2011*.
Ever since ISO14001 standard implementation, DHB's EMS involves a thorough environmental management in all aspects of its business -which are monitored and audited to ensure they meet the commitments which are related to the port's environmental policy. The ISO 14001

implementation focused on the provision of plans and schemes so as to enable constant improvement, (DHB, 2008).
in 2006, the Port of Dover was rewarded for its "green business practices" continuing its efforts to reduce its carbon emissions and maintain a good environmental management, and monitoring system,. The port's Environmental Office received recognition at the Environmental Awards for Kent Business 2006, achieving one of the top places and a "Highly Commended" certificate which recognizes Kent businesses and their commitment to limit their impact on the local environment. The judges were impressed by the Board's unique Environmental Management System, detailed environmental monitoring, pollution occurrence management, as well as, energy saving and recycling campaigns (integrated in its waste management plan).

- *Environmental Policy*

Environmental management and monitoring were undertaken within the port's jurisdiction limits. The scope of ISO 14001 certification covers all port activities while it includes management of the Board's tenants and all kinds of port facilities. The Board's Environmental Policy Statement, which had been in place since 2002, was redrafted in 2008 during the ISO 14001 standard implementation.
The port of Dover is an internationally recognized example of how a port influences EM in tenants, (GHD, 2013). The ISO 14001 certified EMS is applied to the port's tenants, as well the port's staff and contractors. In 2010, 17 tenant audits were carried out to maintain legislative compliance (DHB, Strategic Review, 2010). The port has been monitoring its tenants and audited compliance with the EMS within the scope of its *Contractors and Suppliers Policy,* a policy component of its Environmental Policy, which also incorporated an *Energy and Water policy as well* (see fig: 3.9). Since 2006, the port's upward Environmental policy has been continually integrating and updating its Energy and Water policy (see section 3.3, p:34).
Apart from committing to continuous improvement of the port's environmental performance through a thorough EMS implementation, since 2008, the Environmental policy has been also committed to actions towards sustainability principles, box 4.2.

Box 4.2: DHB's actions towards sustainability principles

- Commitment to 'compliance plus' ethic of the ports industry through association with research institutions and consultation with port users, regulators and stakeholders in environmental matters as well as having a community involvement within the local area.
- Assist Dover District Council with meeting the objectives set within the Local Air Quality Management Plan and work towards reducing port associated emissions through the implementation of a green Travel Plan to reduce the number of single occupancy vehicles used by employees.

Source: Port of Dover Environmental Policy, 2008

Air quality is a particularly sensitive local issue in Dover port-city. It is clear that the port management has recognized that positive measures need to be adopted if the situation is not to deteriorate. DHB recognized that whilst it is neither the ship operator nor the vehicle operator, it has a role to play in helping to find suitable improvement measures and mitigation to the growing (traffic related) environmental issues.
The port has constantly worked with the local authorities, regarding:

1. the Air Quality Management Area (AQMA) scheme by the Dover District Council for the Eastern Docks, since 2002;
2. the EIA required for both Terminal 2 and any buffer zone proposals in close association with Dover District Council's Air Quality Action Plan (see section 2.1 p:20).
3. Since 2006, national and local government has encouraged all major employers to implement travel plans, and government planning has guidance stipulated that a travel plan will be required in support of any planning application with implications for the local transport network. In 2007, DHB designed a Travel Plan for the Eastern Docks (as part of the proposed developments for Terminal 2 towards two primary objectives: 1) reducing its own carbon footprint due to cutting single occupancy car use by DHB employees, and 2) contributing to the reduction of peak hour traffic in the port-city. Key achievements in 2010 were the maintained certification to quality standards ISO 9001 and ISO Carbon Trust Standard award.

o *Monitoring*

Through the years, since 2004 until its finalization to an Environmental Occurrence Reporting system, the EMS enhanced quarterly and bi-annual monitoring, by drawing attention to changes in spatial and temporal trends that may have been a result of natural or anthropogenic factors.

- The planned progression of environmental measurements has encouraged the development of in-house expertise and ensured that the system capabilities and deliverables reflect the port's unique characteristics and circumstances and they confirm compliance with relevant legislation.

The port implemented environmental programs and produced environmental performance indicators which began to disclose cost benefits -particularly in terms of resource conservation and data provision for environmental impact assessment. The potential environmental impact of the *port's development* was another part of its EMS.

o *Reporting*

Overall, improved credibility of a greater transparency has motivated the port's reporting on environmental issues (De Leffe, et.al. 2003). With more than a decade of experience in environmental reporting, the port's environmental officer states that "*DHB recognises the value of monitoring and reporting its environmental performance as an effective approach to management and stakeholder relations*", (Case, 2011).

Since the ISO 14001 implementation DHB has produced: 1) an annual environmental Strategic Performance Report for the Board and public, and 2) an annual Environmental Bulletin downloadable on the web-site.

o *Environmental Assistance*

Among the extensive objectives and targets that the DHB sets yearly, a main priority remained an up-to-date and efficient environmental office. A positive contribution to this, as well as towards upgrading the port's environmental performance over the last 15years, was the constant co-partnership work with various "green agencies" (table 4.2). Educational and research bodies across local, national and European networks contributed to a successful association that provided environmental assistance. Even work placements in the port for students from Cardiff University (DHB, 2007) continue to be a success in enhancing environmental information. Particularly, the 2007 EPF network partnership aimed to ensure that the Environmental Officer could maintain communications with European ports and port-related stakeholders on environmental matters, (DHB Environmental Report, 2007).

Table 4.2: "GREEN AGENCIES" in co-partnership work with the port of Dover

"GREEN AGENCIES"	scope of the partnership-work
The EcoPorts Foundation	Entering into partnership with the EcoPorts Foundation.
The Environment Agency and DEFRA	Ensuring that the port's activities do not have a detrimental impact upon the quality of the environment.
Cardiff University	Monitoring research
Dover District Council	Air Quality Action Plan Air Quality Management Area (AQMA) – Eastern Docks
Regional Air Quality Management Stakeholders Group	Dover's Environmental Officer regularly meets with stakeholders
Royal Haskoning	EIA of Terminal2
Bramley Associates	Ecological and biodiversity surveys of Shakespeare – Langdon beaches
Kent & Medway and English Channel Oil Spill Pollution Group	Large scale oil spill disaster
The Carbon Trust and Energy Management Solutions (EMS)	Energy consumption
CarbonPlan	Carbon footprint
The Energy Savings Trust	'Green Fleet Review'
The River Dour Steering Group	River Dour a significant source of microbiological pollutants into port (identified in 2007 by EA)

Source: DHB, Environmental Report 2007 – own elaboration

- *Staff involvement - Training*

Since the PERS standard implementation in 2003, DHB has promoted in-house intensive training programmes which enable the staff to understand the needs and requirements of an EMS. Since the ISO implementation, the port has targeted to maintain and increase communication and awareness of environmental issues through the port -in all the working areas and with all the staff.
In 2008, the DHB initiated a port wide 'green week' in order to promote update environmental issues and staff involvement. The attempt proved a valuable tool for communicating environmental information. Regarding EM issues the staff members were informed about: the legal requirements that affect port operations; issues to look out for and what to report; where to find information about the facilities available and the proper procedures.

Table 4.3: DHB 'Green Week" event

DHB 'Green Week" event		
year	**Themes**	Staff participation
2008	• The Wildlife in Dover Harbour • Using Green Transport to get into work and around Kent • Climate Change and Renewable Energy in the Port of Dover • Recycling in the port and at home • Being Green out and about in Kent.	95 staff members
2009	• 14001 Reasons to be Green	120 staff members
2010	• 21 toolbox talks on waste management	140 staff members

Source: DHB Environmental Bulletin, 2008-2010 – own elaboration

Energy management programmes can be divided into infrastructure improvements and projects to change attitude and perception (DHB, Environmental Report 2010). Staff support was particularly integral to the port's energy management.

5. CONCLUSIONS

The **UK port industry**, in terms of port types, is one of the largest and unarguably the most diverse in Europe. Since the 1980's the UK ports have been aggressively privatized. The sector certainly considered itself as a UK asset and rightly looked for the support and direction of an updated Government policy.
Launched in 2000, *the 'Modern Ports'* was the first UK governmental port policy attempt. Success, sustainability and safety were the three underlying themes of this Government's policy paper, which had an impact on both Government and industry and moved the UK port policy agenda forward, (Cuthbert, 2002). 'Modern Ports' had the advantage of strong political support*:*

"[Ports] must succeed not only to meet the immediate demands of their customers, but also to invest in new facilities, in safety, and to safeguard communities and the environment"
D. Jamieson, Minister for Shipping, 2002.

This was a high demand, especially as there were pressures from all sides, and since the beginning of the new century the protection of marine life, the environment, security (especially post-9/11), infrastructure developments and competition, have been the principal issues of the UK port industry, (UKMPG, 2008). UK ports did recognize the importance of protecting the environment but they nevertheless believed that the burden of compliance with a plethora of legislation was out of all proportion difficult, *thus* they pointed that further help and guidance would be welcome, ('Modern ports–Facing the Future', Conference Report, 2002).
The demand once again found support at the national political level. After a long-lasting political debate, the "Securing the Future" S.D. strategy in 2005 turned the emphasis on port potential environmental policy to be developed and implemented on *the basis of strong scientific evidence* whilst taking into account scientific uncertainty (through the precautionary principle) as well as public attitudes and values. Policy-makers acknowledged and promoted increasing aspirations towards public accountability and democratic control of the directing ports to use the newest of science and technology (DEFRA, 2004: 16). Since the 2000s, the country has had a clear focus on guiding port environmental policy, with the aspiration to increase the ports' understanding of their marine environment and the potential impact of their business processes on the environment and humans. In a more general aspect it pointed as well to the future need of a sound cultural maritime heritage. I comment that this crystal clear political guidance was attended by a robust proportion of private port organizations.

The **Port of Dover** (DHB) is one of the world's largest international ferry ports and it is the UK's leading link with Europe, occupying a unique strategic position on the shortest and most efficient sea route from the UK and Ireland to the continent. The EU enlargement gave rise to freight sector and overall the port recorded enhanced performance in ferry activities (DHB, Performance Report 2004). Preparing for large volumes of cross-Channel traffic, the port has also developed its general cargo, cruise and non-ferry businesses. Over the years the port has invested in the very latest port technology and has focused on developing a highly technical and professional organization-developing people and technology- unprecedented in similar ferry ports (Buczek, 2012).
As a result, since the 2000's DHB has been the fourth largest importer of fruit and vegetables in the UK and one of the busiest cruise ports in northern Europe. In 2007, the port handled over 130 ferry arrivals and departures per day,14.2 million passengers, 25,1 million tons of cargo, (DHB, 2008). All this was aimed to be achieved within a compact port area of 243ha water and 140ha land. Thus, the total of these port's operations produced a noteworthy environmental impact and significant considerations over its 24 hours a day, year-round management programme. In addition, space usage at terminals has reached its optimum (DHB, Performance Report 2004), despite the port's efforts to optimise the use of this scarce resource. Space has been constantly under review, thus -*although increasingly mindful of the environmental considerations inherent in port development projects*-, DHB management developed the Terminal 2 project at Western Docks under the port's 30years Master Plan.

The port of Dover *"prides itself on monitoring and improving performance to meet environmental objectives and regulations"*,
DHB Environmental Bulletin, 2009.

The port's management considers the port as an environmentally aware organization. Already in the early 90's, approaching a "green" behaviour, the DHB started organizing "green" plans and actions while, in terms of the environment's quality, it adopted an environmental management approach of 'compliance plus'. The management board moved towards embarking a phased development EMS with a special focus on environmental quality.
Through the 1990's, *green integration* into the port's business and operational plans indicated efficiency as well as cost-effective results. To achieve the EMS implementation objectives - not to mention to obtain certificates- ports needed money, time and trained personnel. The DHB phase development decision on EMS implementation allowed the port to develop its own green port path due to the gradual planning of efforts and resources *while* it reflected in the best possible way the port's special geographical, hydrographic and organizational characteristics. It was a timely and right decision.

By the end of 1990's the port of Dover had more than 180 UK and EU laws to comply with, (Jenkins, 2003), which was a fairly common condition throughout European ports, but due to the port's Environmental Monitoring Programme since 1992 the port had benefited from its advantageous position. The port had already implemented an environmental management practice and in 1998 it had in place its first Environmental policy, a structure of appropriate working groups, designated personnel responsible for environmental protection and an EMS formation that provided: *"compliance with legislation; environmental performance; management performance; cost-benefit results"*, (Paipai, 1999:42). The port's active involvement in environmental research with a range of agencies and institutions has proven to be primarily scientifically beneficial and in addition cost-effective.

Ports are proud to gain certificates that improve the port's image and show to the stakeholders and clients how serious they are in managing their environmental impact. DHB has a longstanding commitment to environmental obligations. The port has endorsed the principles of the ESPO (Environmental Code of Practice) early -since its issue in 1994- and has retained until today its status as a lead European port regarding the longest SDM records (since 1998); it was the first European port to have a certified EMS in compliance with the EPF/PERS standard in 2003; and the first to be re-accredited in 2006. In 2008, the port was certified with the internationally recognised ISO 14001 standard which entails demonstration of continuous improvement in environmental performance.

Dover endorsed the sector's port specific EMS standard to obtain its first certification. In fact, the port aimed at a positive attribute in terms of marketing (particularly for the cruise, ferry and water sports industries), public relations and overall improved image. But it turned out that DHB fully endorsed the benefits from networking and worked (once more) on a phase development implementing an internationally recognizable EMS standard like ISO 14001.

- The PERS standard experience was used as a stepping stone to the ISO 14001 certification in line with the ESPO/EPF suggestions. To accomplish it, the port of Dover: 1) specified precise objectives and targets, 2) prioritized environmental issues in terms of action and resources, and 3) provided accurate quantitative data for the assessment of environmental performance, enhancing its monitoring capacity.
- The ISO 14001 experience at the port's managerial level further advanced: 1) environmental reporting on a regular basis and communication of the port environmental activities to all different stakeholders; 2) an integrated EMS development by involving all tenants and operators within the port.

Finally, facing perhaps the most challenging issue among those ports have to confront building their reputation towards SD, DHB decided to regenerate the Western Docks, facing up all the potential environmental constraints. The planning for Terminal 2 was undertaken in consultation with regulators and stakeholders at a very early stage. This approach has allowed the input of experts from a wide variety of fields, something that has given DHB the best possible understanding of the impacts and implications of the new development and it has allowed environmental considerations to become an integral part of the planning.

DHB regards the potential environmental impact of the *port's development* as another part of its EMS. Aspects of the DHB's master-planning that are deemed as an example of environmental best practice include: 1) on going, early and integrated assessment of environmental issues; 2) strong governance commitment and follow-up; 3) evidence of engagement throughout the process; 4) early consideration of alternative sites or development approaches; 5) detailed collaboration with a range of stakeholders, (GHD, 2013).

In sum, the port of Dover endorsed the (central UK political) approach towards strong scientific evidence on environmental protection at the *early* EM development stages and initiated (but also further continued through the years) a number of communicative and collaborative schemes with "green" scientific agencies, aiming at environmental assistance.

The port turned out to be indeed a pioneer EU port in terms of ESPO/EPF objectives realization. Aiming at the environmental protection of its area, the port advanced benefits from networking and facilitated the way *from* green practices *to* green certification. The regime of 'compliance plus' over the years has established self-regulation, in-house training, corporate representation in negotiation and in-house capability development.

What is to be expected in the future? Based on positive probabilities, Dover as a ferry port will continue to adapt and prosper even taking advantage of any opportunity to do other things (extend its cargo trade, cruise sector, etc.). Based on its more than 15 years "green" efforts, a preliminary view of its "green" practising capability, reveals that it will continue to build on the work done and it will be innovative towards SD in the port–city relation on a more solid basis.

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- *Position of People interviewed or contacted via questionnaire*:

Jenkins, Nicola	DHB – Environmental officer (until 2005)
Christine Marsh	DHB – Environmental officer (until 2005-2009)
Vickie Case	DHB – Environmental officer (until 2009-ownward)
Mike Krayenbrink	DHB - Director of Port Development
Wooldridge, C.	Earth and Ocean Studies Cardiff University, UK- EPF scientific consultant expert
Peter Barham	ABP – Sustainable Developer Manager

ANNEX 2

CASE STUDY 2: THESSALONIKI PORT

THESSALONIKI PORT –

Exploring the “green port” in Europe;
Was the *“GREENPORTh”* experience enough, *why* & *how*?

CONTENTS

1.0 INTRODUCTION

1.1 Greece - the failure of a "green" national context

In 1975, the Constitution of the new - born third Republic in Greece embodied pioneer, detailed regulations for the protection of the "natural and cultural environment", thus Art. 24 underlined the obligation of the State to take all preventive and repressive measures required to protect the environment, (Hlepas, 2007). The Greek National Report at the 1992 Rio Conference clearly portrayed the impact of previous EU policies emphasising that, although Sustainable Development (SD) was desirable, the economic problems did not favour public spending for improvements in the country's ecological base. The report underlined that SD constitutes a real 'challenge' for Greece, a member state rich in significant natural resources but lagging behind the Northern EU countries in terms of economic growth, (Kousis, 2004).

In the 1990's, despite some notable efforts, the country's response to the SD challenge was limited. The main barriers were institutional fragmentation, lack of economic resources and the absence of a strong environmental movement in Greece, (Fousekis & Lekakis, 1998). Although the Greek government has centralized control over environmental affairs, the country (as much Spain) has a large ministry comprising environment with the area of public works, therefore *"conflict of policy interests, notably between development projects and the environment are intra-ministerial"* (Pridham 1994:82). Both Pridham (1994) and Bŏrzel (2000) identify that fragmented administrative structures in Greece (as much as in most southern European countries) hamper the effectiveness of environmental policies. Economic constraints, appeared to be a major factor in the absence of an environmental movement in Greece in the 1990's (Kousis, 2004), while the Greek environmentalism has been also shaped significantly by the political context (Boudourides & Kalamaras, 2002).

Due to both historical and political reasons diachronically a common feature of the Greek policy is its *over-concentrated administrative structure* described as a hierarchical (top-down) governance model, (Boudourides & Kalamaras, 2002), and a *political culture* modified by two important components: a) the 'clientelist' influence, usually identified as the reason of the non-participatory character [of the Greek political culture], and its '*partyness*' (there are two dominant parties in Greece in the last 25 years); and b) the hegemony of parties as political institutions, (Alexandropoulos & Serdedakis, 2000).

Alexandropoulos and Serdedakis (2000:12), note that social problems can become political issues in Greece only when they are intermediated by political parties. The break-up of the Federation of Ecologists-Alternatives in 1990 has signalled the failure of a green party to give autonomous political phrase to ecological concerns and to break through into the particularities of the Greek political, cultural and institutional context, (Demertzis, 1995). Under this particular economic and political context the country's response to environmental protection minimized in actions formed by the transnational policy making of the EU supranational institutions, (Kousis, 1994). Since the 1990's, Greece has been struggling to implement policies towards sustainability, in sectors such as energy, tourism, transport agriculture and industry. It should be outlined, that most researchers (Fousekis & Lekakis, 1998; Boudourides & Kalamaras, 2002; Kousis, 2004; Hlepas, 2007; Hatzi, 2008) underlined the fact that EC funds acted as catalysts for the promotion of environmental policies and the creation of new organizational structures.

- *Governmental Actions*

Responsibility for environmental matters at the national level lies with the *Ministry for the Environment, Physical Planning and Public Works* (YPEHODE), which is initially responsible for environmental legislation and policy development. The first *National Environmental Program* for Greece aimed from its beginning, at addressing the country's major environmental problems, mostly at creating the infrastructures for the efficient management of the Greek environment The *Operational Environmental Program* (OEP) for the period 1994-2000, was supported by both national and community funding. Under the legal framework of the National Law 1650/86, the Program implemented the country's obligations with respect to International Environmental Agreements and Conventions for the protection of the environment, and the EC environmental regulations and directives. It was a mainstream national environmental program, based upon the general principles of: (a) sustainability, as it aims at improving or protecting the environmental conditions in Greece, while at the same time preserving the development's efforts in the industrial, tourist and agricultural sectors; (b) polluters pays, as it recognises the responsibility of the major pollutants who are called to take rectification measures; (c) precautionary, as it attempts to prevent, rather than rectify an environmental problem, with technical interventions at the source rather than at the end of the pipe line; and (d) of joint responsibility as it recognises the common obligations of the central, regional and local authorities as far as the environment is concerned. The first OEP (1994-2000) aimed to address environmental degradation in Greece, creating the infrastructures for the efficient management of the Greek environment in the 21st century.

OEP challenges were the development of the National Environmental Information Network, the establishment of the National Center for Environment and Sustainable Development first and second of the country's Environmental Inspectorate Authority. The latter is one of the main bodies for enforcement and compliance to the environmental legislation. Opportunities for environmental inspections were also given to various authorities, such as departmental and regional authorities responsible for the operation or the environmental permits. The Port Authorities were among them too. OEP still in the 2000s, aimed to improve the existing monitoring networks, and to develop the **National Environmental Information Network,** the Greek contribution to the EIONET of the European Environment Agency (EEA). In the recent years, the National Environmental Information Networ*k* has been set up in order to collect environmental data at a national level, exchange information between competent administrations and agencies, and disseminate information to the general public. The main areas of the national environmental information network are air quality, water, nature, waste, and environmental impact assessment. The central political tendency during the 2000's consisted of involving as many as possible institutions and other public or private bodies in the environmental matters (UN, 2009). Greece has not produced reports on its environmental state on a regular basis. Reporting in response to EU and international agreements obligations has not been timely or satisfactory, (OECD, 2009). In response to the Kyoto's Protocol requirements, the national inventory system of greenhouse gas emissions was upgraded in 2008 so as to meet the international reporting requirements.

Since the 2000's there has been increased public demand for reliable environmental information (NCESD, 2003), *yet* despite the progress environmental awareness in Greece appears to be lower than in other countries, (OECD, 2009). Environmental pressures in the urban areas of Greece are mostly related to transportation, as far as air quality is concerned and additionally, they are mostly located in certain large urban centres, (YPEHODE, 2006). Over the last decade Greece has intensified its efforts to adequately comply with the EU environmental legislation (OECD, 2009). The country passed important *environmental legislation* and transposed recent EU directives, and as a result the Greek environmental policy is largely based on environmental regulations, and on EU directives.

In 2001, the Greek *National Center for the Environment and Sustainable Development* (NCESD) was established by the Presidential Decree 325/2000, and has been operated as a private body supervised by the Minister of the Environment, Physical Planning and Public Works (YPEHODE). The NCESD has been appointed as the state's strategic advisor on issues of the environment and sustainable development, supporting policy-making and implementation, (Deliyannis, 2003). It has been introduced as a knowledge mechanism that could integrate the environmental dimension to sectoral developmental policies and/or coordinate governmental policies influencing environmental management, (Deliyannis, 2003). The main NCESD's thematic areas of responsibility have been; a) climate change; b) biodiversity; c) water and waste management; and d) environment and human health. The strategy has not been fully used to its potential as an integrative tool, while it has not been really influential and it has not been thoroughly monitored (OECD, 2009).

Since 2003 Greece has developed a national framework of Sustainability Indicators, in co-operation with OECD and EU. Various ministries are the main entities responsible, while domestic educational institutions, private environmental institutions and laboratories, as well as NGO's have contributed. There are two more structures under the Ministry of Environment active in environmental issues: a) the *MedWet* Initiative, a coordination group promoting protection of Ramsar Convention wetlands in the Mediterranean countries; and b) the *Natura 2000 National Committee*.

Until the 2000's Greece lacked a wide and comprehensive inspectorate system. There were neither technical terms of reference nor a legal framework to provide the required infrastructure. The OEP

(1994-2000) included action for the development of an *Environmental Inspectorate System*. The Greek Environmental Inspectorate has been operational since December 2003, but still in the late 2000's the country was suffering from insufficient implementation of environmental legislation, due to the lack of coordination between various administrative levels vested with the competence of applying environmental law (Hatzi, 2008). In general the "green" national context has been a failure so far. Lack of enforcement remains the Achilles' heel of environmental policy implementation, weakening the effectiveness of regulations and permitting, whereas the potential value of public participation in policy-making is still weakly acknowledged (OECD, 2009).

1.2 Is there any national port policy ?

Greece is a traditional *shipping nation* and among the leaders in international shipping, consequently the shipping sector is the country's leading business sector. The net inflow of foreign exchange resulting from shipping is considerable and in 2000 stood at 4.182 million Euros, up 60.5% compared to the 2.606 million euros earned in 1999, (Emporiki Trade, 2002). In 2004, the Greek commercial fleet contributed more than €1bn to the Greek economy, (Ministry of Economy and Finance, 2007). Although, one in six tons transported internationally is transported by Greek-registered or Greek-owned ships, due to the small position that the country possesses in the world market, the national administrations have placed little importance on infrastructure for the development of maritime transport. The state through its principal governmental agent, the Ministry of Mercantile Marine (MMM), focuses on *'flag-state' policies* - policies supporting the large Greek-flagged and Greek-owned fleet - rather than on *'port-state' policies* for providing port services, (Pallis, 2007a). Furthermore, the location of the Greek ports at the crossroads of three continents and their prospective to become among the most important nodes to the Far East connection with Europe has been omitted, (Pallis, 2007b).

The *Greek Port Policy* was reconsidered in the late 90's, *"based on the need to overcome long-term inefficiencies"*, (Pallis, 2007b:166). The prevailing concept that ports are public welfare services justified a predominant role of state authorities as regulators and the public sector responsible for the direct management provision of services, exposed deficiencies of the port structures, in the evolved context of the recovering restructuring of the worldwide trade activity and flows, (Pallis & Syriopoulos, 2006). The *national port policy reforms* that have been underway for almost ten years, since 1999, following a worldwide trend, aim at transferring port management and the responsibility for port services provision *from the national government* (i.e. the Ministry of Mercantile Marine) *to port level entities*; thus breaking a long-standing tradition of state-controlled comprehensive port organizations[1], these initiatives direct port governance in Greece to a devolution context, (Pallis & Syriopoulos, 2006; Pallis 2007a,b).

The reform of the national Greek port policy has been justified since 2002 (Law 2932/2001). The national policy, has promoted "*the greatest possible participation in the provision of port services*", (MMM, 2002) and has focused on: a) bilateral maritime relations with countries exporting significant cargo volumes; b) port competitiveness in light of the international economic environment; c) *sustainable and integrated port development in order to meet social and environmental needs*; d) social cohesion of the island area and populations; and e) safeguarding cargoes transported through Greek ports, (Pallis, 2007b).

Devolution: the new statutory formation: ESPO points out some very important steps that have been realized during the last years concerning the institutional and organisation system of Greek ports; thus the establishment of: a) the *General Secretariat of Ports and Harbour Policy at the Ministry of Mercantile Marin*e, b) the *Port Planning and Development Committee*, c) the *Hellenic Ports Association* (HEPA), and d) the *transformation 12 port authorities in limited companies*, (ESPO, 2005).

- Law 2932/2001 put forward the creation of the **General Secretariat of Ports and Harbour Policy** in the Ministry of Mercantile Marine. The General Secretariat has the responsibility for

[1] Comprehensive port organization (model): the port authority owns and maintains infrastructure, superstructure and provides (almost) all the port services; in this line ports were a 'public law undertaking' ruled according to the general regulatory regime of public entities in Greece.

the overall planning of the national harbour policy, ensuring growth of Greek ports, development of modern infrastructure to conform with the current and future needs of shipping, and international competition in the port services market, (ESPO, 2005). Pallis (2007b) considers this new entry in the policy reform “one-stop shop”.

- The **Port Planning and Development Committee**, whose members are representatives of eight ministries, ensures the planning and follow-up of port programmes The Committee is responsible for the general planning, monitoring and implementation of port programmes, and the allocation of financing for the adaptation of infrastructure, (Pallis, 2007b); thus approving, revising and realising the development projects and master plans of the ports, (ESPO, 2005).
- The **Greek** (Hellenic) **Ports Association** (HEPA) is called to carry out the co-ordination of the twelve main Greek ports (ESPO, 2005), or under a different perspective to ensure collaboration between the ports, (Pallis & Syriopoulos, 2006). The 12 main Greek ports (see table 1.1, p:7) are members and shareholders of the Association. The responsibilities of the Hellenic Ports Association are the follow-up of the application of legislation, of market developments and of statistical data; and the general co-ordination between the Greek ports.
- The most important change was the transformation of the 12 main Greek ports into limited companies. The reform is in the benefit of the quality of services and the competitiveness of prices; Greek ports act as commercial enterprises, operating in a free market. At the same time, the transformation establishes a more flexible frame for the ports’ management, given the degree of autonomy that allows the port authorities to take immediate decisions.

Pagoulatos studying the first privatization attempts in the beginnings of the 90’s, argued that policy failure was the result of a static strategy, produced by governmental poorly-coordination characterized as “intra-governmental feudalization” (Pagoulatos, 2001:138), lack of policy preparation, the isolation of key technocratic advisers; all of them key factors to undermine effectiveness and coherence. The overall strategy considerably matches the changes that had taken place in other Mediterranean EU countries (Italy, France and Portugal). The Spanish case, where the public entity Puertos del Estado is responsible for the coordination and efficiency control of 25 autonomous port authorities, stands as the example pattern. The tradition that led to a distinct Mediterranean port region within the EU (CEU, 1997) is alive, albeit its features are structurally different from those of the past (Pallis & Syriopoulos, 2006).

o *<u>Background to port reform</u>*

The criticism for unproductive investment decisions, and the absence of innovative ideas by port managers who lacked sectoral experience -but whose appointment facilitated clientele political practices - was also explicit, as were the frequent conflicts between vested interests and port administrations (INU, 1995; Pallis & Syriopoulos, 2006; Pallis, 2007b). Like in other parts of the world (cf. Everett, 2003) an inappropriate legislative regime had produced applied port structures that resulted in an environment of politically appointed controlling boards with little business competence. Politicians also used ports to solve employment problems, even exercise social policies. In 1997 the Port of Piraeus had a workforce of 1.300 and was obliged (under a 1961 Law Act) to spend almost 20% of its annual income to provide pensions to 1.800 retired port workers. These practices affected port operations, delaying necessary capital and other expenditure on projects required to meet market development, in order to suit short-term government agendas.
Since the mid 90’s acute port users’ criticism, concerning the absence of port facilities and inland connections was intensely recorded; the insensitivity towards users’ demands and lack of investment were the most common complaints. The 1997 publication of the EU Green paper on seaports stating the EU intention to create a ‘level playing field’ between and within EU ports with international traffic throughout Europe (CEU, 1997) contributed to a ‘wait and see’ policy in Greece, thus following EU-level decisions minimized political costs, (Chlomoudis & Pallis, 2005). Nonetheless, the pace towards reforms decelerated the formation of EU policies. Moreover, due to budget constraints and serious shortcomings (i.e. transshipment installations, inland transport infrastructure), public investments had stagnated, and outdated infrastructure were common (Chlomoudis & Pallis, 1997). Worldwide trends transformed ports to a capital-intensive sector

demanding heavy financial burdens but in Greece the construction and renewal of port infrastructure -even the efficient maintenance of existing facilities-, were problematic.
The overall outcome was low productivity levels, generally poor operating conditions and a large amount of infrastructure inefficiencies. Along with the absence of effective pricing mechanisms (Psaraftis, 2005), the administrative and operational deficiencies resulted in frequent cargo losses. Sub-optimal performance, short-term planning and lack of commitment to long-term strategies were apparent. The latter would have enabled Greek ports (like any organisation) to meet the needs of markets, -either via configuration or resources-, and to fulfill stakeholder expectations within a changing economic environment. When changes in the transportation process (i.e. new technologies, logistics) demanded specialisation of port operations (Chlomoudis et al, 2003), the Greek ports experienced a quite common phenomenon in Europe (Noteboom & Wielkemans, 2001): the 'political management' structures impeded public port organisations from developing enough flexibility and versatility to cope with a lack of productivity and innovation and adequately respond to structural changes. Since 2008 Greece has been at last moving down the path of port privatization with the partial concession of container terminal capacity in Piraeus and the full concession of container terminal facilities in Thessaloniki. But is it a fair privatization process and will it render a good result?

Ministry of Mercantile Marine (MMM): It is the main responsible service for marine and coastal pollution prevention. It coordinates the activities of the Port Authorities (PAs) of the State (Directorate of Port Police–Marine Environment Protection Division). The basic priorities at the core of the port policy implemented by the Ministry of Mercantile Marine have been: a) the improvement of productivity, efficiency and quality of port services; b) the modernization and development of infrastructure and equipment; c) the investment in innovation and human resources; d) the upgrading of the operational framework; e) the port system's adaptation to international standards. The strategic plan has initially foreseen the immediate implementation of investment programs for the country's two largest ports (Piraeus Port Authority and Thessaloniki Port Authority) and their parallel strategic placement within the global port network. The main strategic choice has been the realization of agreements with strategic investors in the international harbour market for the concession of business.

1.2.1 Types of ports – Greek port policy: Overall legislative and operational level
Greece has one of the longest coastlines in the whole EU. Seaports operations constitute essential conditions for the maintenance of territorial unit and cohesion, ensuring access to all inhabited islands of the country, (Polyzos, et.al., 2008) Beyond their importance in guaranteeing territorial cohesion, Greek ports also play an important role in the conduct of trade and more generally in the economic growth of the country. (Polyzos, et.al., 2008).
Greece's extensive use of marine transport relies on an infrastructure of ports throughout the country that serve domestic and international passenger and cargo needs. With a coastline of 15.000km, Greece's many islands and islets -as well as its geographical peculiarities- are attested by the 440 ports to be found all over the country, 123 of which (cargo and passengers' ports) charge port fees; and 50 are upgraded with funding from EU, while additional investment is expected to be generated by the privatization of Greece's ports.
The leader ports are: a) Piraeus (the chief port of Athens' greater metropolitan area), b) Thessaloniki (the main port for cargo traffic to the Balkans and the Black Sea), and c) Patras (the main departure point for destinations along the Adriatic). The international transport of cargo is carried out primarily by sea, while domestic sea transport accounts for only a small percentage of the goods transported in the mainland. In this section, the development and contemporary forms of port governance in Greece are presented. In total, the gross weight of goods handled in all Greek major and small ports is 111.1 million tonnes, including almost 2 million TEUs container cargo (ESPO, 2005).
The *port management model* has been changed in Greece since the late 90's. Twelve ports of national interest reformed from 'public law undertakings' to government-owned port corporations. In 1999, the *two trans-European port organizations* of the country, namely the port authorities of Piraeus and Thessaloniki, were transformed into limited companies (Law 2688/99) listed at the

Athens Stock Exchange (with State's stake on the order of 75%); the PAs of Alexandroupolis, Volos, Elefsis, Igoumenitsa, Heraklion, Kavala, Corfu, Lavrion, Patras and Rafina followed in 2001 (Law 2932/2001). These ports are supposed to operate as 'private-sector' businesses with the objective to develop infrastructure and offer quality and competitive services, (Pallis & Syriopoulios, 2006). The country's top two state-controlled ports and the first reformed, Piraeus and Thessaloniki, are considered 'large transeuropean ports', but the inclusion of both these ports in the same tier may be misleading, as Piraeus is about three times the size of Thessaloniki in terms of annual turnover. It is important to mention that the 12 top ports have no formal relation with the municipalities in which they are located, as it is common in many other European ports.

Table 1.1: The Greek Port System

	Port	Goods Throughput (in tonnes)	Passenger Traffic (in persons)	Sea-going Vessels (in no)
Major Trans-European Ports	Piraeus	21.425.318	12.536.608	26.333
	Thessaloniki	14.898.720	201.282	2.855
National Ports	Patra	3.399.034	1.263.124	81.581
	Heraklion	3.350.000	1.651.946	1.879
	Elefsina	3.249.750	800.000	5.003
	Kavala	1.633.445	1.454.222	7.330
	Volos	1.240.911	392.395	3.494
	Lavrio	824.527	213.412	1.815
	Corfu *	642.432	2.146.179	9.899
	Alexandroupoli	638.660	168.800	1.757
	Igoumenitsa	494.826	1.193.148	12.227
	Rafina*	96.772	1.760.776	4.305
	Total of the 12 Ports	51.894.395	23.781.892	158.478
Peripheral Ports	1,250 Peripheral ports, marinas, fishing harbours subject to the jurisdiction of 188 port authorities.			
Municipal Port Funds	53 Municipal Port Funds,			

* 2002 Data.

Source: HEPA (Hellenic Ports Association), (2003).

The rest Greek ports' management has been undertaken (gradually since 1993) by *local* and *municipal authorities*, replacing former managing boards directly appointed by the government. This reform aimed at better utilisation of public funds and other resources, as well as better service for the population and the local tourist industry, (Pallis, 2007b). Goulielmos (1999) notes that the transferring of port management to the local authorities, was more an ideologically driven move, initiated for the purpose of decentralization, having nothing to do with confronting, state possession, control or management. The total of the reforms attempted to facilitate the adjustment of the sector to contemporary trends and to overcome deficiencies of the earlier port structures (Pallis and Syriopoulos, 2006). Pallis (2007b) highlights the two main constraints: the inappropriate legislative regime had produced port structures that were controlled by boards with little business competence, and the fact that *"politicians used ports to solve employment problems and exercise social policies"*, (Pallis, 2007b:156).The outcomes were low productivity levels, generally poor operating conditions, infrastructure inefficiencies (Chlomoudis & Pallis, 1997), and ineffective pricing mechanisms, which appear to be a long standing obstacle, even after the port devolution (Psaraftis,2005).

Table 1.2: Greek Port Market Shares & Ranking

	2002		2004	
	market share	rank	market share	rank
PIRAEUS	66.47%	1	67.79%	1
THESSALONIKI	19.76%	2	20.84%	2
VOLOS	2.34%	4	1.89%	4
KAVALA	0.23%	12	0.48%	11
ALEXANDROUPOLI	0.24%	11	0.30%	12
IGOUMENITSA	2.27%	5	1.56%	5
HERAKLIO	1.00%	7	0.89%	6
KERKYRA	0.82%	8	0.67%	8
PATRA	4.84%	3	3.52%	3
ELEFSINA	1.21%	6	0.87%	7
LAVRIO	0.25%	10	0.58%	10
RAFINA	0.58%	9	0.60%	9

Note: market shares and ranking based on revenue.

Source: Pallis and Syriopoulos (2006)

While international specialization was the new reality in port business, in Greece sub-optimal performance and lack of long-term strategies prevented ports from fulfilling stakeholder expectations and resulted in frequent loss of business (Chlomoudis et.al., 2003). The resistance on the domestic front was apparent and structural reforms in the Greek public sector were limited, although the deregulation of utilities became part of the agenda, in view of the Single European Market. The last attempt for a national port policy came in 2006. This new policy framework was focused upon three directions: 1) promotion of combined transports and infrastructure in connection with the railway; 2) growth of Short Sea Shipping (SSS) to interconnect important Greek ports with ports of Eastern Mediterranean, Adriatic and Black Sea; and 3) improvement of port connection with the local port-city network.

Finally, in terms of port environmental protection, Tzerefou (2006) studying the attitude of Greek port administrations towards the prospect of environmental management in port operations, concludes that although the Greek port authorities recognize the need for protecting and improving the environment, only a few ports have undertaken initiatives of environmental management beyond those compelled by legislation; and furthermore, that the majority of Greek ports does not fulfill the conditions for the implementation of standard Environmental Management Systems (EMS).

1.3 Thessaloniki port – the port profile

In the beginning of the 20th century Thessaloniki was one of the largest cities in the Ottoman Empire, and was the rail link with Europe (1888) and Istanbul (1895) which made the port the Balkans' financial center. In 1904 Turkey and France signed an agreement to set up the French company named: "Société Ottomane d' Exploitation du Port de Salonique", which undertook construction projects and the operation of the port for the next forty years. The port was becoming a source of profit and development after the construction of the breakwater, the warehouses on the first pier, the Customs House, the port railway lines, and the purchase of the first cargo-handling equipment. By 1912 Thessaloniki had become part of Greece and the Greek governments were deeply interested in the development of the port, which was regarded as the most important harbour in the whole Balkan Peninsula and the port itself has experienced major changes (Table:1.3). The port was run as an independent state entity from the 1930's to the year 2000.

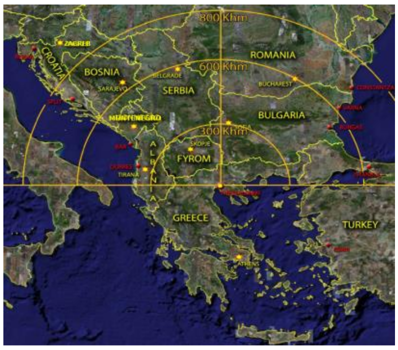
Table 1.3: Changes experienced by the Port of Thessaloniki, GR

1914	Establishment of the Free Zone.
1923	Establishment of the legal entity operating under public law.
1924	Beginning of operation of the Free Zone.
1930	Establishment of the "Thessaloniki Port Fund".
1953	Merging of the "Board of the Free Zone" and of the "Thessaloniki Port Fund" into the "Free Zone and Port of Thessaloniki".
1970	Assignment of the port management to the "Thessaloniki Port Authority" (OLTH).
1999	Incorporation of the Thessaloniki Port Authority into a public limited company named "Thessaloniki Port Authority s.a." (Th.P.A s.a.)
2001	**On 27.6.2001** a concession agreement of 40 years duration was entered into between the Greek State and ThPA s.a, according to which the PA was granted the exclusive right of use and exploitation of the lands, buildings and facilities of Thessaloniki Port Terrestrial Zone, owned by the Greek State.
2001	Listing of the Thessaloniki Port Authority s.a. on the Athens Stock exchange.

Source: www.thpa.gr

Today the port of Thessaloniki is the second largest Greek seaport and one of the largest in the Aegean Sea basin, with a total annual traffic capacity of over 16 million tonnes (7million tonnes dry bulk and 9 million tonnes liquid bulk) and the second largest Greek container port after the Port of Piraeus handling 370.000TEU's. The port provides services per year to almost 3.000 ships and 220.000 passengers, (Source: www.thpa.gr, Vafaki, 2008).

For some 70 years, and up to 1999, the ports of Piraeus and Thessaloniki, officially known as Piraeus Port Authority (OLP) and Thessaloniki Port Authority (**OLTh**) respectively, had been functioning as 'public law undertakings', an institutional model that can be found in almost all public sector organizations in Greece, (Antoniou & Stamatiou, 2007).The most recent historic change for the port was its 1999 transformation into corporation, at that time wholly owned by the Greek State under the Law 2688/99, "as a prelude to the future privatization through the stock market", (Barros & Athanassiou, 2004).



PORT of THESSALONIKI :

- **16 million tonnes of cargo are handled annually**
  of which approximately 7million tonnes dry bulk and
  9 million tonnes liquid bulk
- **more than 220.000 passengers are transferred**
- **more than 370.000 TEUs are handled**
- **one of the 27 Free Zones of the EU operates into the port**

Thessaloniki Port Authority s.a. (**Th.P.A. s.a.**) is the company operating the port since 1999. Before that the port was 'public law undertaking' and was ruled according to the general regulatory regime of Greek public entities. In 2001, the company was public listing on the Athens Stock Exchange, with the state retaining 75% of the port's shares. The port provides employment directly to 600 people (ThPA s.a., 2008- number of employees) or indirectly to more than 3,000 people (Tzaras, 2007).

Figure 1.1: Satellite image of the Thermaikos Bay and the city of Thessaloniki

The geographic setting of the port is a freshwater embayment as the port is located on the northwest coast of the Thermaikos Gulf. The area of the port extends eastwards to the lighthouse of Epanomi without including it, and westwards, uninterrupted, to the Axios river estuary. The marine zone of the Port of Thessaloniki is defined in article 16 of the mandatory Law 2971/01 and it includes any basins or protected bays extending along the sea shore or constructed quays as well as an open sea area of up to 500m from the shore of the terrestrial zone or/and more than 500m to the point where the sea is 30m deep, *provided that* the marine zone waters are shallow.

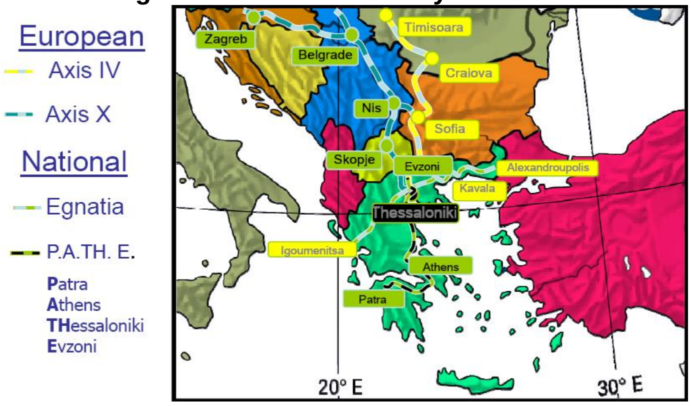
The Port of Thessaloniki has six (6) piers (Fig 1.2) with a total quay length of 6,200 meters and a sea depth of up to 12 meters. It has a 600,000m^2 area of covered and open-air storage. The total land port area is estimated about 1,55 million m^2. The port has a railway network in all its piers and access to road and railway networks (East-West via the Egnatia Highway, South-North via the P.A.Th.E. highway network) and the European corridors IV and X, (Fig 1.4).

Fig 1.2: The Port of Thessaloniki

Source: www.thpa.gr

The port's excellent railway and road networks, classify it as the biggest marine gate of the Balkans to the Mediterranean. Its services include the distribution of charges of direct approach (direct call), meaning that the land transport of goods take place at a small distance, and it is directed or emanated mainly from regions of N. Greece but also charges that require transports of larger distances. The port demonstrates an important activity with regard to the merchandising distribution with the Balkans and its location as a centre of transit in the Balkans is strengthened by the completion of the Sofia–Thessaloniki railway and road network (MMM, 2008; Polyzos, et.al., 2008).

Fig 1.3 : Road and Railway Networks



Source: Arvantitidis (2008)

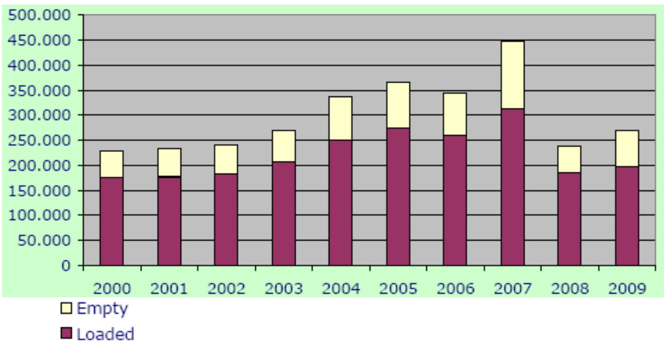
Thessaloniki Port Authority s.a. (ThPA s.a.) is a transit port. The PA's *activities* split up into: container transport, conventional dry cargo transport, liquid traffic (through private oil companies installations), services to passengers of coastal and cruise ships and services to ships (docking, mooring, berthing), plus the operation of organized vehicle parking areas. In 2007, ThPA handled 14.734,245 tons of cargo and 222.824 TEU's making it one of the busiest cargo ports in the country, and second after Piraeus. Although it has been built according to the old-fashioned way (several small piers, shallow waters) it is still able to serve the present vessel traffic. Among the port's advantages is -even today- its Free Zone (Control Type I), which operates according to the EU customs code.

Container Terminal: Container handling is one of the most important port's operations, (see table 1.5). The container terminal located in the western part of pier 6, operating 24/7 with flat rates, has the ability to receive ships with 12- meter draught, and it is linked to the national railway network by a double truck railway. Being part of the Free Zone, it covers a surface area of 254.000m^2 with an on-site storage capacity of 4.696 TEU's, (ThPA s.a, 2007), but also with a capacity to serve 3 ships simultaneously. The terminal operates using a Management Information System, which provides automatic and safe control of the movements to and from land and sea, optimization of container receipt-delivery time and space, control of collection stowage in the stowage area, plus graphic and electronic information data of various types.

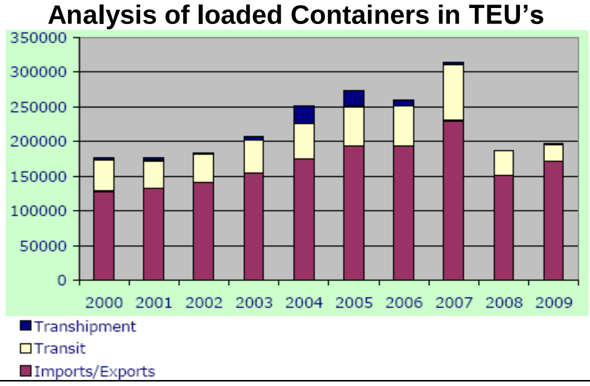
Table 1.4: Seaborne Containers Throughput at ThPA Area in TEU's

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
229.745	233.904	240.439	269.552	336.096	365.925	343.727	447.211	238.940	270.181
%Difference	1.8	2.8	12.1	24.7	8.9	-6.1	30.1	-46.6	13.1

Containers in TEU's



Analysis of loaded Containers in TEU's



Source: ThPA s.a. Statistical Data 2009

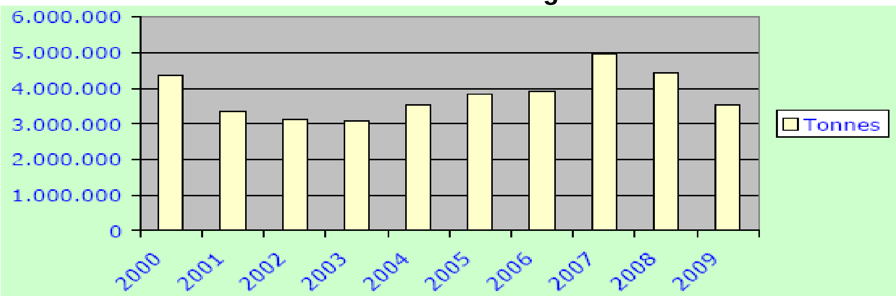
Conventional Terminal: The port of Thessaloniki is the leading transit port of Greece in terms of conventional cargoes. The handling of conventional cargo takes place in the Terrestrial Zone of Thessaloniki's port, in an area of 1.000.000m^2. General cargo, dry bulk cargo, liquid bulk cargo, and vehicles through Ro-Ro facilities are transported from quays with a total length of 4,000 meters, and depth of up to 12m. The cargo terminal specializes in the handling of general cargoes (steelwork products, metal sheets, timber, marble, pallet cargo, tobacco, food products, etc.), solid bulk cargo (minerals, ore, coal, solid fuel, cereals, feed, fertilizers, cement, scrap), liquid bulk cargo with pipelines (spirits, chloroform, asphalt, chemi-mineral oils, wine) and Ro-Ro vehicles, (ThPA, 2008). The conventional cargoes and particularly the transit cargo is supplemented and enhanced by the operation of the Free Zone (of Control Type I). The terminal serves a major transshipment hub in the Aegean Sea being used by other Balkan countries like Serbia, FYROM, Albania and Montenegro.

Table 1.5: Seaborne Cargo Throughput at ThPA area excluding containers and Ro-Ro in Tonnes

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
4.368.151	3.342.138	3.142.808	3.094.033	3.526.301	3.840.869	3.895.984	4.956.319	4.445.644	3.538.140
%Difference	-23.5	-6.0	-1.6	14.0	8.9	1.4	27.2	-10.3	-20.4

Source: ThPA s.a. Statistical Data 2009

Conventional Cargo



Source: ThPA s.a. Statistical Data 2009

Passenger Terminal: The port of Thessaloniki is not an exclusively commercial port. The port is also linked to the Greek islands, as it welcomes cruise ships. Sea service lines operate throughout the year with an increased number of itineraries in the summer transporting passengers and trucks to various island destinations (North-Eastern Aegean Islands Samos–Dodecanese, and Northern Sporades). The Passenger Terminal, a neoclassical building constructed in the early 20th century, has been operating since 1987 and it is located only 500 meters from the city's center.

Table 1.6: Passenger Traffic

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
248.429	231.580	218.032	201.282	209.066	217.538	129.684	150.202	163.502	158.179
%Difference	-6.8	-5.9	-7.7	3.9	4.1	-40.4	15.8	8.9	-3.3

Source: ThPA s.a. Statistical Data 2009

Beyond its supremacy in infrastructures and connections with transportation networks, in relation to the other ports of N. Greece, the greatest advantage of the port, originates from the existence of its "Free Zone", (Polyzos, et.al., 2008). Until 2010, the port remained one of the major employers of Northern Greece with a workforce of more than 450 people while over 2000 people work daily on its premises (ThPA, 2010)

Fig. 1.4: ThPA Passenger Terminal

The Port and the City

While preserving traditional architecture, the ThPA renovated the old warehouses in the 1st Pier and transformed them into multi-purpose buildings available for various activities (movies, theatres, conferences, seminars, exhibitions and concerts). The 1st pier is considered a cultural events center, since it is used together with three museums (Cinema, Photography, and Contemporary Art) and the International Film Festival of Thessaloniki. The prestige of the port is enhanced by the blending of its traditional characteristics with the contemporary events that take place in the city.

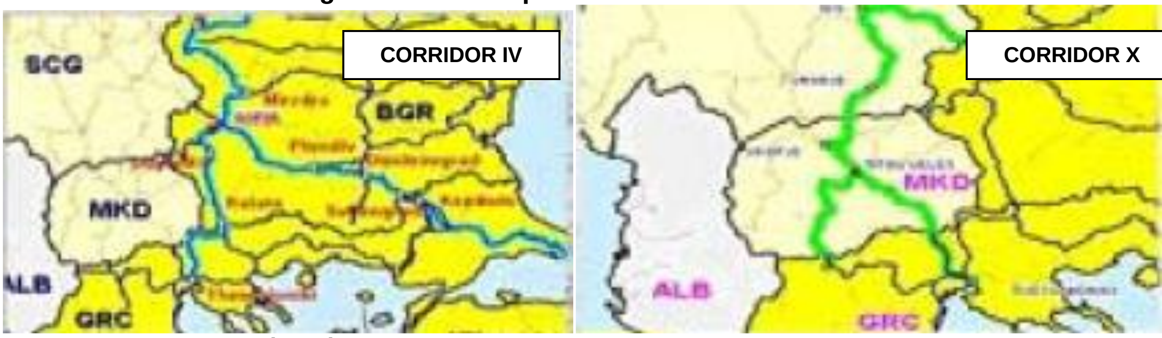
1.4 The port's reaction to changes in the port sector

The Port of Thessaloniki: A Regional Gateway Port

The Port of Thessaloniki, Greece's second largest city, serves the growing needs of Northern Greece and it is an important part of the country's transport network. It is better located to serve primary agricultural regions- compared to Piraeus- and its position on the crossroads of Eastern and Western European markets makes it a prime platform for handling cargo in and out of the Balkans, Eastern Europe and the Black Sea. Thus, it is politically considered as a vital link for the markets beyond Greece, providing import and export of raw material and consumer products to the countries of the Balkan Peninsula. The development prospects of the port increase as the economies of these countries stabilize and gradually grow. According to the management director the port *"constitutes one of the most dynamic companies in the broader region, as it is a trading route for 30% of the regional GDP and 5% of the country's GDP"*, (Tsaras, 2007). The prospects of the port look positive, with the line of Far East- Suez Canal-Thessaloniki-Eastern Europe showing a boom over the last decade while this trend is expected to continue since an increasing number of companies are using Thessaloniki as a gateway to the Balkans and other EU states and short-term storage is at minimum capacity, (Transport Intelligence Ltd, 2007).

The port has an advantageous position being located at the crossroads of land transport networks: 1) east-west via the Egnatia highway which links Turkey with the Greek coast on the Adriatic Sea; and 2) north-south via the PATHE motorway to the Pan-European Corridors IV and X. It is the only port in Greece which is directly connected with the national rail network, while it is expected that interconnection of road and railway internal network with the equivalents of countries of SE Europe, via the Pan-European Axes (Corridor IV and Corridor X) will enhance the services provided by the port. Impediments remain the facts that: 1) the Greek railway system has considerably fallen short of investments and *thus* the railway transports did not contribute, as expected, to the total transportation activity -particularly of N. Greece; and 2) the port of Thessaloniki is within the boundaries of the urban area, therefore its connections are intermingled with the urban networks.

Fig. 1.5: Pan-European Axes of Greek Interest

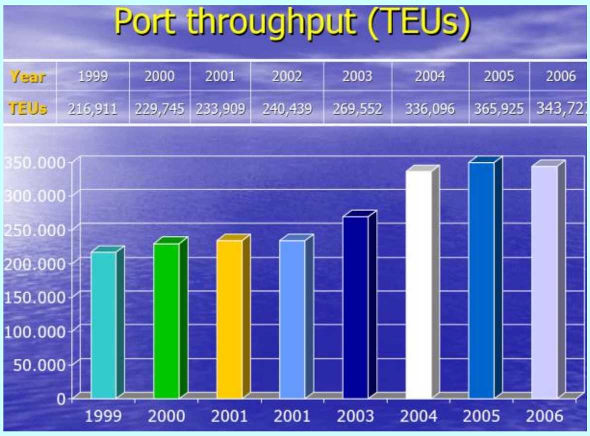


Source: UNECE (2008)

The port is considered -by the National Port Policy- a major Trans-European Port, (see table 1.2). Hence, in line with the national policy's objectives, it is conceded that its business performance should be based on the new volumes of international trade, new technologies and organisational structures that attract high-yield investments, (Pallis & Syriopoulos, 2006).

The Greek national policy reform was in line with the World Bank (2000:46) taxonomy, which -in the case of ports of national interest- puts an emphasis on a corporatization process, and aims to decrease direct government control over the PAs and makes them more responsive to market forces. Until the end of the 90's the Port of Thessaloniki, following the national predicament, experienced "political management" structures that obstructed steps forward on structural changes, as it was proved to happen in other parts of Europe (Notteboom & Winkelmans, 2001). Since 1999 ThPA has been a public limited company of public utility *"that operates according to the principles of private economy and enjoys administrative and economic independence"*, (ThPA Annual Report, 2006:18). ThPA's public listing was a move to secure private funds and limit the fiscal burden of port modernisation (Pallis & Syriopoulos, 2006), and indeed, the PA has acquired greater flexibility in its decision making process, but for those advocating the privatisation of ports the ThPA's reform remained over the last decade a first step towards this direction.

Fig. 1.6: ThPA experienced its first strong growth between 2004 and 2007



- In 2004 the annual throughput was up 20% and it reached 15milion tonnes, including 6,9milion tonnes of dry cargo and 320.000 TEUs containers, while it served more than 3.000 ships and 230.000 passengers.
- In 2006 throughput was just under 17milion tonnes.
- In 2007 the ThPA reaching pick performance handled 16,2million tonnes of cargo, including 7,6milion tonnes of dry cargo and 408.212 TEUs.
- In 2008 and 2009 the port lost a significant part of its throughput due to port labour protests against the government's intentions to proceed with a concession of the Container Terminal that lasted almost two years. The lost cargoes of the period 2008–2009 were 29% of the dry bulk and general cargoes and about 38%of the container traffic.

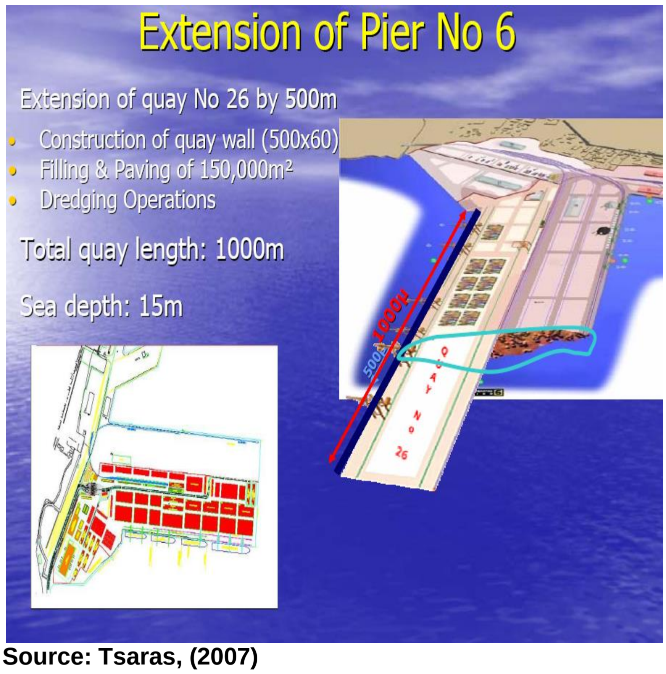
Source: Tsaras, (2007)

In many regions in the Balkan area, phenomena of overlapping port hinterland are observed although the last decade showed certain constant dependences between regions of the Balkans from concrete ports. Consequently, *port competition* -particularly from Bulgaria and Romania because of the fact that these countries have applied significant upgrading programs of infrastructures to increase their ports' capacity and extend their ports' hinterland - sets the frames in which ThPA is called to move towards expanding its business activities in the SE Europe (Polyzos, et.al., 2008).

A change of port reform

In 2008, Greece launched an International Public Tender inviting companies to upgrade and run commercial facilities at the ports of Piraeus and Thessaloniki in order to boost their role as regional hubs. ThPA had named the Hutchison Consortium, a 50/50 joint venture between Hutchison Port Holdings' (HPH) and the Greek pharmaceutical company Alapis Holding as the preferred bidder. The consortium offered €419mil ($544mil) for the 30-year concession period and it was proclaimed 'Provisional Highest Bidder'. On the 23th of December 2008, the ThPA announced that the Hutchison Consortium notified the PA that it withdraws its interest from the concession of Thessaloniki's Port Container Terminal, although the two sides were at the stage of drafting the relevant contract. Although the PA reported profit for 2007, nearly fourfold and the *"net profit for the year advanced to €13.9mil from €3.64mil euros a year earlier, while turnover rose 44% to €66.28mil"*, (ThPA Annual Report, 2008), the Greek media attributed the decision to the economic crisis and the inability of the consortium -led by the Consortium itself- to find the required bank funding. For the next two years the port faced a decline in its business activities, although the management team had proclaimed that the port stayed on its predefined policy targets and continued to respond to port industry's changing conditions by *"modernizing port management systems, following well-organized planning and by using the latest port and information technologies"*, (Tsaras, 2008). The port has failed to keep up the throughput development of other Mediterranean ports. Moreover, the whole Greek port system has confirmed that it was not capable to respond to both international challenges and competition.

During the last decade the most *crucial aspect* for the port remained the extension of the 6th pier. This extension according to the port planning is expected to increase the annual handling capacity of the container terminal to over 400,000 TEUs (Tzaras, 2007). The functional area of the ThPA Container Terminal is 200.000m^2 meters and 530m long, accommodating ships with a draught of 12m. Over €51milion has been spent on the port since 1997 with further investment planned.



Source: Tsaras, (2007)

The completion of the 6th Pier construction project has been long considered as a matter of national importance and, when completed, it is going to expand the quay length by 500 meters to a depth of 15.8 meters, providing adequate berths to the newly built big motherboards. The project will allow the Port of Thessaloniki to maintain its comparative advantage of container handling in the hinterland, as market research studies point the increasing of the demand-driven container traffic through the port. Value added services will be provided in the logistics chain and the provision of these services will be accelerated by the construction of a Logistics & Distribution Center, with an area of 300,000 m^2, close to the Container Terminal. It is anticipated that this initiative will provide integrated solutions in port services to customers and create new business opportunities in the region.

2.0 COPING WITH ENVIRONMENTAL ISSUES IN THE PORT AREA

The major environmental aspects that the port of Thessaloniki faced in the time period from 2002 to 2010, as defined by the Port Authority (ThPA) itself were:

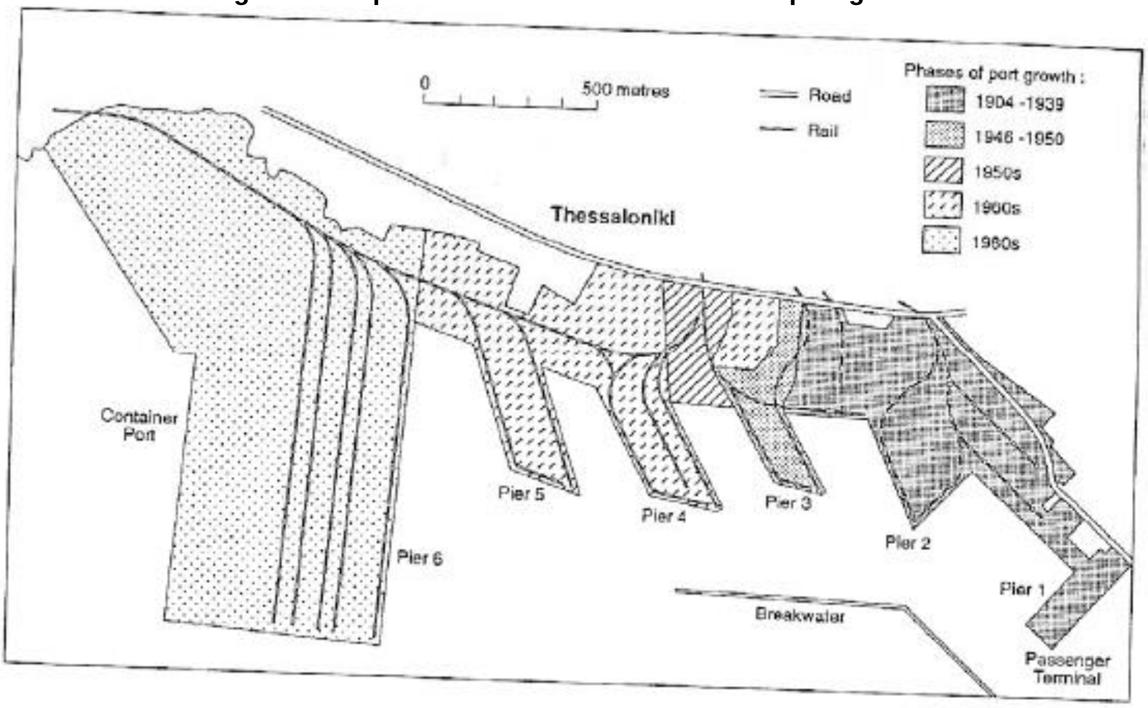
2002-2006	2007-2010
• Dredging and dredging disposal • Dust • Noise • Waste • Sea water quality • Air quality • Landscape quality • Resources consumption • Risk/emergencies • Compliance with regulations	• Dust • Port waste • Ship-generated waste • Sea water quality • Resources consumption • Risk/emergencies

Source : ThPA 2011, 2007.

2.1 Port Development in Thessaloniki, Pier 6 – Dredging & disposal of dredged material

Port Development – ThPA Pier 6: Ever since the beginning of the modern port construction in Thessaloniki in 1901 (Pier1), the port has been gradually extending from Pier 1 to Pier 6, (Fig.2.1). The core port business operations have been moving from pier 1 to the new piers towards the west.

Fig. 2.1: The port of Thessaloniki – Phases of port growth

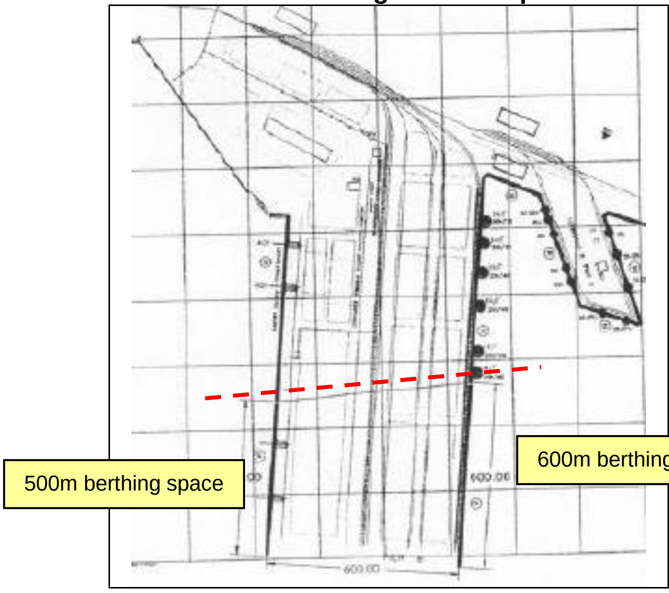


Source: Kostopoulou (1996)

Since the late 1990's the 6th Pier expansion project has occurred as a major development project for the port of Thessaloniki (total budget of 108.5 million €), aiming to increase the port's operational capacity in container transportation and dry cargo handling.

Financial resources problems have changed the start date of implementation (1999). In March 1999 the port of Thessaloniki was transformed into ThPA. s.a and this caused problems with the financial resources. Simply, the port could not anymore be financed as a state priority. The Phase A1 of the project (budget of 17.5 million €) -although delayed- was finally financed from the 3rd Community Support Framework and the Regional Operational Program. Not to mention that the expected December 2005 end date of implementation was over-estimated. Although planned within the last decade, the 6th Pier construction project followed the port's decline after the 2007 pick performance and remained a future plan.

Fig. 2.2 : The port of Thessaloniki - the 6th Pier expansion



<u>ThPA Pier 6</u>

The plans embraced extension and expansion which will provide :

- 150.000m^2 surface area to the Container Terminal and 500m of berthing space,
- 170.000m^2 surface area to the eastern section of the bulk cargo dock and 600m of berthing space and,
- a useful depth of 15m alongside the new wharfs.

Total surface area: 320.000 m^2

The planned constructions are expected to generate the following effects: 1) disturbance of the marine life, 2) changes in the seabed environment and to the water dynamic characteristics, and 3) discharge of contaminants and sediments into seawater. The impact on the sea environment was a concern, while the port's 'physical characteristics' created another problem.
Because of the docks No26 and No24 length extension (500m) and (600m), the area in between the two wharfs of approximately 330.000m^2 has to be land-filled. The new wharfs will be made from 'caissons' and the created area will be completed with further infrastructure works. The project implementation will take place over a seabed of very bad quality in terms of foundation suitability. *Thus*, the <u>*seabed excavation*</u> and the replacement of huge volumes of sediment and clay by good quality sand are considered a *major environmental problem*.
To tackle the issue, the PA has consulted the local University. In addition, mandatory obligations of any potential expansion project for port land and water, before the construction phase, require the preparation of an Environmental Impact Assessment (EIA), which has a need of approval by the competent local as well as national authorities.
Thus, in 1998 a comprehensive consultation procedure with the local community (authorities, interested parties) for the future port expansion (Pier 6) was carried out, as part of the required EIA study. The study has taken into account the Environmental Impact Assessment Law, identifying all the potential impacts on the surrounding environment and, also, the local conditions (undermined quality of Thermaikos Gulf, pressure of local groups). The Environmental Terms provided by the study, imposed requirements for the efficient and adequate protection of the Thermaikos bay, in terms of environmental quality. All the Environmental Terms were systematically addressed and the project has been approved.

The EIA study encountered the seabed excavation issue as well. Pollutants of various forms were investigated, so that the seabed material should be classified. The Aristotle University of Thessaloniki (AUTh) conducted a dredged spoil sampling and elaborated sample analysis, reflecting the depth, the size and the amount of the excavated area. The excavated material along the new wharfs basis proved to be not of the worst quality and suitable for alternative use. It could be disposed for land filling of the area between the two wharfs, or it could be disposed in the maritime area of the Thermaikos Gulf. Furthermore, the EIA study proposed particular practical measures. Surrounding silt curtains have been planned in order to avoid the horizontal dispersion of the plume of suspended matter generated by the operation of excavations and to protect the excavation areas. In this case, also the collaboration with the AUTh proved of significant value, as a detailed study of mathematical model simulation was carried out by experts' academics. Finally, any construction phase has been scheduled to be observed by means of a monitoring system implementation (assessment, prevention and mitigation of the associated environmental impacts

during the work process and the future operation) which will measure the effects, whether direct or indirect, in the marine environment. This system will evaluate the physical, chemical and biological quality of the new situation with reference areas, using various indicators, such as dissolved oxygen, aquatic organism (e.g. clams), heavy metals, etc. Within this scope the ThPA has set up a group of qualified experts.
The whole project is not expected to interrupt any commercial activity of the port. For smaller construction projects, the PA initiates appropriate Environmental Management Plans, identifying relevant environmental aspects and potential restrictions.

Dredging & disposal of dredged material
Dredging activity consists of periodic removal of material from the seabed in approach channels to the port and harbour basins, to maintain widths and depths in previously dredged areas in order to ensure the safe access for vessels, involving the disposal of the excavated material, (ABP Research, 1999). In this regard, one of the Thessaloniki port's comparative advantage is its natural sea entrance, which implies no need for dredging (Arvanitidis, 2009).
Dredging is an aspect of minor significance for the Thessaloniki Port, as it is not affected by tidal movements or runoff from rivers or surrounding land areas, (ThPA, 2007; 2011). During the last decade, as almost no built-up of sediments has been produced, the depth of berths and navigation channels was kept steady. A small-sized dredging activity took place along cruise ships berths in 2002 (ThPA, 2007).
In general, in case of works where dredging activities are necessary, the relevant legal requirements are applied (impact assessment, terms, measures etc.). The PA has also been aware of the environmental issues concerning the construction phase of the quay extension. Thus, the issues of sediment disposal and water quality are actively being addressed, (ThPA, 2011).
During the Phase A1, when the port's expansion project required dredging activities to provide land filling of the 6th Pier basis at the west end of the port, there was a systematic study, carried out by the AUTh. Both the short and long-term effects of dredging and dredging disposal were of concern, in order to minimize the potential effects on the sea environment. Derived from the results of this study and consultations with the competent authorities, the overall assessment of the dredging activities' impacts was formed, a permit authorising sea dredging and dredged material disposal was issued, and the appropriate measures for the marine environmental protection were implemented by the PA.
In case that excavated materials from the port's expansion works should be disposed in the marine area of the Thermaikos Gulf, the PA has taken a permit in advance authorising sea *disposal of the dredged materials*. A research study commissioned by the AUTh investigated the potential disposal sites. The site selection was based on environmental criteria, as much as the economic and operational feasibility.

Contaminated dredged material in the port of Thessaloniki: The 6th pier extension project, aimed to increase the range of port activities, providing direct entrance to the port by road and rail from the west and adequate space for the development of a Commercial and Logistics Centre. During the initial stage of the construction phase, the land-filling of the pier's basis at the west end of the port, and although the construction site was a small coastal zone with a seabed of +0.0m to –4.0m under the sea level, a major pollution issue occurred.
Sampling of the bottom sediments' contamination was undertaken, and mathematical models, simulating the transport, diffusion and settlement of sediments, were applied. It confirmed that the seabed was heavily polluted (composed of a mixture of polluted clay and mud) and -as expected- of poor foundation capacity, while the simulation models revealed a large dispersal of harmful substances around the site, (Papachristou, et.al., 2008).
The relevant EIA study (conducted by the AUTh) suggested that the heavily polluted seabed (overloaded with organic load, hydrocarbons and chromium - the chromium concentration was up to 20 times higher than the rest seabed of the gulf, but lower than warning value of 1,000ppm). For this reason, as much as concerns for severe environmental impact, it could not be disposed in the marine environment of the Thermaikos Gulf. In addition, because of the area's direct (bad smells)

and indirect (fauna) effects to its surroundings, the area had to be cleaned and sanitised as well. The solution that was finally applied included:

1. initial site preparation, involving excavating (with sea disposal) of the polluted seabed material;
2. the coverage of the excavated polluted seabed with a layer of geo-textile (Fig. 2.4);
3. gradual landfilling with good quality sediment material (sand and gravel);
4. installation of a dense grid of vertical drains (de-watering through the drains and the consolidation of the bed layer); and
5. final reclamation (Fig. 2.3)

Fig. 2.3 : The port of Thessaloniki - the 6th Pier extension before and after reclamation

Source: ThPA

Fig 2.4 : The construction phase – polluted seabed coverage during the geo-textiles application

Source: ThPA

The result was an environmental upgrading of the surrounding area. The whole project was financed by the port's own funds. It has been considered of great environmental effectiveness as it overcame both the polluted seabed and the disposal of the dredged material to the Thermaikos Bay.

It was evaluated, by the sector's green experts, as *"an innovative approach addressing the issues of historic pollution and the requirements for identifying port space and environmental enhancements"*, (Naniopoulos, 2004). It has been considered as a <u>*good practice*</u> regarding the reclamation of a polluted port coastal zone, which other port and harbour authorities can adopt. As such, it has been incorporated to the Ecoports Data Base of best practices available to all Ecoports port partners.

2.2 Air quality – Dust

Ships and port activities are strongly related to environmental impact. The diesel engines at ports, which power ships, trucks, trains, and cargo-handling equipment, create vast amounts of air pollution that affect the health of workers and people living in nearby communities and significantly contribute to regional air pollution (Mitchell, 2001).

Kelessis et.al., (2002) provided further support to the previous findings regarding the port of Thessaloniki, indicating that ambient air quality levels in Thessaloniki are influenced not only by local sources, but also by the transport of air pollution from Thessaloniki's coastal area, which acts as a reservoir of air pollutants. The conclusions of the study also demonstrate the complexity of the diffusion of air pollutants concentrations in the city, and the influence of both local sources and meteorological conditions in determining the ambient air pollutants levels in the urban area of Thessaloniki, (Kelessis, et.al., 2002). During the last decade, ThPA has identified *dust emissions* and *air quality* as priority issues as well. Thus, both issues have been recognized as of significant importance for further investigation based on the result of the SDM implementation, and the PERS certification procedures (Boile, et.al., 2006), back in 2003. In 2007, the PA identified them as the first two of the top (3) priority issues of the port's implemented EMS (ThPA, 2007).

In Thessaloniki's port, the problems with airborne particles generated mainly at piers 5 and 6, where the dry bulk cargo is stored. The average residence time of dry bulk storage in the port of Thessaloniki area is ten days. The intense weather sometimes aggravates the air quality of the close port area at the western part of Thessaloniki city centre.

Table 2.1: Pollutant emissions from the maritime and port activities under the responsibility of the ThPA s.a. (reference year 2010, reference area: 100x100km2)

ACTIVITIES OF SHIPS AND VESSELS							
Emissions (tn/y)	**CO**	**NOx**	**SOx**	**NMVOCs**	**NH_3**	**PM10**	**PM2.5**
Passenger ships*	60.67	36.80	10.38	12.73	0.009	1.62	1.62
Cargo ships*	881.02	7022.23	4399.48	113.92	0.904	220.79	220.79
Tugs	2.13	10.10	0.44	0.39	0.004	0.39	0.39
Total	**943.82**	**7069.13**	**4410.30**	**127.04**	**0.92**	**222.80**	**222.80**
IN-PORT STORAGE							
Emissions (tn/y)	**CO**	**NOx**	**SOx**	**NMVOCs**	**NH_3**	**PM10**	**PM2.5**
Loading	-	-	-	-	-	6.2	0.94
Unloading	-	-	-	-	-	14.7	2.23
Pilling	-	-	-	-	-	16.3	2.47
Total	-	-	-	-	-	**37.2**	**5.64**
IN-PORT TRAFFIC LOAD INDUCED BY PORT ACTIVITIES							
Emissions (tn/y)	**CO**	**NOx**	**SOx**	**NMVOCs**	**NH_3**	**PM10**	**PM2.5**
Vehicles operating in the port	-	-	-	-	-	**0.181**	**0.043**

Source: APICE project, (2012)

Air pollution concerns were related to some of the main actions taken within the framework of the port's environmental management program. The Department of Environment and Health and Safety has been appointed as the responsible key personnel for the Air Quality Monitoring action implementation. Based on zero (0) dust complaints documented since 2002, and the air quality measurements, (up to 2010), the contribution of the port's operation to the residential area air contamination was considered minimal, although the major problem seems to be dust dispersion from the bulk cargo storage, (ThPA 2007; 2011). A number of implemented preventive measures, such as: 1) the strict application of the "exhaust check card" for all Th.P.A.'s vehicles; 2) the appropriate operation and maintenance of central heating and boilers installations, in the total of Th.P.A.'s S.A. buildings and equipment, contributed to the discharge of pollutants in the air.

The PA has also conducted an extensive study including the monitoring of the air quality where the port employees workers are exposed, seeking to be in line with the exposure limit values of Health and Safety legislation, (see section 3.1). However, in the port's planning, since 2006 there has been scheduled monitoring of the basic pollutants in the air (CO, CO2, NOx, Pb) in critical locations and congestion times. In addition, the application of models investigating the distribution of the pollutants, as much as the investigation of the feasibility of natural gas-use in specific areas of the port, was as well proposed by external consulting (AUTh Team) (see section 3.1).

Air Quality, objectives and performance indicators for 2007-2009.

AIR QUALITY	
To ensure compliance with current health and safety standards	• **Evaluation and measurement of air pollution agents**

Source : ThPA Environmental Report 2002-2006.

The external consulting during the GREENPORTh I project, proposed the establishment of a dust (from the port land) and air pollution monitoring system. The suggested monitoring system comprised of fixed stations and regular periodic measurements, correlated with meteorological condition at critical locations and peak times, which until 2006 remained a future plan. Since 2008 the port has implemented air quality measurements including chemical agents (NOx, Benzol, TPH, CO, CO_2, O_3, Ethyl alcohol, Chloroform, Carbon tetrachloride, Phosphine) levels, as prior action of the port's Health and Safety Management Plan, which did not exceed the limit exposure values, (Vafaki & Palantzas, 2008), (see section 3.1). Today, the main goal of ThPA regarding air pollution, is to reduce emissions up to 20% and take compensatory actions for the greenhouse gas (GHG) emissions up to 25% annually (APICE, 2012).

➢ The problem of the Fugitive Dust in the port of Thessaloniki

Similar to the case of air pollution in the ports, is the case of the fugitive dust emissions. Dust emissions (particulate matters) result in health risks, threatening the health of workers and local communities, in terms of affecting the respiratory system, skin and eyes irritation and allergies (NRDC, 2004). <u>Fugitive dust can</u> result from: dry cargo unloading, uploading and storage; establishment, repairing or maintenance of building structures; construction works of infrastructure (roads, rail); other industrial activities and civil works (land and maritime); ship breaking activities; trucks, cars and ships traffic. The issue of significance is strongly illustrated by the ESPO survey's in 1996, 2004 and 2009, wherein dust ranked the 5^{th}, 4^{th} and the 8^{th} respectively major environmental aspect, among the top 10 environmental issues concerning seaports.

Dust can impact on: a) air quality, b) atmospheric visibility and amenity, c) people' health, d) water quality, e) buildings condition, f) vegetation and animals, and g) indeed, a port's profile, as the possible source of the problem. Impacts generated by these emissions are not the same for every port and can affect different urban and natural areas around the port, other port users and some especially sensitive cargoes (e.g. cars). Thus, <u>*dust emissions are part of the air pollution problem*</u> and it is laid under the same Directives, Conventions and International Agreements as in the case of air pollution (the MARPOL ANNEX VI entered into force 19 May 2005). Dust is a serious health problem in most cities, although it is difficult to quantify the impact of non-exhaust particles on overall ambient concentrations, (Koutitas, et.al., 2005). In accordance with this situation, under the legal framework established in the last years, the main legislative action taken at a European level *is* the 'Ambient Air Quality Directive 1999/EC/30' which obliges ports not only to control air quality for suspended particles but it also obliges them to act as environmental managers in the sense that they become responsible for reducing the amount of dust (and other air pollutants) generated by port activities, (www.ecoports.com).

Up to 2010, air quality measurements have shown that the contribution of the port's operation to the residential area air contamination is minimal. The major problem seems to be dust dispersion from the bulk cargo storage. In 2005, the port of Thessaloniki, faced such a challenge and confronted the issue of dust emissions. Dust from bulk cargoes was determined to be a major source of air pollution to the surrounding urban area, as the area's air quality level fell far below acceptable standards (Koutitas et al, 2005). The PA planned action policies and implemented procedures to control, minimize and monitor dust emissions (see section 3.2).

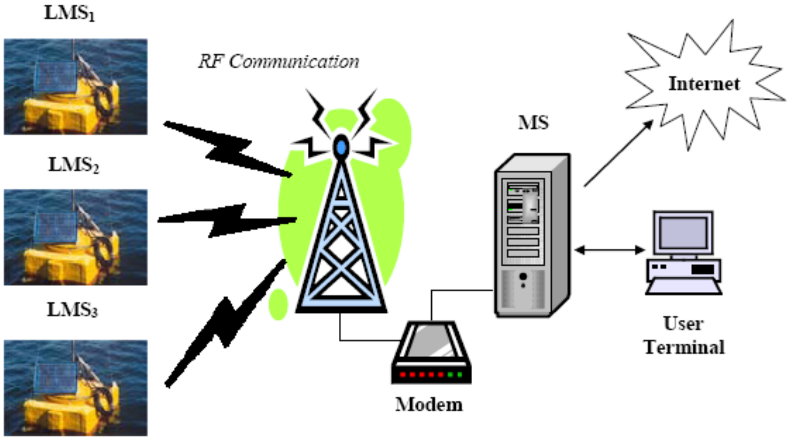
2.3 Water quality

The port of Thessaloniki has been benefited from an expert system that monitors sea water quality and pollution, through a sensor network installed in the Thermaikos Gulf of Thessaloniki called the **ANDROMEDA** sea-water network. The expert system consists of three local measurement stations as well as one central data collection station and provides added-value services on top of the Andromeda network, (Hatzikos, et.al., 2007, Partalas, et.al., 2008), aiming to help the authorities in the "decision-making" process to tackle pollution of the aquatic environment, by intelligently monitoring hydrological parameters of sea waters.

The expert system monitors sensor data collected by Local Monitoring Stations (LMS) and it is able to determine when the environmental parameters exceed certain "pollution" limits, -which are specified either by the authorities or by environmental scientists-, and issue appropriate alerts, informing about the current level of water suitability for various aquatic uses, such as swimming and piscicultures (Hatzikos, et.al., 2007, Partalas, et.al., 2008). The system is able to check complex conjunctive situations using fuzzy logic. Fuzzy logic achieves a more stable behaviour than classical logic, which would constantly change the system's conclusion about water suitability if the sensor measurements would fluctuate around a pollution limit, (Hatzikos, et.al., 2007).

The Andromeda network (Figure 2.5) is a network of sensors plunged into the Thermaikos Gulf that collects aquatic numeric data concerning sea water. The network consists of: a) *Local Monitoring Stations (LMSs),* which record and transmit aquatic data to the main station, and b) the *Main Station (MS)*, which initiates the communication process with all LMSs and stores the data in the database for future processing.

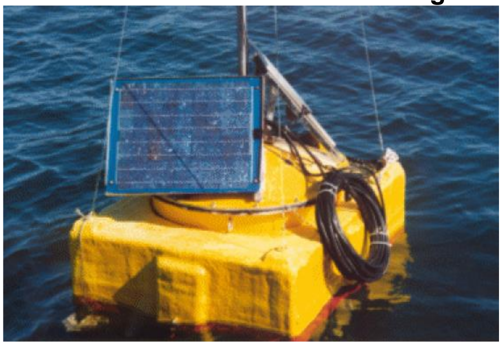
Fig. 2.5: The Architecture of the Andromeda network.



Source: Hatzikos, et.al., 2007

Local Monitoring Stations *(LMSs)*: The LMS (Figure 2.6) incorporates sensors, batteries, solar cells, electronics and a Programmable Logic Circuit (PLC) by Siemens. The PLC is responsible for the LMS operation and storage of the measurements to the local memory, and at fixed time points transmits the data to the central data collection station (MS), over a wireless network. The sensors measure the following hydrological parameters: *water temperature*, *pH*, *amount of dissolved oxygen (DO)*, *percentage of dissolved oxygen (DO %)*, *conductance*, *turbidity*, *sea currents*, and *salinity*. The necessary power is provided by the batteries and solar cells to the sensors and the electronics.

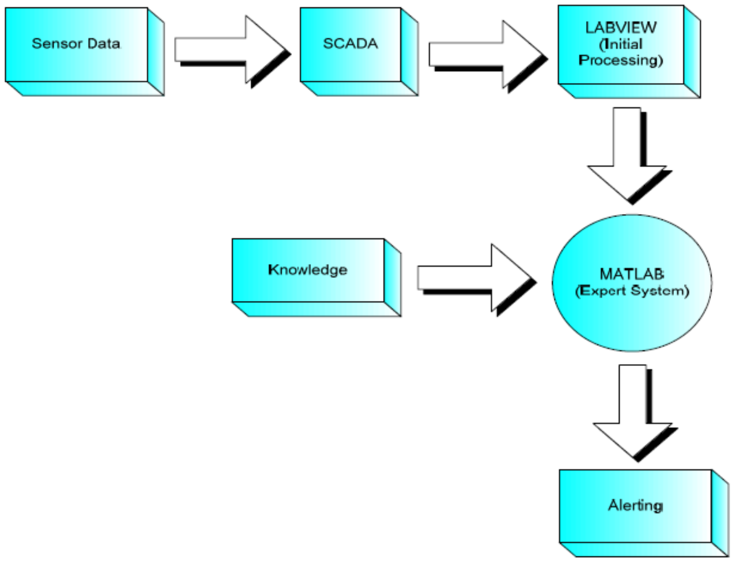
Fig. 2.6 :Andromeda's Local Monitoring Station.



Source: Hatzikos, et.al., 2007

***Main Station** (MS)*: The Main Station (MS) of the Andromeda network is a workstation that collects sensor measurements from all the LMSs and visualizes the results in a SCADA5 environment, (Hatzikos, 2002). The MS is the “master” of the communication process, i.e. it initiates the communication with each of the LMSs in predetermined time intervals using a hand-shake protocol. The total number of measurements that are collected is between 8 and 24 daily, and the frequency of measurements can be increased in case of emergency, i.e. an emergency in case of pollution. This communication policy reduces the consumption of energy by the local stations, since they operate only when they have to send data to the central station, (Partalas, et.al., 2008). The description of the system’s data flow is depicted in Fig. 2.7..

Fig. 2.7 : Main Station's data flow, including the expert system.



Source: Hatzikos, et.al., 2007

LabView, the main software of the monitoring system, is responsible for the data reception, visualization and storage at the MS. After visualizing the sensor measurements, data are processed by the Expert System, which is implemented in MATLAB, and the central station hosts an intelligent alerting system that gives the reasons of the current level of water suitability for various aquatic uses, such as swimming, shell-culture and piscicultures.

The Expert System requires scientific Knowledge, thus, it is developed to embed the existing scientific knowledge about the *desired* and *allowed* parameter *values,* elicited from the Greek environmental legislation and, according to this, it draws conclusions concerning potential danger, using fuzzy logic, when certain environmental parameters exceed certain “pollution” limits, and it finally alerts the user. The aim of this intelligent alerting system is, to help the authorities in the “decision-making” process in the battle against the pollution of the aquatic environment, which is indeed vital for the public health and the economy of the region, (Hatzikos, et.al., 2007, Partalas, et.al., 2008). Furthermore, the system employs Machine Learning and Adaptive Filtering techniques and algorithms which successfully predict measurements a day ahead, (Partalas, et.al., 2008, Bassiliades, et.al., 2009).

The Andromeda sea water network, due to its design, responds well to extreme weather conditions, increased energy requirements, and furthermore, the expert system that monitors sea water quality through the Andromeda sensor network, meets the processing and storage needs to effectively monitor the sea waters for alerting purposes regarding pollution in the Thermaikos Gulf. The main advantage of the system’s architecture is its flexibility/versatility, by means of extensibility and mobility. Concerning the sensor network, new sensors for a variety of environmental readings (e.g. hydrological, meteorological, etc.) have been easily added to the system. LMS can be easily updated and expanded, and a variety of technologies, -depending on the geomorphologic and socioeconomic features of the installation area-, respond to the communication between the LMSs and the MS, has been implemented. New methodologies and techniques both for predicting and monitoring can be used without disturbing the rest of the system, (Bassiliades, et.al., 2009).

The Andromeda network was working productively from 1998 until 2005, when it ceased working due to lack of Governmental funding. The expert system was working for 18 months in conjunction with the pre-existing simple monitoring system of the MS, during 2004-2005. During that period "events" of pollution were regularly recorded, since the LMSs were installed near the port and the industrial area of Thessaloniki, where the sea quality is very poor, and in one case, when all sensors strongly indicated a very large deterioration of water quality, it turned out that the reason of pollution was a spill from a ship, (Hatzikos, et.al., 2007, Partalas, et.al., 2008). Finally, there were several false and/or missed alarms when the maintenance of sensors was inappropriate, thus their indications were not trustful, or when littering was cluttering sensor readings, (Hatzikos, et.al., 2007).

Despite the problems, the port-operations today are friendly to the sea environment, due to a series of preventive actions realized mostly after the PERS implementation:

1. the toxic antifouling paints (e.g. TBT based), used on ships, have been prohibited and were replaced with environmentally friendly ones;
2. all ship-generated waste are delivered to the appropriate port reception facilities (see 3.3);
3. each year oil spill accidents are of minor severity, due to prompt response (see 3.4);
4. the airborne dust, coming from dry bulk cargo handling settled on the sea surface, has been further eliminated due to fugitive dust preventive measures, (ThPA, 2011).

2.4 Port waste and Ship-Generated Waste

Port waste is oil and oily waters, noxious liquid, specially controlled and hazardous wastes, sewage and garbage (ECOPORTS, 2006). Beside the large amount of waste generated annually, the port waste issue is particularly complex. The complexity is mainly related to a vast amount of national and EU legislation. Additionally, port waste is generated from two different sources: 1) port related waste, and 2) ship related waste. MARPOL 73/78 Convention is a world-wide accepted categorisation of ship-generated waste. The same categorisation is followed in the case of port generated waste. Since 2000, through the Directive 2000/59/EC enforcement the EU actively supported the application of MARPOL 73/78 before its adoption by all IMO members.

Port wastes can be classified as hazardous or non-hazardous, according to their origin, content and properties and thus, they are subject to different ways of disposal and recovery (ECOPORTS, 2008). In ship-generated waste it can also be included spills involving oil and noxious substances, coming from ships accidents. International Conventions (i.e. OPRC 1990) set up measures dealing with such pollution impact.

In the last decade, waste management has proved to be one of Greece's most complicated environmental, political, legal and social problems, while nowadays, most of the Greek waste management legislation pursues the relevant European legislation developments (Papachristou, 2008). The port waste environmental issues in the port of Thessaloniki haven't followed this national general trend. The PA has been proactive aiming to ensure compliance with relevant legislation on common and recyclable waste management.

Port waste

The port of Thessaloniki has been issued a license by the Local Authority, for shore (port land) waste collection and handling. The license regards the collection from the port's personnel of domestic waste of work places, wastes from the port's docks and roads, and cargo residues on the docks.

Ship-Generated Waste

The Port of Thessaloniki belongs to the Mediterranean Sea "special area", in reference to the MARPOL Convention Annexes I (Regulations for the prevention of pollution by oil) and V (Prevention of pollution by garbage from ships). But this was mainly because of the demand to ensure compliance with all the relevant Greek and EU legislation (ThPA, 2007) and finally due to the obligation towards the Directive 2000/59/EC "on port reception facilities for ship-generated waste and cargo residues", which in 2002 was fully adopted in Greece and triggered the PA to handle the ship generated garbage (see 3.3).

Hazardous Waste

The constant port–local university (ThPA-AUTh) collaboration also provided a detailed study on hazardous waste streams in the port area. The study presented an overview of types and quantities of waste produced per port facility/activity (Table 2.2). It explored all the port's facilities/activities and identified: 1) appropriate collection methods, 2) recycling potentiality, 3) treatment practices and 4) relevant costs (Papachristou, et.al., 2008).

Table 2.2: ThPA - Potential hazardous waste types related port facilities and activities.

Port Facility / Activity	Hazardous Waste Type
Sea Constructions / Dredging	Contaminated sediments/dredged material
Vehicles / Equipment Maintenance, coolants, Workshops hydraulic fluids, waste oils, agents	Solvents, cleaning agents, contaminated absorbent pads, oil filters, oil/lubricant/grease packaging, antifreeze, brake fluids, batteries, accumulators, electronic and electrical equipment, paints, detergents, contaminated rags and barrels, dry cleaning
Building / Ground Maintenance	Herbicide/pesticide/insecticide/fertilizer packaging, asbestos, electrical & electronic equipment, paints, varnishes, white spirits, resins
Lighting	Fluorescent lamps, high intensity discharge lamps, other electronic and electrical equipment
Electrical Substations	PCBs, electronic and electrical equipment
Warehouses	Electronic and electrical equipment, asbestos, hazardous cargo remnants
Offices	Cartridges, surfactants/detergents containing hazardous substances, batteries, dry cleaning agents, electrical and electronic equipment, sewage
Handling and Storage of Cargo	Hazardous cargo remnants, packaging containing residues of hazardous material, contaminated waterfront drainage and storm water run-off, oil and noxious substances spills
Fuelling Area	Contaminated storm water run-off, oily rags, oil leaks and spills
Public Access	Sewage, batteries
Healthcare Premise	Medical waste

Source: Papachristou, et.al., 2008.

Recycling

There are a number of waste products generated at ports that are not directly characterized as hazardous (including glass, paper, plastic, scrap wood, brochures, coffee filters, magazines, newspapers, scrap metals, shrink wrap, aluminium cans, cardboard, metal pallets, plastic bottles etc.). These materials can be subject to successful alternative management and recycling methods.
Since 2003, the ThPA has participated in the regional recycling program of the local Authority separating (where appropriate) material placed into the buckets (hazardous waste, plastic, tins, glasses, etc.). The amount and type of the port's recyclable material has been reported since 2008.

The port has put in place a waste management plan for both land and ship's generated waste (see 3.3), aiming at reduction of the quantity of waste disposal and the sustainable waste management (ThPA, 2011). Since 2002, ThPA has fully conformed to the Directive 2000/59/EC and MARPOL 73/78 requirements and has developed a "Ships Generated Waste Management Plan" and appointed a contractor for the collection and management of all ships' waste. Hazardous waste management has been carried out as well by a private external operator.
Although part of hazardous type of waste, the port has also developed Contingency Plan for Oil/Noxious substances spills. (see 3.3).

2.5 others (Soil Contamination – Noise – Biodiversity – Landscape Conservation)

Soil / Land Contamination

The Port of Thessaloniki is exclusively providing port services rather than hosting production and processing units, given the fact that its activities do not significantly affect soil/land contamination, (ThPA, 2007). However, port land is leased to private companies whose activities may generate soil contamination. To prevent land contamination, environmental management plans are required for new establishments, while the port's Environmental Management System (EMS) incorporates appropriate action plans that have to be applied to protect the environment in case of an incident.
The PA effectively confronted soil contamination in a coastal-land zone at the west end of the port (see 2.1). The seabed material was gradually contaminated by pollutants from the small industries placed in the surrounding area. Because of the area's direct (soil and seawater contamination, bad smells, aesthetics) and indirect (fauna) effects on its surroundings, ThPA carried out a unique project (from 1990 to 2001) to clean and sanitise the area. Now, the area is covered with good quality graved material and can be used for the port's operation improvement.

Noise

Noise can be emitted *from* engines and transmission equipment fitted *to* lifting appliances and vehicles and it seriously affects the loss of hearing. The noisiest part of the Thessaloniki port area, the container terminal, is located fairly far from the urban surroundings. As expected the occurrence reporting system of the PA has not documented any noise complaints from neighbouring residents as much as from the port staff. The main noisy activity that may exceed target levels, concerned the trucks and rail wagons access/exit to/from the port gates.
Irregular noise measurements have been applied into "hot" spots around the port. They have so far revealed that the typical noise levels were <60 dBA at the closest residential areas (maximum level: 65 dBA) (ThPA, 2011, 2007). In general, noise level is lower than 65 dBA around the port area. Since the upgrading of the Health & Safety management plan in 2005 and noise issues increasing awareness, great emphasis has been given on the assessment of noise port workers are exposed to (see 3.1).

Biodiversity – Landscape Conservation

The major part of the port (where activities take place) is covered with concrete and asphalt. Only a small area on Pier 1 is stone-covered, where the ThPA's Main Offices, the Harbour Master's Office and buildings used for cultural activities are located. The PA has looked after the port area's landscape conservation and thus improved the aesthetic image of the port. In the last decade ThPA landscaped port areas with series of trees and shrubs (ThPA, 2011).

Fig. 2.8 : Upgraded Landscape quality in the port of Thessaloniki

Source: ThPA, 2011

3.0 RECURRING THE PROBLEMS : THE PORT MANAGEMENT EFFORTS

3.1 Health and Safety in the Port of Thessaloniki

Since the 1990's there have been a range of EU Directives relating to the health and safety at work area. Ports today are facing these issues which are typical to other large industrial and manufacturing industries. Consequently, PAs have been forced to recognize H&S issues as a priority area affecting their daily life, while they are aware of the particular value incorporating them in their business policy, due to significant economic and social benefits, (WORKPORT, 2000).

In the mid 2000's, the port of Thessaloniki was introduced as among the few ports throughout Europe that declared a Health and Safety Policy Statement or/and developed and implemented a Health and Safety Management Plan, (Vafaki & Palantzas, 2005). The port environmental team outlined health and safety *"as an issue that defines ways of both working and behaving"* (Vafaki & Palantzas, 2008).

ThPA has considered H&S as a vital component of its Environmental Management System (EMS). The port's Environmental Policy states that: *"ThPA sa is committed to high standards of occupational safety and health in order to safeguard the well-being of those working at, visiting or living near our operation"* (THPA, 2007). The Environment, Health & Safety Department has emphasized on port sustainable operation, in terms of health and safety, aiming at sustainable port operations that ensure *"the situation in which the port is able to meet the customers-ships needs without endangering its productivity, personnel's well-being and surrounding community's welfare"*, (Vafaki & Palantzas, 2008).

The sustained "protocol of cooperation with the "Sustainable Port" network of the Aristotle University of Thessaloniki (AUTH) on various research environmental issues", (Tzaras, 2007) produce, among others, a continuing work related to health and safety issues. As a result, the port has applied an accurate <u>*H&S Management Plan*</u> since 2003, just after the first PERS application. This development's basis lies on the time, when the Health & Safety Office of the ThPA *"decided to improve progressively year-by-year the health and safety issues awareness and importance at all port personnel and port users"*, (Vafaki & Palantzas, 2008).

In general, the health and safety improvements in ports result from a wide range of reasons (mandatory and preventative measures, improvements in awareness, information and training, positive image and mitigation costs avoidance, etc.). In the case of the ThPA, the port discovered that managing the dust was necessary not only to comply with legislated standards in the European Union, but also to improve the health and safety of its workers and the surrounding communities (Vafaki, 2008). It was a strong decision of the port's management team to invest in the employees' health and safety by constantly improving the occupational conditions (ThPA Annual Report, 2006).Back in 2003, the lately established Environment Health & Safety Department systematically planned its H&S management Plan. Its efforts to realize the plans implementation involved: 1) employment of specialized permanent staff (Safety Technician, Doctor); 2) an initial review and risk assessment related to workplaces implementation; 3) purchase of appropriate and specialized electronic equipment relevant to environmental and health and safety monitoring parameters (noise dosimeter, sound level meters, chemical agents control unit, dust control unit, weather station, personal protective equipment); 4) consultation with port personnel and workers to formulate the plan; 5) presentation of the plan and its requirements to the port leadership and requesting for commitment to support it, which resulted into the allocation of annual resources, specifically for health and safety issues (Vafaki & Palantzas, 2008).

The ThPA H&S management Plan has identified legal requirements and established roles and responsibilities. Workplaces and personnel have been categorized, and by each workplace hazards and risk assessment was identified by means of on-site study and monitoring. The port has implemented H&S control procedures to avoid the risk and provided adequate information, training, instructions and personal protective equipment to port personnel and workers (Vafaki & Palantzas, 2008). The Plan has emphasized on particular assessment of noise and chemical agents that the port workers are exposed to.

ThPA is characterized as any port by a wide range and variety of workplaces and workstations, electronic and mechanical equipment and machines, working methods and cargo-type distribution. Based on three years' data (2005-2008), the **noise measurements** which are referred to the daily noise exposure level $L_{EP,d}$ (dBA) are presented below. Emitted noise from machines operation has resulted in exceeding the upper exposure action value of 90 dBA. In the cases of dockers, noise levels depend mainly on the workplace (dock or hold), from the immediate operation of machines and the type of the cargo distributed. In the container terminal, the values are shaped by the sound signals and alarms.

Table 3.1:ThPA H&S Management Plan – Noise measurements

Categorization of personnel and workplace	Daily noise exposure levels $L_{EP,d}$ (dBA)
Electricians	70,9-84,7
Operators (electrically powered and automotive cranes)	75,1-83,2
Operators (bridge cranes)	74-78
Operators (straddle carriers)	75,2-79,3
Operators (forklifts)	76,2-89,1
Operators (rail wagons tractors)	79,2-83,7
Operators (other work machinery)	78,2-88,3
Technicians (machine shop)	79,3-92,8
Technicians (carpenter's workshop)	80,5-93,1
Technicians (structural works)	77,3-82,5
Technicians (maintenance and repair of work machinery and vehicles)	76,7-84,3
Dockers (container terminal)	78,4-83,5
Dockers (bulk cargo)	77,6-89,9
Dockers (unpacking)	76,5-80,1
Dockers (coils, scrap, etc)	79,2-83,5
Dockers (cartons, sacks)	78,5-82,8
Dockers (timber products)	74,3-83,4
Dockers (palette cargo)	75,6-83,2
Guards	73,9-80,5

Source: Vafaki & Palantzas, 2008

One of the most crucial parts of the ThPA H&S management Plan regarding health and safety management in ports, concerns the **air chemical agents**. Since 2007, the Plan has incorporated air quality monitoring where port workers are exposed, in quest of being in line with the exposure limit values of H&S legislation. The monitoring program regards the protection of workers against health and safety hazards related to chemical air agents at work, and aims at necessary techniques and procedures for protecting health and safety of the personnel. The monitoring program includes a network of 8 workplaces where a set of air chemical agents at work are measured. Thus, the following parameters are measured on a regular basis: Nitrogen dioxide (NO2), Carbon monoxide (CO), Carbon dioxide (CO2), Petroleum Hydrocarbons (TPH), Benzene (C6H6), Ethanol (C2H6O), Chloroform (CHCI3), Phosphine (PH3), Total solid particulates (TSP) (Vafaki & Palantzas, 2010; 2008).

The chemical agent's exposure levels were determined by the monitoring control unit "Drager CMS", ISO certified. The measurements of phosphine were carried out by the monitoring recorder unit "Drager REGARD-1". During the last years the implemented air quality measurements concerning chemical agents levels, as prior action of the port's Health and Safety Management Plan (see section 3.1), did not exceed the limit exposure values, (Vafaki & Palantzas, 2008) as the design and layout of the workplaces (open areas, limited number of personnel per workplace), the appropriate maintenance of the work equipment and workplaces, and the correct use of the work equipment, reduce the presence of high concentration levels. Phosphine represented an aspect for which an individual action plan was carried out. Vafaki and Palantzas, (2008) demonstrate that *"although health and safety issues vary from port to port, it can be considered that ports have common challenges and interests to demonstrate compliance with the health and safety regulations"*, and develop a working culture which will become an important area of competitive advantage in the future.

Table 3.2: ThPA H&S Management Plan –Chemical agents monitoring program

Chemical agent	Workplace	TWA (ppm)	Limit values
NO_x	Workshop (maintenance and repair of work machinery) - Gatehouses	<0,5 0.58-1.45	TWA NO2 5 ppm, NO 25 ppm
Benzol	Gatehouses Warehouses	<0,5 <20	TWA Benzol 0,5 ppm
Petr. Hydrocarbons	Workshop (maintenance and repair of work machinery) Gatehouses Warehouses	<10 5-75 2 <100	TWA 300 ppm
CO	Gatehouses Warehouses	<5 <5	TWA CO 25 ppm
CO2	Container terminal Gatehouses	<1000-1180 <1050	TWA CO2 5000 ppm
O3	Gatehouses Warehouses	<25 ppb <25 ppb	--------
Ethyl alcohol	On dock	<2,5	TWA 1000 ppm
Chloroform	On dock	<2	TWA Chloroform 10 ppm
Carbon tetrachloride	Gatehouses Warehouses	<1 ppm <0,5 ppm	--------
Phosphine	Sacking / Silo On hold	<0,3	TWA Phosphine 0,3 ppm

Source: Vafaki & Palantzas, 2010; 2008.

The port has systematically achieved a large improvement in occupational H&S conditions, which is as well credited to a series of technical and medical measures, such as: 1) placement of all appropriate safety signs for all the workplaces; 2) set up of precautionary medical check-up for port personnel; 3) removing of all devices and installations containing PCBs and asbestos, (ThPA Environmental Report, 2011).

In 2007 the port's Environment H&S Department went ahead for implementation of the OHSAS 18001 standard. The OHSAS 18001 standard is the most acknowledged standard dealing with health and safety issues. ThPA has aimed to achieve the certification for the entire company in 2010, but this particular target was not realized. Nevertheless, the International Labour Office (ILO) granted ThPA the Greek translation and editing right, of its code of practice "H&S in ports ".

3.2 Dust emissions Management Plan of in the port of Thessaloniki

In the port's environmental management program, developed in 2002 within the framework of the research project "GREENPORTh" (i. s.a.–AUTH) and still firmly framed to the present day, dust is consistently identified as a *high-priority problem for the port of Thessaloniki*. The range of reasons to manage the problem of dust in an integrated way, vary from: 1) compliance with legislation; 2) environmental protection and improvement; 3) positive image; 4) increased confidence of employees and city's leadership; 5) support for cooperated port-city planning and development actions; 6) health and safety risk management; and finally, 7) the cost of implementation of any action plan, (Koutitas, et.al., 2005).

It is difficult to be identified wherefore exactly the port was engaged to implement an action plan tackling any form of dust impact. Indeed, the SDM procedure (see section 4) ringed up the problem, and especially described it as problem concerning *fugitive dust emissions*. Dust is categorized by different classes (i.e. nuisance, respirable etc.) and various size fractions: a) total suspended particulates (TSP), b) particulate matter less than 10 microns in size (PM10) or 2.5microns (PM2.5). *Fugitive dust* is a particulate matter which becomes airborne and contributes to air quality as a nuisance and threat to human health and the environment. Koutitas, et.al., (2005) spot the main points that must be considered to manage dust generation and impacts in a port area, dividing them into two different types of actions: a) actions related to the emission of dust (identification of sources, actions and strategies to reduce emissions); and b) actions related to dust atmospheric concentrations (dust monitoring and modelling). Although dust emissions in a port come from different port activities, the main source of dust within the Thessaloniki port area comes from dry bulk cargo handling and related trucks' traffic (ThPA Environmental Report, 2002-2006); this fact was the result of: a) an applied inventory (register all potential sources and series of various elements, e.g. type of cargo handled, equipment used during the handling process, way and amount of cargo storage); and b) the quantification of dust emission main sources, (Koutitas, et.al., 2005). The GREENPORTh II project (see section 3.0) indicated that critical best practice in dust management is increasingly using complex technical methods, such as *modelling*. The ThPA s.a. is nowadays seeking to manage the fugitive dust emissions, by: a) application of computational dispersion models to quantify the fate of the suspended and transported by wind dust, b) use of technical equipment and organisational practices applied to reduce dust generation and impacts, c) dust monitoring.

Fig. 3.1: The most affected port's area from dust particulate matter diffusion

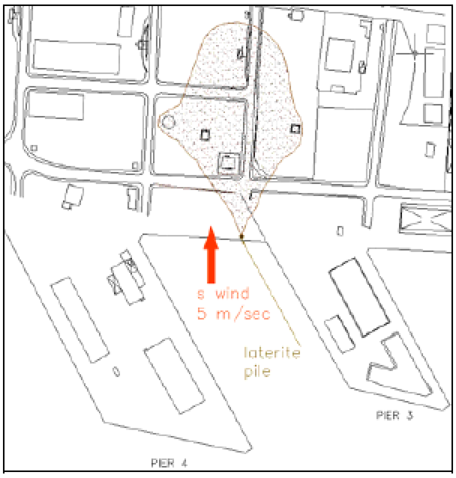


Fig. 3.2: The flow separation and redistribution of the air stream around the buildings

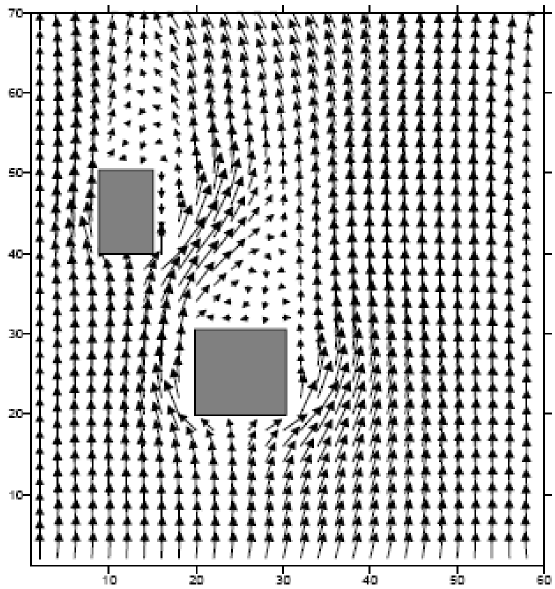
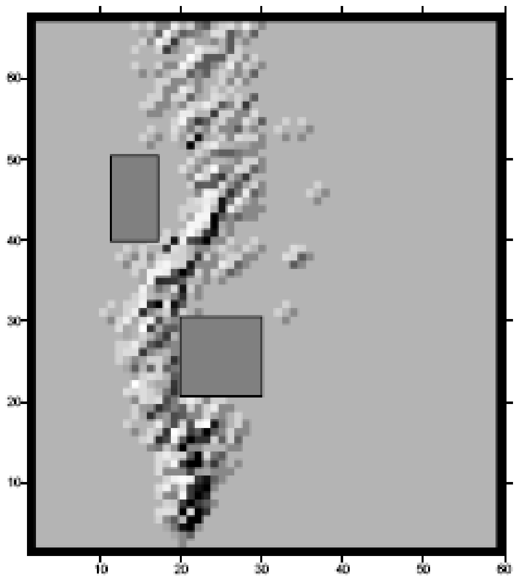


Fig. 3.3: The dust particles' suspension and flow inside the air column, settled on the ground and the sea and trapped on the buildings' lateral surfaces



Source : ThPA s.a., Environmental Report 2002-2006

The port is using a three dimensional application of a <u>*dust dispersion model*</u> developed to assist ThPA s.a. to: a) predict dust pollution levels; and b) set up step by step plan to control, minimize and monitor dust emissions in port area. The numerical model developed by ThPA, divided into the

sub-model for the wind circulation and the suspended matter transport model, providing production of “contour” maps of dust concentrations. As a result, the major contributing sources can be highlighted at the planning stage, allowing various dust configurations and control options to be tested and incorporated, (Koutitas, et.al., 2005).
As part of the actions and strategies of the ThPA s.a. to reduce associated effects and impacts of dust emissions, some *preventive measures* have been undertaken, (ThPA s.a., Environmental Report 2002-2006) : 1) cargo storage into surrounding perimeters of concrete retaining wall units; 2) covering of the cargo piles with dust sheets and/or tarpaulins; 3) spraying or covering of cargoes from which dust may be generated when being transported to or from the site; 4) watering cargo which has the potential to create dust prior to being loaded into or unloaded from trucks; 5) use of hoppers and pneumatic conveyors; 6) regular sweeping of cargo handling areas; 7) installation of dust extraction equipment on conveyors and ship loaders; 8) providing means of environmental and health and safety awareness and training.

Fig. 3.4: Bulk cargo (zinc) dune covered by tarpaulin

Fig. 3.5: Covering of dry bulk cargo pile with tarpaulin in a perimetric screen of concrete blocks

Fig. 3.6: Cargo storage into surrounding perimeters of concrete and metal retaining wall units

Fig. 3.7: Removable cover on trucks

Fig. 3.8:Spreading of dry bulk cargo in a perimetric screen of concrete blocks

Fig. 3.9: Phosphate & coke dust raised by truck

Fig. 3.10: Truck loaded with pet-coke, covered

Source : ThPA s.a., Environmental Report 2002-2006 ; Koutitas, et.al., 2005.

Since June 2005, the *Dust monitoring* plan of the ThPA has involved the set-up of a *dust* and *meteorological* monitoring program, which collects baseline data on dust air pollution prior to and during cargo handling operation, aiming to evaluate the effectiveness of mitigation measures.

The DustTRAK Aerosol Monitor

Wind direction and speed measurement

s/n	Date	Source location	Radial distance from the source	Type of cargo	Measurement duration	TSP (mg/m^3)	Wind (direction, speed)
1	28/04/2005	Dock 14, middle	50 m	Laterite	10 min	13,91	NW, ~8m/s

Indicative TSP measurement during the loading of laterite

Source: Koutitas, et.al., 2005.

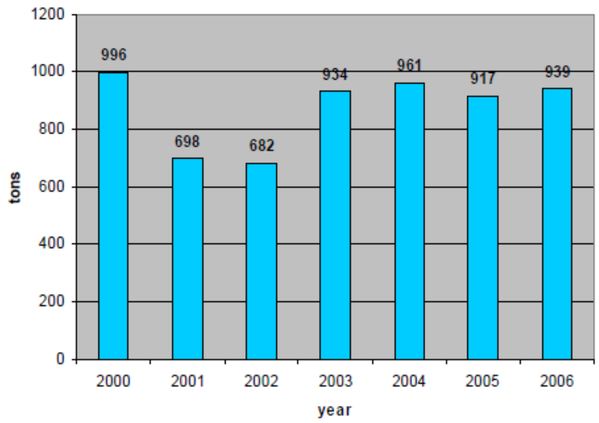
The GREENPORTh II project (ThPA AUTH), (see section 3.5) also provided a study of possible hazards at workers' health, advanced measurement of dust in workplaces in the port area, and especially, measurement of TSP concentrations, radial and at increasing distances downwind of the emission source during operations. The TSP levels are then compared to national and European air quality standards. Koutitas et.al., (2005) providing evidence inform that "total measurements collected till today are in a primary level, regarding amount and density, so conclusions cannot be derived in a safe manner".
To conclude, the dust significance has been appointed by the port of Thessaloniki since 2002, with the form of one of the three (3) structured management plans in order to monitor and evaluate the noise levels, chemical agents and *fugitive dust*, (Vafaki & Palantzas, 2008). It was acknowledged that "the dust may not only become a public nuisance but can also threaten the health of port personnel and local communities, as well as the ecosystem", (Vafaki & Palantzas, 2005); and the port had to "set up the necessary schemes to manage, in a sustainable way, the dust issues, providing, in parallel, an adequate public explanation that is accurate without being overly technical", (Koutitas et.al., 2005).

3.3 The ThPA Waste Management Plan

The ThPA waste management plan incorporates procedures to effective management control, treatment and disposal of waste generated during the port operation and from the ships, (staff workplaces, cleaning of roads and platforms, cargo residues).
In the framework of the research project "GREENPORTh I" a comprehensive study on integrated management of the shore-generated solid waste has been completed. The study identified several specific "waste streams" which could be more effectively managed, the aim being to reduce its overall environmental impacts and to fulfil the relevant legislation.
As a result, the port was able to prioritize and define waste management specific procedures. Since 2007, the shore (port land) waste collection and handling is done by the ThPA (port personnel), which has all appropriate licences, means and equipment (ThPA Environmental Report, 2011).

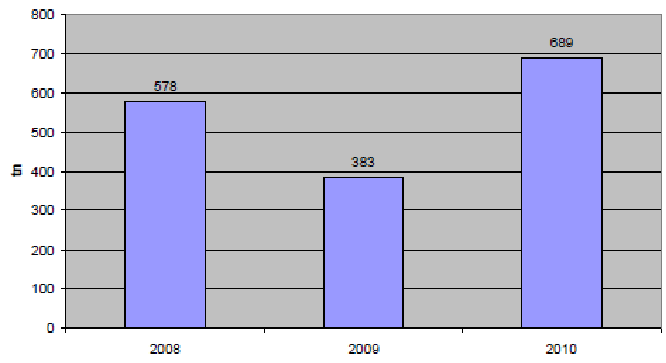
Fig 3.11: ThPA shore-generated waste (2000-2010)

Shore-generated solid waste



Source: ThPA, Environmental Report 2007

Shore-generated garbage



Source: ThPA, Environmental Report 2011

Under its <u>Recycling Program</u> the ThPA has defined specific procedures for the collection, temporary storage, management and delivery of recyclable waste, such as paper, waste oils, used batteries and accumulators, aluminium, waste electrical and electronic equipment. For each type of waste the PA has provided the necessary store equipment, and has signed contracts of collaboration with companies specialised in waste handling, (ThPA Environmental Report, 2007). The port's recycling efforts have included initiatives such as: 1) provision of additional recycling bins, 2) employee awareness programme, and 3) relocation and provision of additional bins to meet changes in high-use areas, (ThPA Environmental Report, 2011). Since 2003, the port has continued to undertake audits monitoring the success of initiatives in order to minimise its waste production and improve the recycling efficiency.

Fig 3.12: ThPA Recycling Program

Bin for paper

Area for tires' storage

Special tank for waste oils

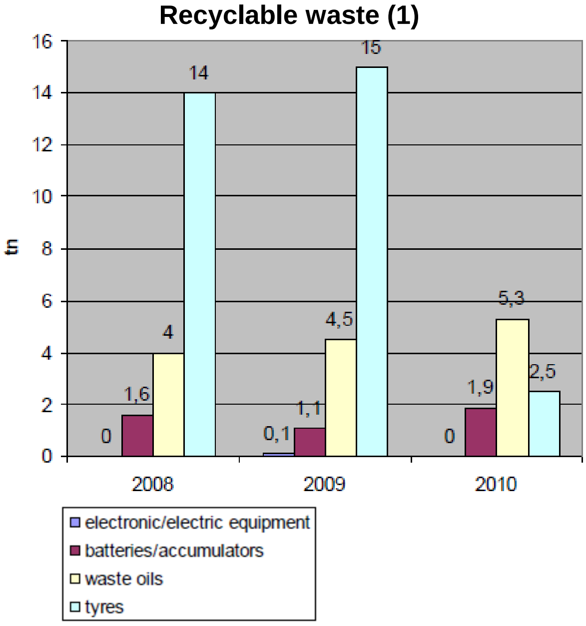
Special tank for accumulators

Source: ThPA, Environmental Report 2007

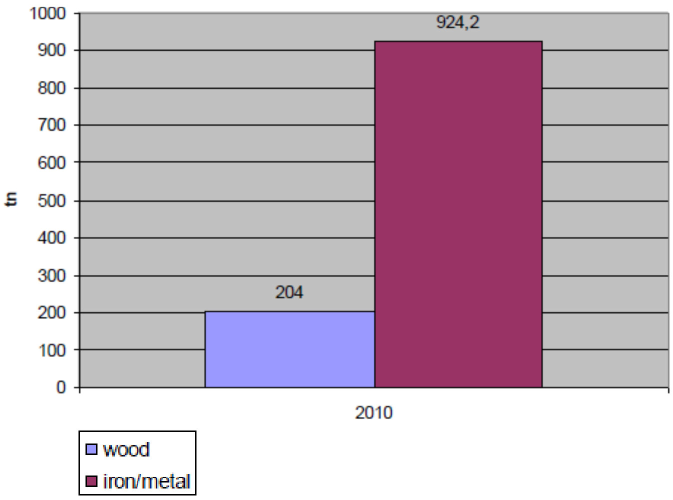
Moreover, the port has also applied a program for the recycling of packaging materials (from general cargoes) as well as for the recycling of the materials used for the cargo handling (i.e. equipment, machinery oils, tires), (Vaggelas, 2012). There was also an attempt -in collaboration with port companies- for waste product alternative management, like waste oil.

Fig 3.13: ThPA Recycling Program – Amounts of recyclable wastes (2008-2010)

Recyclable waste (1)



Recyclable waste (2)



Source: ThPA, Environmental Report 2011

<u>*ThPA Ship-Generated Waste and Cargo Residues*</u>: In the beginning of the 2000's, all European ports were obliged, according to the Directive 2000//59/EC *"on port reception facilities for ship-generated waste and cargo residues"*, to prepare a 'plan', describing their management process applied for the reception of ships' generated waste and cargo residues.

ThPA assigned to the local university a research for the developing of an appropriate "waste reception and handling plan" for the port, in order to implement the Directive as much as the relevant Greek Law (Ministerial Decision No.3418/07/2002). The plan aimed at the ships' waste management and adequate reception facilities preparation. In 2003, the ThPA's '<u>Waste reception and handling plan for ship-generated waste and cargo residues</u>' was already approved by the administration of the Regional Authority and the Ministry of Mercantile Marine. An important component of the plan was the drawing up of a tariff policy for the ships that will deliver their waste.The plan's elaboration was assigned to the Network of Collaborative Laboratories *"Sustainable Port"* of the A.U.Th., in the framework of the "GREENPORTh I" project. It should be noted that the research team followed an approach based on relevant EU Practices and Guidelines on plan developing and reception facilities organizing, e.g. ESPO, U.K. Department of the Environment, Transport and Regions, (Palantzas, et.al.2005).

Table 3.3: ThPa - Waste reception and handling for ship-generated waste and cargo residues

	Type of waste	**Infrastructure of port reception facilities**	**Licenses**	**Final disposal**
Management of ships' oily waste Annex I, MARPOL73/78	• Sludge, Bilge water, Slops and oil sediments. • Oil-bearing ballast water • Waste oil and fuel remnants, Lubricants and refined products. • Hydraulic and thermal oil. • Cleaning remnants from centrifugal filters.	**Facilities for ships' oily waste:** • *Self-moving floating reception facility* • *Tanker vehicles*	PA PA	Refinery of Aspropyrgos
Management of ships' garbage Annex V, MARPOL73/78	• Domestic wastes, that are all types of food remnants and wastes generated in the living spaces on board. • Cargo associated wastes, which refer to all materials that have become wastes as a result of use on board for cargo stowage and handling. • Maintenance wastes, which refer to materials collected by the engine and deck department while operating the vessel.	**Port reception facilities for ships' garbage :** • *Self-moving floating reception facility* • *Buckets, containers and lorries*	**Operation licence:** Approval of Environmental Terms of the *management of solid waste collection and transport* , licensed by the Prefectural Authority "Operation License of the *management of solid waste collection and transport*", licensed by the Prefectural Authority.	Landfill of Thessaloniki's eastern area

Source: ThPA (2002), *"Waste reception & handling plan for ship generated waste and cargo residues"*–own elaboration

Based on a study of hazardous waste streams in the port area (see 2.4-pp:23), the port has established a method of recording the amounts and types of ship-generated hazardous waste received, and of supervising the management process.

Table 3.4: ThPa - Waste reception and handling for of noxious liquid substances in bulk

	Type of waste	**Management plan**	**Licenses**	**Final disposal**
Management of noxious liquid substances in bulk Annex II, MARPOL73/78	• Dangerous waste, either solid or liquid defined by national Law • Noxious liquid substances defined by : MARPOL 73/78 – Annex II IMO Code IMDG	**Procedures applied** • identification, • classification • categorization, • reception, packaging, • carriage • disposal or recycling	• Licenses base to Waste packaging parameters / various authorities • Carriage – Specific Containers <u>Subcontractor company</u> licensed by the Prefectural Authority on toxic & dangerous waste management	Delivered to modern installations of E.U. countries,

Source: ThPA (2002), *"Waste reception & handling plan for ship generated waste and cargo residues"* – own elaboration

The management process applied, identified the involvement of various organizations and authorities, while it outlined the environmental legislative framework that should be applied to all Greek ports and identified challenges for future involvement, (Palantzas, et.al., 2007). After the “Waste Management Plan” development, the ThPA has conformed to the above requirements by announcing a public competition for the appointment of a contractor for the management of ship-generated waste. After an open and public bid, the providing of all reception facilities in the port for the ship-generated waste was assigned to an ISO certified private company, which has all the appropriate licenses, means and equipment.

Fig 3.14: ThPA-Waste reception and handling for ship-generated waste and cargo residues

The garbage collection vessel – private company

The vessel for the oily waste collection–private company

Trucks for oily residues, sewage and noxious liquid substances collection

Container for bulky waste and garbage

The ThPA waste management plan preparation also revealed stakeholder involvement. The consultation procedures, with the main actors involved in waste management procedures exposed the following main interests of each one (see table3.4).

Table 3.4: Stakeholder involvement in preparation of the
‘Waste reception and handling for ship-generated waste and cargo residues’ plan

Actors	Main interests
PA	appropriate response to legislative and regulatory framework; penalties and negative publicity avoidance; services supplied of high quality; cost; profit making; environmental dimension promotion.
Contractor/s	cost; profit making; fame and acknowledgment; penalties and fines avoidance.
Ship owners	low tariff; penalties and fines avoidance; undue delay avoidance.
Supervising Authorities	response to legislative and regulatory framework; policy and goals promotion.
Community	reduction of the pollution; low cost of services supplied.

Source: Palantzas, et.al., 2005

The port’s special characteristics and demands were significant factors in this waste management plan’s development, so that the plan’s implementation meet the legal and scientific requirements, without any harm to the port’s competitive position, (Palantzas, et.al., 2007). The port was among the first to provide these particular port-reception facilities. The ThPA waste management plan has been commended by the European Maritime Safety Agency (EMSA) for its functionality and effectiveness. Specifically, the methodological process applied in the ThPA’s Waste reception and handling for ship-generated waste and cargo residues’ plan, is promoted to be used in other port cases (at least among the domestic ports, where the legal framework is the same).

3.4 Thessaloniki's port Contingency Plan

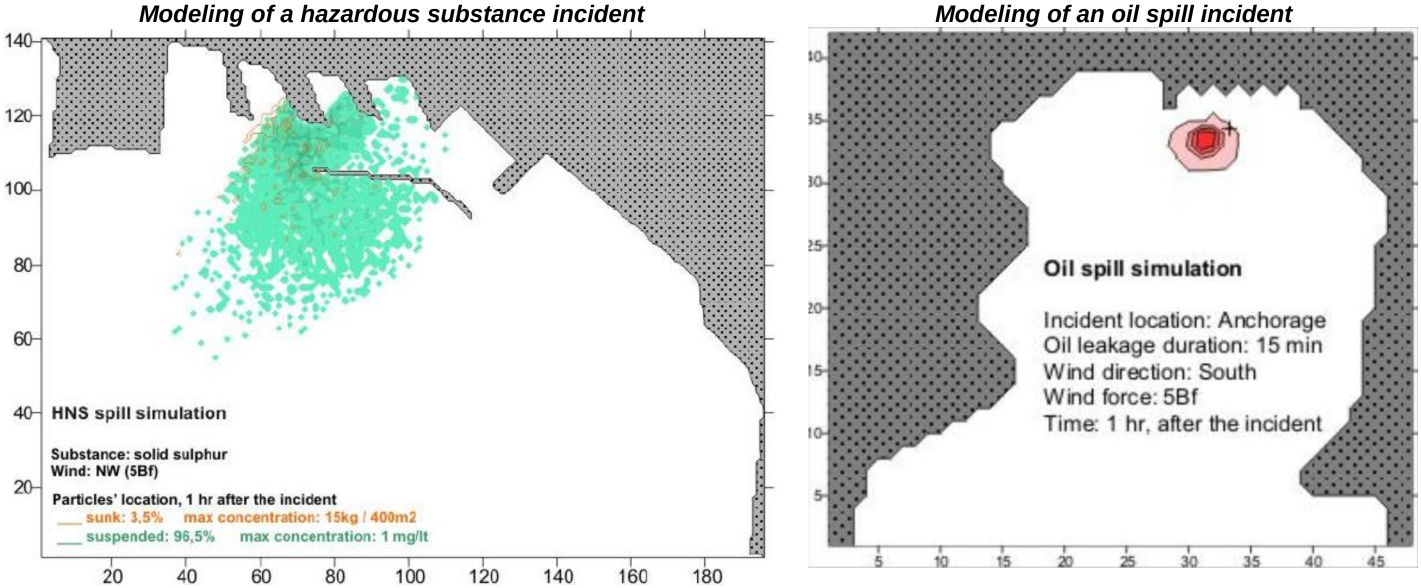
Accidents and incidents can happen throughout handling of cargo, fuelling and other port activities, as much as illegal discharges from ships. All of them produce spills of oil products and/or noxious substances on quays or on sea surface. Ports, under the threat of compensation, recognize the significance of environmental liability in case of marine pollution. Thus, PAs conform with the legislation related to the establishment of oil and hazardous substances contingency plans. In a way, contingency plans testify the green awareness of ports (ThPA, 2007).

Spills can also be included in the sense of ships-generated waste but they are subject to special treatment. The IMO's international Convention OPRC (1990) and the OPRC-HNS Protocol (2000) establish measures to competent states and authorities for dealing with pollution incidents involving oil and hazardous and noxious substances. Both of them, as much as the relevant Greek Law (FEK 20A/2003) on "Certification of the Protocol on Response, Preparedness and Cooperation to pollution incidents by Hazardous and Noxious Substances", have been applied to the Thessaloniki's port Contingency Plan preparation. The plan has incorporated a Port Oil Spill Response Plan and a Port Chemical Spill Response Plan. These plans set the methodology and the process for dealing with spills and incidents/accidents occurring within port area, while they are in line with the respective National Plans (Greek Law, FEK 6B/2002. "National Oil Contingency Plan", including a process for activating the National Plans in the case of major spills, (Papachristou, et.al., 2008).

Spill simulation models are increasingly used in the preparation of Contingency plans. Their capability of predicting the progress of an oil spill or the dispersion of a hazardous substance incident in time and space, was a valuable operational tool in the case of the Port of Thessaloniki. These operational computer models took into account major physical processes in the area of the Thermaikos Gulf and simulated the movement, the spreading and the aging of any potential floating substances. They are able *either* to trace the source of a spill, *or* to forecast mode predicting the path, the horizontal extent and the mass balance, assisting in this way the real-time crisis management, (Koutitas, et, al., 2006) and thus, provided considerable assistance in the ThPA oil spill planning and response.

Fig. 3.15: Simulation models use for the preparation of ThPA Contingency Plan

Modeling of a hazardous substance incident ***Modeling of an oil spill incident***



Source: ThPA, 2011, 2007

ThPA has acknowledged that port activities may lead to emergencies either for people or the environment, (ThPA, 2011). After their implementation (in 2002), the ThPA's contingency plans are regularly reviewed and updated. Since 2002, marine pollution incidents (spills) occurred within the port area were all considered minor in nature and none resulted in environmental harm, (ThPA, 2011; 2007). After an open and public bid, the spill cleanup in the port has been assigned to a private company, which has all appropriate licenses, means and equipment. In times of spillage, the company implements anti-pollution procedures and has equipment in place as part of the national spill response plan.

Fig. 3.16: Thessaloniki's port Contingency Plan – spill clean-up / private company

Annual drill for oil pollution

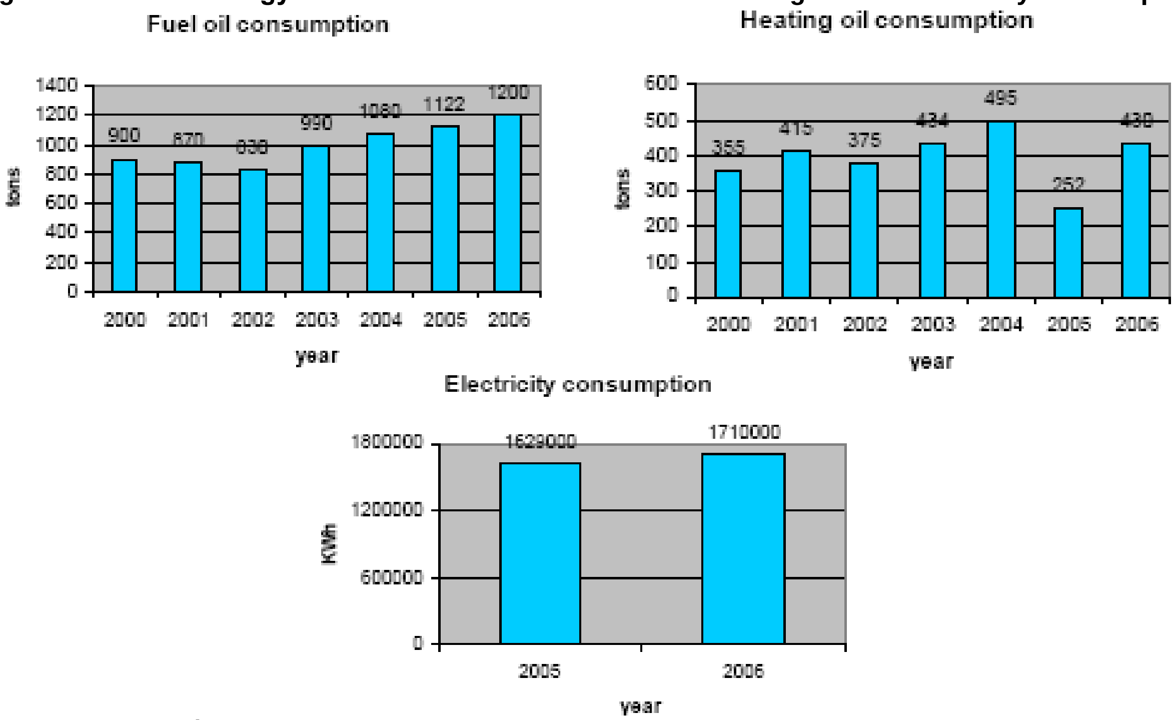
Source: ThPA, 2011; 2007.

The port has also developed an Emergency Response Plan for accidents occurred on land, covering situations such as fire, explosion, fatalities etc., while on the other hand it has implemented a port facilities security plan in accordance with the ISPS Code requirements and has taken appropriate preventative measures against security incidents affecting ships or port facilities, (ThPA, 2011).

3.5 Resources consumption in the port of Thessaloniki

The ThPA's Environmental Policy statement (2003) declared natural resources protection and preservation. The port has aimed to reduce energy cost in the total port's operating cost in a sustainable way. Within this scope, the port conducted a first degree "energy audit" (2005-2006) of all port activities, including electricity, fuel and heating oil consumption.

Fig 3.17 : ThPA "energy audit" – Annual amount of fuel - heating oil and electricity consumption

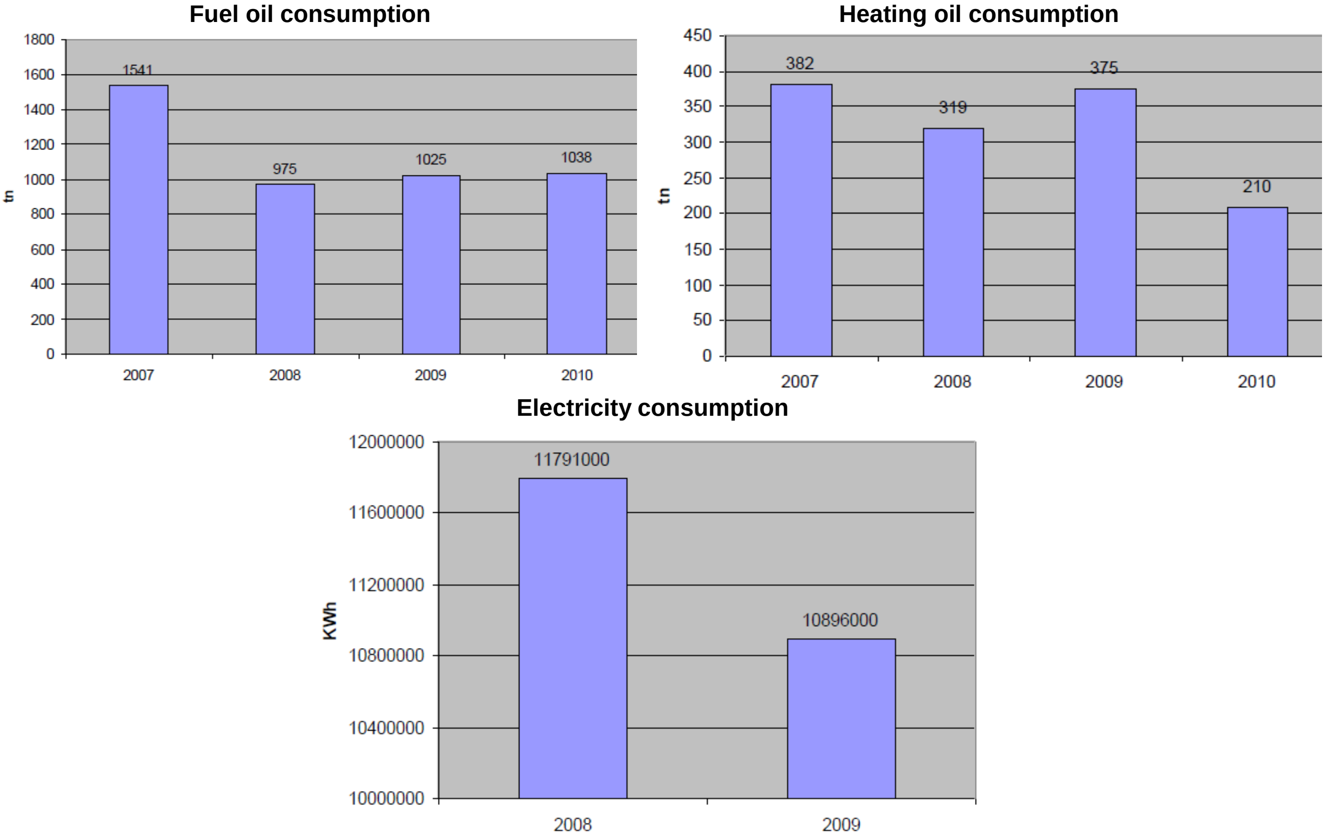


Source: ThPA, 2007

The "energy audit" was carried out in collaboration with the SU. PORT/AUTh academics and external experts, in the framework of the Research Program GREENPORT-II, was financed by the PA. According to the results, the application of practical and of low-cost actions could lead, among others, to an annual saving of 300.000 €. While the results of the auditing do not provide the final answer to the problem, they *did* help to identify the existing potential for energy conservation, convincing the port management team to advance efforts in this area, (ThPA,2007).

Aiming at improving the overall energy consumption at port operation the audit team proposed 10 steps of implementation for both electricity and oil audit. The approach focused on *involvement of all interested parties* during the audit so that the measures and actions proposed and incorporated into the final proposals to be feasible from an operation and maintenance perspective. In short, the audit operation included:1) interviews with Key Port Personnel; 2) port tour; 3) document-data review; 4) port inspection; 5) staff interviews; 6) utility analysis; 7) feasible energy conservation measures identification; 8) brief economic analysis; 9) audit findings; 10) review recommendations with key port personnel (ThPA PERS-section 1.6, 2007).
The initial “energy audit” was adequate to prioritize energy efficiency projects and determine the need for more detailed audits. The port has gradually invested in certain energy conservation actions. The following diagrams demonstrate the notable reduction in resources consumption in terms of oil and electricity consumption since 2006.

Fig 3.18 : ThPA “energy audit”– Annual amount of fuel - heating oil and electricity consumption



Source: ThPA, 2011

The resource conservation measures proposed as a result from the oil and electricity audit provided benefits to the ports:

1. financial benefits which have contributed to operating costs reduction;
2. organizational benefits which assist the port management to improve the productivity and safety of the means and the installations, improve the personnel’s work comfort and productivity, as well as sensitise and activate them;
3. environmental benefits – reduction of CO, SO_2, NO_x CO_2 emissions, resources consumption.

Besides the environmental awareness campaign and the supply of the buildings of the 1st Pier with natural gas, -since the reduction of the electric energy amount has partially reflected the introduction of natural gas use in the buildings of the Pier I-, the port has planned further practices to improve energy use such as: 1) the extension of the natural gas network in the rest building areas, 2) the use of photovoltaic systems in buildings’ roof and other areas, 3) the implementation of a series of technical interventions on buildings, for energy improvement, 4) the gradual replacement of old type vehicles with hybrid ones (ThPA, 2011).

3.6 ThPA Environmental Management System (EMS)

Since the mid 1990's seaports around Europe have recognised that multiple environmental effects of their activities' quest for sustainable policies and have applied some form of EMS (Theofanis & Palantzas, 2005). Following that trend, the port of Thessaloniki has commenced preparation towards environmental management since 2000 (Vafaki, 2012).

In the late 1990's, the port confronted environmental issues coming from its extension and expansion projects (see 2.1) and the port development was enormously influenced by the Strategic Environmental Assessment of transportation development plans, the Directive on the assessment of the effects of certain public and private projects on the environment (Naniopoulos, et.al., 2006). The port of Thessaloniki was aware of the forthcoming pressing legislation already back in 2000 (Vafaki, 2012), while the Environmental Code of Practice published by the European Seaports Organization (ESPO 2003) has had a major influence on policy development in the port (Naniopoulos, et.al., 2006). Moreover, it seemed that there was also an alert concerning local community's demands (Vafaki, 2012), but in my opinion at that time it was of minor significance. It was the impending mandatory obligation in 2002 on the port's "waste reception facilities" that provoked actions towards green policy actions.

- *The GREENPORTh project(s)*

In 2001, the port sought for cooperation with academics and experts mainly from the local university (AUTh). The result was the assignment of the first GREENPORTh project to the research group "Sustainable-Port" of AUTh (SU-PORT/AUTh) in 2002. This initial assignment evolved to a partnership between collaborative research teams and the port of Thessaloniki. Three main research projects were initiated and realized i.e. GREENPORThI (4/2002 – 7/2003), GREENPORThII (1/2005 – 1/2006), GREENPORThIII (20006) commissioned by ThPA.

Table 3.5: *GREENPORTh* Projects produced through the ThPA-AUTh partnership

Time	*Project*	*Research area*
2002	***GREENPORTh I***	Ship's waste reception and handling plan. Preparation for EMS implementation - exploration of ISO 14001 certification capability.
2005	***GREENPORTh II***	Implementation of environmental projects under the PERS standard re-evaluation: • Energy auditing of electricity and oil consumption; • Monitor Safety and Health issues; • Monitor and mitigation plan of dust emissions; • Integrated port waste management plan
2006	***GREENPORTh III***	exploration of EMAS certification capability.

Source: own elaboration

Once the PA faced as a core policy objective to assess the implications of current sound environmental legislation, the lack of available information to provide policy suggestions became apparent (Kourbeti, 2003). The Greenporth I project assisted, at first, in the development of the port's "ship-generated waste management plan", but the project's main focus was on the investigation of the necessary techniques, as much as the administrative and legal steps that were required for environmental management planning and EMS implementation (Kourbeti, 2003; Theofanis & Palantzas, 2005).

The Greenporth I project's agenda illustrated the PA's acknowledgement for the need to upgrade its operational environmental standards, in compliance with the existing National and European law, and International standards, (Kourbeti, 2003). Back in 2002, environmental protection was an important focus on the port's policy however ThPA had to define a starting point for formulating and developing an appropriate and effective environmental policy. Thus, the Greenporth I project's main objective, among others, was to search for abroad experiences and best practices (Kourbeti, 2003). The port was already an ESPO member and was aware of the ESPO Code of Practice but it was the SUPORT research team that introduced the ECOPORTS network to the port of Thessaloniki. As a result, in 2003 ThPA's top management decisions pursued for EMS implementation and certification according to the EPF/PERS standard.

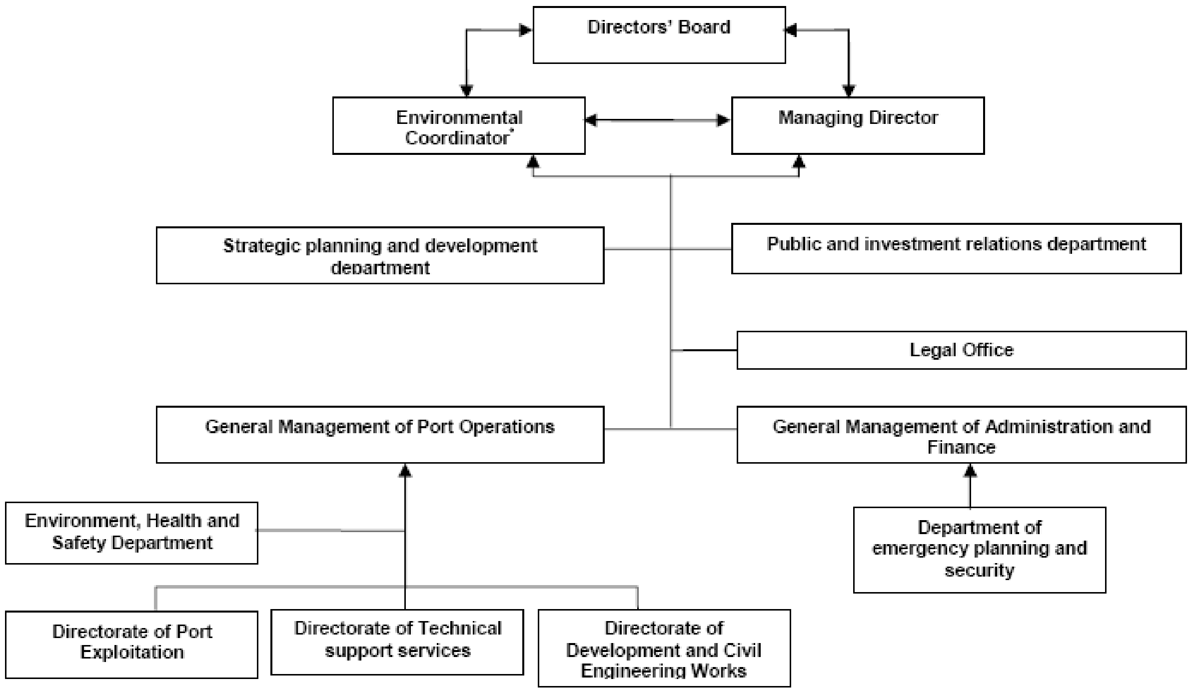
SUPORT ("sustainable port") is a thematic research network of collaborating Laboratories of AUTh established by its Research Committee and it was the project's coordinator. The in-house research capacity of SUPORT has been enhanced through collaboration with various external research units among which are the Universities of Piraeus (GR) and Cardiff (UK). The latter has been an active

member of the ECOPORTS network. It should be mentioned that the Piraeus port followed the same path towards EMS implementation. The OLPIS project (3/2004-3/2005) was elaborated by the same research team and commissioned by the PA of Piraeus. In both partnership cases, the universities collaboration was considered that provided *"positive and cost-effective results to mutual advantage"*, (Naniopoulos, et.al., 2006).
After the first PERS Certification period and the evaluation of the existing environmental situation of the port, the port initiated the research framework of the Greenporth II project. Under this framework, the ThPA gradually further elaborated environmental projects which produced issue specific *action plans* aiming at integrated EMS implementation.
These actions were reinforced by: 1) employees training and 2) follow up of new scientific trends in port EM (ThPA Environmental Report, 2007), both supported by the project's research team, while port executives were actively involved (see table 4.1). The PERS process has been considered as a positive intermediate step in the gradual implementation of a comprehensive EMS and the experience of its implementation has built internal capacity supported by the local collaborative partnership and the interaction within the Ecoports network (Vafaki, 2012).
In 2006, the port proceeded to a further investigation of priority issues and commissioned an R&D project once again in joint cooperation with the SUPORT team. Building on the PERS experience, the PA has been encouraged by the SUPORT team to consider the application of ISO 14001 or EMAS, in selected port areas. The company aimed at developing its recently integrated EMS according to more comprehensive standards, and to that end, it joined the research program Greenporth III. The EMAS certification potential, although extensively elaborated, it was put away and the ThPA progressed its first PERS re-certification.

o *Changes in ThPA's Organizational structure*

Within the EM implementation, according to PERS standard, the ThPA owed, to demonstrate suitable administrative and organisational structure, obligated to environmental aspects due to explicit responsibilities of key personnel and furthermore to undertake action plans for the sustainable operation of the port (Kourbeti, 2003).

Fig. 3.19 : The ThPA s.a. Organizational Structure

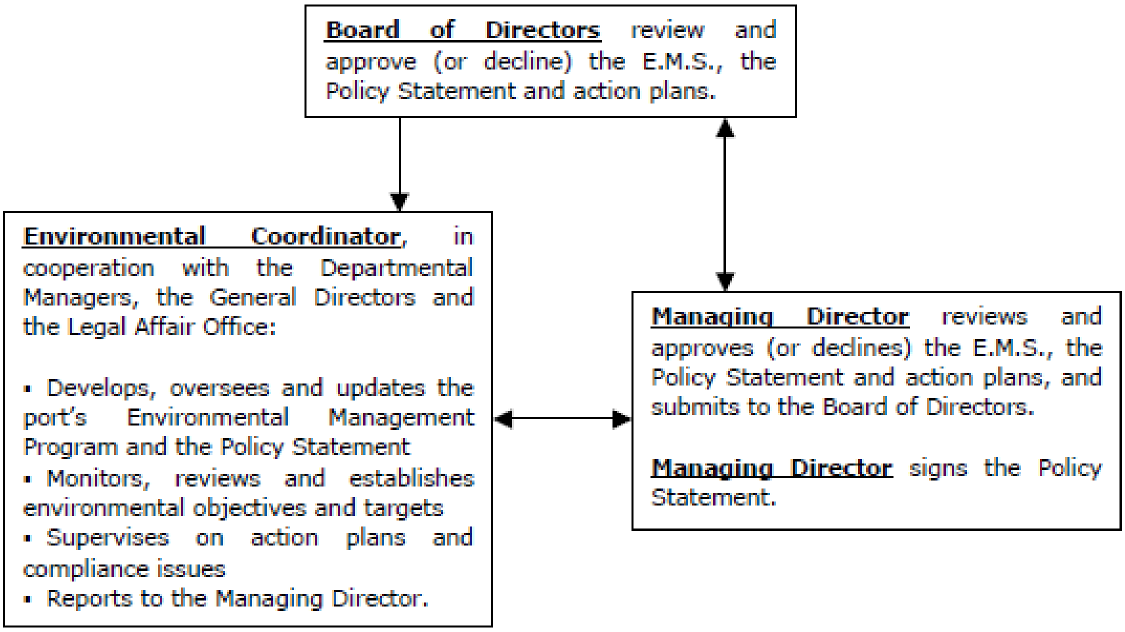


Source : ThPA Environmental Report, 2007

In this instance, the upgraded environmental awareness of the top port administration has resulted in the setting-up of an Environmental Department, while environmental responsibility has been defined at Board level. The following figure illustrates the ThPA's Organisational Structure for

environmental responsibilities. The structure is based on the Organisational Chart of the PA, in accordance with the Ministerial Decision No. 1575/22.01.2003 of the 25 February 2003.
The *Environmental Coordinator* can be an External Consultants Team (e.g. academics of local University) or port personnel specifically appointed by the Board of Directors. The designation depends upon the environmental case/aspect/problem. Since 2003, the port's EMS implementation and continuous improvement has been a result of the close organisational cooperation among the ThPA Management Board, the Environmental Coordinator and the Managing Director and the Board of Directors (see fig:3.20).

Fig. 3.20: ThPA green inter-organizational cooperation



Source: ThPA, PERS-section 1.3: Documented responsibilities, 2003

Mrs. Vafaki was among the *"staff with permanent executive"*, (Tzaras, 2007) and since the PERS application and EMS implementation in 2003, she has remained the person responsible for the renaming of "Department of Health and safety" to "*Department of Environmental Health and Safety*", but she has been appointed with new responsibilities and duties.

- *ThPA - Environmental policy*

The most valuable outcome of an EMS implementation according to a standard is that it overcomes the gap between an environmental policy statement and the actual environmental protection implementation. This is an objective well-defined and supported in the RERS standard.
Selecting to implement PERS, the ThPA advanced a structured formulation of its Environmental Policy Statement. The PA for the first time publicly stated its intentions and principles in relation to its overall environmental performance, while it introduced its own framework for action and established its environmental objectives and targets. The statement's preparation was among others a result of the Greenporth I project, within the scope of the PERS application. At that time the port was already member of the Ecoports network. The PA was consulted by experts of the SUPORT team and particularly by a leading executive of ECOPORTS, while the Dover's PERS implementation was already in place and available to the network members.
The ThPA Environmental Policy referred to issues addressed in the port area and should cover significant environmental impacts of activities, for which the PA is directly responsible. The fundamental aim of the policy is to at least ensure compliance with regulatory standards and legal requirements. After the investigation of all environmental consequences from port operation, the final policy statement resulted and clarified action plans. ThPA's intentions were put into practice. The produced document of ThPA's Environmental Policy Statement comprised a series of short statements in two different areas of action: 1) EMS implementation policy, and 2) sub-policies action plans reflecting the port's specific environmental priorities.

Table3.6: ThPA Environmental Policy (2003) - short statement themes

EMS implementation policy	Sub-policies
• Environmental improvement • Environmental management system • Legal compliance • Communication – Consultation • Training – Awareness and Skills • Pollution prevention • Environmental monitoring	• H&S and Environment • Energy use – Technology • Natural conservation • Coastal zone management • Emergency response

Source: own elaboration

Since 2003, the Environmental Policy has been annually reviewed in order to adopt any significant changes. The Environmental Coordinator in cooperation with Environment and H&S manager are responsible for reviewing the Policy. Copies of the Environmental Police Statement are maintained by each Directorate and Department, and are available to all Thessaloniki Port personnel.

4.0 EMS IMPLEMENTATION TOWARDS PERS CERTIFICATION

4.1 PERS CERTIFIED 2003 (1st)

The pre-PERS stage was a productive phase of preparation in terms of: 1) consultation activities, 2) workshops and training courses with the port personnel involved, and 3) frequent informative meetings and interviews with all actors involved, (Theofanis & Palantzas, 2005). It was the time that the ISO 14001 standard implementation was considered not feasible for the port of Thessaloniki. This indication was also a result of the Greenporth I project. The cost was deemed as a critical factor. The estimated certification's cost per port segment, -since segmentation of the THPA's port operations (container terminal, management of bulk, passenger terminal, etc.) is a characteristic of the port-, and the cost of ISO 14001 maintenance in total and per section, were considered excessively high, (Palantzas, et.al., 2006).

The port decided on a <u>*phased development*</u> of its environmental action plans. *Thus*, the progressive application and incorporation of environmental requirements in all segments of the port was selected as a feasible priority. According to the consulting team, the implementation of the voluntary and self- regulating PERS System aimed at the *"smooth transition to the PERS regime and further encouragement to action on environmental issues"* , (Palantzas, et.al., 2006). The PERS standard application feasibility in Thessaloniki port was also thoroughly examined and meetings were realized among SUPORT researchers and port executives.

<u>SDM methodology</u>

The SDM methodology was the first ECOPORTS Foundation (EPF) tool used by the port of Thessaloniki, and the first step towards raising awareness (Vafaki, 2008). The SDM is a questionnaire methodology first developed in the EU ECO-Information project finalized and administered by EPF. The SDM methodology has been formed in a checklist of components (regularly present in a credible environmental management program), which will provide a concise overview of the port's current environmental situation when completed. *"It was a useful tool in the preparation towards environmental management and has assisted on focusing the management effort into key areas"*, (Vafaki, 2008).

In 2003, the first ThPA SDM implementation ensured the port membership in the EcoPorts network and the port took advantage of the benefits of <u>networking</u> (Kourbeti, 2003). *"During the EMS preparation stage, networking with ports and experts facilitated for ThPA exchange of experience and good practices"*, (Vafaki, 2012). The SDM methodology provided the port with *"a comprehensive and efficient audit tool"*, while the tool's use by ports across Europe allowing the port to benchmark its environmental performance with other EU ports, was also evaluated by the port team involved as beneficial (sector specific) positive outcome, (Theodosiou, 2003). Based on that encouraging evaluation, the ThPA has continued to provide periodical self-evaluation of its environmental improvement in the port area using the <u>SDM methodology annually</u>.

- *PERS implementation*

The ThPA has implemented its EMS on the basis of PERS standard. This sector specific EMS standard examines the total of a port's environmental issues that concern the port, and constitutes an explicit proof that the port's environmental policy implementation moves to the correct direction. The first ThPA's PERS implementation aimed to materialize the ThPA's initial Environmental Policy Statement into everyday practice.
The PA made suitable changes in its administrative and organizational structure and following the standard's requirements the PA identified:

- the significant environmental aspects of the port's activities and services, (whether it has a direct involvement or an influence i.e. tenants, sub-contractors), and registered the effects,
- the relevant legal obligations and
- the relevant environmental performance indicators (EPI).

Thus, implementing an environmental management framework assisted the PA to define duties and responsibilities, set up performance indicators, as well as identify priorities and the port's capacity (Vafaki, 2012). The port's personnel were able to acquire knowledge of the environmental issues relevant to their job description, while the port managers could follow up the port's response to tackling environmental issues by using the identified appropriate *environmental performance indicators*, for both managerial and environmental quality. The indicators concerned all the significant environmental aspects listed at the SDM results carried out by the GREENPORTh I project. For each issue a declaration is made regarding calculated or estimated results. The EPI's selection was also based on consultations by ECOPORTS' executive in collaboration with the SUPORT team and the results of the Research Project "Environmental Performance Indicators in European Ports" (2004), carried out by the University of Amsterdam.
The initiation of EMS implementation was just after the development and application of the ThPA's "Ships-generated waste management plan", whose implementation had been considered as a best practice. According to EMSA this was *"a brilliant and effective ships' waste management plan and cost recovery system, in full compliance with the objectives of the Directive 2000/59/EK"*, (Vafaki, 2008). Thus, the ThPA was already aware of the value and need of action plans. Since the PERS implementation the importance of *monitoring* and *reporting* has been introduced to the port.

- *ThPA – Environmental Reporting*

Reporting was incorporated in the port's Environmental Policy Statement, reflecting the ThPA commitment and progress in improving the port's environmental performance. The initial PERS implementation included the establishment of procedures that appoint future objectives, action plans and research initiatives, while on the other hand it commenced the synthesis of an Environmental Report. In the first ThPA's *Environmental Report*, the recently identified indicators related to the significant environmental aspects of port activities, provided scientific evidence of green behaviour.
The Environmental officer (in the case of ThPA Mrs. Vafaki is the manager responsible for Environmental and H&S issues) has been appointed in cooperation with the Environmental Coordinator to assess and compile the port's green information, and submit the Report to the Managing Director and the Board of Directors for approval. The Environmental Report aimed to be reviewed and produced at least once every two years.
Nevertheless, the following publicly available Environmental Reports in 2007 and 2011 have enabled the PA to present, in both qualitative and quantitative way, its implemented environmental action year by year from the base of 2000.
The Thessaloniki Port Authority spent 4 months working with PERS before applying for a Certificate. On 23rd of October 2003 the ThPA was awarded the EPF/PERS certificate.
According to Mr. Theodosiou (ThPA, Director of Technical Support) the most important benefits for the ThPA that have occurred from the PERS Certification can be summarized as follows: *"The PA identified its actual environmental situation, understood the business risks involved and decided to work towards prevention of pollution"*, while the realization of the port's environmental policy objectives profited from the EMS implementation (according to PERS), in terms of *"increased environmental awareness of the port's personnel, and improved mutual trust with the local community, the port users and all the interested stakeholders"*, (Theodosiou, 2003).

4.2 PERS RE-CERTIFIED 2006(2nd); 2011(3d)

The following tables summarize the ThPA's PERS certification evolution and present the particular *action plans* during the pre-PERS re-certification phase (2004-2007) which have enhanced the port's objective towards an integrated EMS implementation.

Table 4.1: ThPA - Background of PERS re-Certification

time	Milestones
2002-2003	SUPORT / AUTh research team supports the ThPA: • to set up an environmental policy framework and • to face specific environment related issues.
7/2003	SDM methodology implementation – ECOPORTS membership
10/2003	PERS Certification
2004-2007	Port's administration and qualified experts continue to actively implement the declared Environmental Policy and the port's EMS, supported by the research team SUPORT/AUTh, in terms of: • research projects execution, • meetings, • annually completion of SMD questionnaire, • training courses, • consultation activities, • interviews.
6/2007	Award of the Prefecture of Central Macedonia on environmental performance: • marine environmental protection • ships-generated waste management plan
2008	PERS re-Certification (1)
2011	PERS re-Certification (2)

Source: Vafaki, (2008), Manager Environment, Health & Safety Department, Thessaloniki Port Authority sa

The EPF professionals promote the PERS as the EPF tool that provides the basis for developing an integrated EMS in a progressive and cost-effective way, in the port's own time-scale (Wooldridge, 2004). The port of Thessaloniki is a good example in terms of the former promotion statement. The ThPA after the PERS initiation, established realistic objectives and was engaged in a cooperative R&D issue specific research projects aiming at the port's operation in the framework of environmental protection. These included the key components presented in following table 4.2.

Table 4.2: ThPA – AUTh Greenporth II collaborative R&D program

Time	**Implementation of environmental action plans**
2004-2008	• Development of a "Port Contingency Plan on oil", according to the IMO/OPRC Convention of IMO • Development of a "Port Contingency Plan on Noxious and Hazardous substances", according to the IMO/HNS Protocol. • Integrated Port Waste Management Plan-Set up of management practices for all recyclable waste. • Management program to monitor and mitigate problems caused by dust emissions • Development and implementation of a management plan on "H&S issues" • Carrying out an "energy auditing" for electricity and oil consumption.

The phased developed Greenporth II project among the ThPA and AUTh partners, delivered substantive results during the (2004-2008) time period which helped the PA to put in place an integrated EMS. A key point was that the results were produced within a convenient time-scale for the port, that was the time needed for education and training of the port's employees on issues of environmental management (ThPA Environmental Report, 2007). Therefore, the EMS implementation based on the PERS standard as much as the multiple standard's certification process according to the port's Environmental Officer has been a *"familiar experience to personnel and administration, with no need for 'strict' procedures"*, (Vafaki, 2012).

In sum, the main benefits and achievements obtained from the evolved (through the years 2003-2010) integrated EMS implementation according to the PERS standard, are summarized in the following table. They are presented based on the perception of the ThPA's Environmental Officer (with a permanent work position over those years) and member of the SUPORT/AUTh research team (see table 4.3). The main identifiable difference between the above two perspectives is in the cost issue. Whereas the researchers identify the PERS benefits in terms of cost savings from efficiency and efficient handling, as much as profits expected from competitiveness and efficiency, it seems that the port availed from the PERS standard, in terms of EMS implementation, and the costs improved. The latter, eliminated the disadvantage of the considerably high cost for the direct application and maintenance of a formal EMS (EMAS, ISO 14001) (ThPA Environmental Report, 2007).

Table 4.3: Benefits and experiences associated with the PERS standard implementation

ThPA	SUPORT / AUTh
The port's Environmental Manager identified the following main benefits the port gained by the PERS implementation: 1. identification of the relevant legislation; 2. recognition of the actual environmental situation; 3. ranking of environmental priorities; 4. allocation of funds to environment according to port capacity and needs; 5. creation of on-going experience, knowledge and awareness. The port has gradually implemented its environmental action plans according to the port environmental priorities (legislation, stakeholders). ○ Efficient distribution of cost. The future step towards *greening* twofold: 1. total integration of logistic chain and 2. stakeholders interests in EMS.	The local university R&D cooperative partner team has also presented the benefits from PERS application: 1. Identification and update of Register of legislation (International, EU, National). 2. Identification of significant environmental aspects and impacts. 3. Development of action plans for prevention of environmental accidents and reduction of risk. 4. Planned cost savings through energy efficiency and efficient waste handling. 5. Profits expected through greater competitiveness and efficiency. 6. Improvement of the port's public image. 7. Raised awareness of employees to environmental issues and the concerns of the local community. 8. Opportunities for contact between key port stakeholders, local administration, general public and environmental pressure groups in order to promote a more transparent EMS. Suggested future action; The PERS process is considered as a sound intermediate step in developing a formal EMS. By building on the PERS experience, the ThPA has been encouraged to consider the application of the ISO 14001 or EMAS.
Source: Vafaki, 2012	**Source: Naniopoulos, et.al., 2006; Theofanis & Palantzas, 2005**

The ThPA PERS implementation, certification as well as re-certification, was a good example of this sector-specific EMS standard implementation, and indeed evolved greening in the port. But until 2010 (the finishing time of this research), there was a sort of "within the box" greening. The port did not proceed to the next step towards ISO 14001 or EMAS, as it is highly recommended by EPF. *The incorporation of the port in the European network of "ECOPORTS" surely* ensured the promotion of the environmental port record, the continuous follow-up of EMS developments at a European level and the improvement of the port's image to the public, but in the end of 2010 the ThPA remained a EPF tools follower. The next fig.4.1 presents the ThPA's best practices that have been incorporated in the ECOPORTS database, and are available to the network partners.

Fig 4.1: ThPA areas of good practice incorporated in the ECOPORTS database

	time	Areas of good practice and knowledge in environmental issues
	**2003**	○ Port development : 1. dredging issues 2. land reclamation ○ Cooperation with the local university
	2007	• Shore-generated waste management • Ship-generated waste management • Dust • Health and Safety • Sea water quality • Oil and electricity consumption

5.0 CONCLUSIONS

Sustainable development in Greece must be considered in the context of the European Union. The country with an overdeveloped state (as most southern European countries), playing a dominant part in the economy, was unable to provide effective environmental policy coordination, in a rather recently modernized country. The lack of policy coordination has constantly presented a powerful obstacle in environmental values and responsibilities, and has *thus* evolved deep implications to the country's response to environmental protection (Pridham, 1994; Anastasopoulos, et.al., 2011).

In the 1980's, environmental concern and awareness in Greece were reported as growing faster than in most other EU countries, but by the late 1990s, public interest in environmental issues dropped to the last place while economic concerns gained primacy, (Kousis, 2004). On the contrary, although paradox, there is proof that in Greece, the adoption of quality (and safety) standards has considerably increased during the last decade, (Chlomoudis & Kostagiolas, 2010).

Since 2008, Greece has been facing its worst ever financial crisis. To an extent, it is a rugged political and social crisis as well.

> In a country [Greece] where: *"abysm was created between the government and the people, so great, when a minister dears to announce to the public that "moral is what is legal", others scorch inconsiderately innocent people belongings, answering: "moral is what is illegal"*.
>
> Kouloglou St., "The asymmetric threat of young people", LiFO No138, 11-12-08

The minister in the above article was at that time the Minister of Mercantile Marine, the person responsible to promote the latest national port policy. The policy's pattern was port devolution. The governance of the Greek port system, which has contributed to a Mediterranean tradition a great deal, has been rather "flag state" than "port state". The past prevailing concept was that *ports are public welfare services*. A reform of the national port policy has been underway since 2002. Since then, the Greek port sector has changed its management model, breaking a long-standing tradition of state-controlled PAs, but it is remaining far from adjusting contemporary trends and overcoming past insufficiencies (Pallis &Syriopoulos, 2006). By the end of this research, a major remaining problem was the continuing governance interference.

The port of Thessaloniki is one of the top two critical export and transit Greek ports and a seaport of medium size in South-eastern Europe. In the early 2000's, its ongoing modernization, privatization, and planned expansion, was enthusiastically anticipated to improve Northern Greece's access to international markets. Just after the port's peak performance in 2007, the port lost in 2008 a chance to work up its sovereign role in the effort of commercial flows growth by failing in its Container Terminal privatization. But still, the port could benefit from its connection with the European networks, its sufficiency in terms of infrastructures and the advantage of its "Free Zone". The aforementioned were (and still are) the ThPA's strong reasons, for promoting the port services by saying that: *"in the Balkans, all Corridors lead to the Port of Thessaloniki",* (ThPA Annual Report, 2002). By the end of 2010, port development, in terms of efficiency margins of the present facilities, aimed to be increased, and new infrastructure related to pier 6 expansion to be developed.

Legal compliance has always been the Greek port's high priority and was the *main trigger* which kicked off the need for green action. Over the past decade, there have been several changes in environmental legislation that have influenced the way in which nowadays ThPA conducts its daily port activities. Nevertheless, back in the beginning of the 2000's, the need to conform to mandatory obligations forced the port into green realistic objectives exploration and the establishment of a policy framework for environmental protection. As a result, the ThPA endorsed the ESPO Environmental Code of Practice and since 2003 has supported a series of research project undertaken by the local university. The first project led to the port's incorporation in the ECOPORTS network, and the use of the EPF tool. The PA implemented the SDM methodology and successfully applied for the PERS Certificate.

The implementation of the EPF/*SDM methodology* in the port of Thessaloniki, advanced the understanding of the port's existing environmental situation. ThPA using the SDM questionnaire registered the total amount of the port environmental aspects and enhanced its capacity in environmental knowledge and awareness creation. The latter added a great deal to the port's Environmental Policy declaration. The port's initial EMS implementation according to the PERS

standard delivered conformity with all the relevant international and national legislation, and contributed to meeting compliance with ESPO guidelines. Networking and network interactions advanced greening transmission. ThPA advanced consulting from the local university and its Ecoports network connections, particularly with science experts from the UK. To a great extent, the port's corporate Environmental policy formation, as much as the port's introduction into a scientific updated and accurate way (at least with the port sector) towards green policy objectives planning, were valuable and helpful results of network interactions.
Although the pre-PERS certification period was characterized by limited environmental concern (Vafaki, 2008), the PERS standard implementation provided green awaking and training, while monitoring and controlling environmental impacts were turning into the company's regular activities. As the ancient Greeks used to say, *"the beginning is half the battle"*, and since 2003 the port has been the most proactive, among the Greek ports, in the field of EM implementation, (Vafaki & Palantzas, 2008). The port's partner research team (from the local university) has strongly acknowledged the PERS importance, in terms of engagement for progressive incorporation of the environmental dimension in the port's corporate policy, pointing that it is directly depended on the port's integrated environmental management initiation, (Naniopoulos, et.al., 2004). This key position was in line with the EPF/tools concept, which has promoted PERS as the basis towards ISO14001 or EMAS certification. PERS was produced "from ports for ports" and it is port friendly enough. Thus, the "option to expand and up-rate EMS at port authority's own timescale (Wooldridge, 2012) has been considered a strong benefit of the tool. Therefore, the ThPA proceeded to further investigation of high priority issues. The latter was again a joint effort with the local university under the Ecoports network umbrella. The progressive application and incorporation of environmental requirements in all port segments were selected as a priority. It was estimated that in this way the distribution of the required cost for an integrated environmental management establishment was rendered optimal, reducing the disadvantage of the considerably high cost for the direct application and maintenance of an EMAS, or ISO14001 EMS. Thus, the PERS implementation was considered as an appropriate intermediate response, according to the stage of the environmental capability and training program.

ThPA has acknowledged the significance of environmental issues related to air, soil and water quality as well as resource consumption and has endeavored greening by minimizing air, land and water emissions in all its operations. PERS certificate recipients are recognized for their creation and implementation of environmental management plans which are in accordance with legislative measures and achieve operational success with little environmental impact. There are a range of management response options that may assist the port professionals in fulfilling environmental responsibilities and duties through self-regulation. For the port of Thessaloniki these were: 1) H&S management plan; 2) Integrated management of the port waste; 3) Dust management; 4) Contingency Plan; 5) Energy auditing; 6) Environmental Quality standards. The PERS initiation evolved organizational and procedural changes setting up duties and responsibilities and identifying performance indicators which over time verify the port's green capacity in an accurate way. By the end of 2010 the port had built in-house knowledge and awareness resulting from the managerial and procedural action plans which were progressively afforded. ThPA has efficiently acknowledged that acting towards port greening is a matter of *"creating of on-going experience"*, (Vafaki, 2012).

In sum, ThPA was the first Greek port which has implemented principles of integrated environmental management in its daily operation, advancing compliance with the relative legislation. The port's most important mean towards its EMS implementation, has been the cooperation with the local University, which enhanced the port's EM in terms of training, specialised know-how in specific issue-based projects and scientific R&D research outcomes. *Last but not least,* it provided the necessary European cooperation with Ecoports network members. The main challenge for the ThPA was and -until 2010 remained- *"to build further effective responses into dynamic management strategies"*, (Vafaki & Palantzas, 2008). For the port of Thessaloniki, the years ahead will certainly involve new challenges.

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http://www.ecoports.com – ecoports network partners
http://www.supportproject.info/
http://www.apice-project.eu
http://www.ni.com/labview/

- *People interviewed – semi structured interviews during:*

1. GreenPorth I project meetings
2. AUTh SDM implementation
3. AUTh training sessions
4. conferences and workshops

Vafaki E.,	ThPA Manager of Environment, Health & Safety Department.
Tsaras, I.,	ThPA CEO - Managing Director.
Theodosiou, P.,	ThPA Director of Technical Support
Palantzas G.,	PhD, AUTh Civil Engineering Department, (SUPORT/AUTh team)
Koutitas, Ch.,	AUTh Professor-Department of Civil Engineering Laboratory of Port Development ThPA Head of the Board (2002-2006)
Naniopoulos, A.,	AUTh Associate Professor-Laboratory of Transport Engineering, (Head of the SUPORT/AUTh team)
Wooldridge, C.,	Earth and Ocean Studies Cardiff University, UK- EPF scientific consultant expert

ANNEX 3

	CASE STUDY 3: VALENCIA PORT

VALENCIAPORT –

valenciaport

Autoridad Portuaria de Valencia

Exploring the "green port";
is a different way an alternative one - *why* & *how*?

CONTENTS

1.0 INTRODUCTION

1.1 Spain - the "green" national context

Between 1987 and 2005, the land allocated to urban, industrial and commercial uses increased by 40% in Spain, four times more than the population increase. Urban planning has been massive in some areas. The Spanish coast represents 7,880 km of land and it is subjected to the pressures of urbanization, coastal erosion and pollution. Thus, the urban areas located on the coast occupy great extensions, mainly the Mediterranean coast. In addition, more than 65% of the Spanish industrial production is also located on the coast, and very important volumes of imported and exported merchandise do so by maritime transport. As a result of these pressures, several natural coastal ecosystems survive with great difficulties (EEA, 2012).
Since 1978, substantial, though not uniform, devolution of environmental decision-making from the central state to the 17 autonomous regions has led to a kind of environmental federalism. Since joining the European Community in 1986, Spain has made much progress in the development of its infrastructure in, for example, transport and water supply. A number of large environmental investment plans have been adopted and are being implemented. (OECD, 1997).
In the 2000's integration of environmental concerns in sectoral policies was progressed, particularly in the *energy* sector. Environmental Impact Assessment (EIA) procedures (e.g. for transport projects) have led to stricter conditions or project modifications. However, as far as institution-based integration is concerned, the OECD reviews point out that *"much remains to be done at the strategic, planning and programming levels"* (OECD, 2004). The major environmental concerns in the last decade include the high GHG emissions, climate change, air quality, and water quality, non-sustainable consumption patterns, waste treatment, biodiversity loss, land degradation, and, in general, the unsustainable use of natural resources. All these elements have been described in the reports about sustainability in Spain prepared by the Spanish Observatory for Sustainability on an annual basis (SSDS, 2007).

The **Spanish Sustainable Development Strategy** (SSDS) was released in 2007. In the context of Environmental sustainability, in order to design the action lines aimed towards the protection of the atmosphere, air quality, water, land, nature and health, the Spanish strategy develops from three interrelated Sections: 1) Production and consumption, 2) Climate change and Conservation and 3) Management of natural resources and land occupation. First, it analyzes resource-use efficiency, responsible production and consumption and sustainable mobility and tourism. Then, it studies the initiatives to mitigate the impact of climate change in terms of clean energy, sectors concerned with diffuse pollution and sinks, as well as market instruments and the adaptation to climate change. Finally, it focuses on hydric resources, biodiversity, land uses and occupation.
The following were among the areas in matters of environmental sustainability, incorporated in the SSDS (2007): 1) the need for an efficient and rational use of natural resources, particularly those related to energy, water, biodiversity and land; as well as developing active policies to mitigate the determinants of climate change in all productive sectors, and especially in the energy and mobility sectors in order to gradually reduce the levels of atmospheric pollution of Spanish cities. These, according to the SSDS, required 1) improvement of the management of productive sectors, 2) promotion and the adoption of technological improvements, optimization of transportation networks, 3) modal change in transport use, to control GHG emissions and other atmospheric polluting agents, and finally 4) to inform and make people and companies aware of the benefits of these measures (SSDS, 2007).
Public participation in the preparation of the NSDS was mainly organized in the form of the 'Conference on Sustainable Development' that was convened within the CAMA (Environmental Advisory Council), which consists of 18 organizations representing civil society. The conference took place for three days in July 2007. So far, there is no National Council for Sustainable Development in Spain. Concerning **coordination** among the strategy's policies, every sectoral policy is coordinated by the national government. There is also coordination between the national and regional level, agreements are signed in those areas for which the regions have implementation responsibilities. The main concern here is to include environmental issues in sectoral policies. So far, no formal body for the coordination between the national and sub-national

level has been established (there is no National Council for SD). Several regions have developed their own regional SD strategies, some well before the NSDS was approved.
The SSDS was reviewed and the draft of the Progress Report was finalized in 2009. The reports have not yet been presented to the Council of Ministers for adoption. The strategy explicitly state a set of 74 **indicators** for its monitoring. The set of indicators was developed in 2007 and has not been revised since then.
In terms of **noise**, in order to evaluate its impact on the population, as a prerequisite for designing the actions that reduce the noise levels to a minimum the elaboration of noise maps has been promoted, along with the application of correction measures (acoustic screens, insulation of houses, etc.) where necessary (SSDS, 2007). As far as **water quality** is concerned, much is still to be done to reach the requirements of the Water Framework Directive (WFD). Thus, in 2005 a diagnosis of the characteristics was made as well as of the environmental and socio-economic circumstances of water masses (as established in article 5 of the WFD), which concluded that there was a high number of masses at risk, as a result of the pressure of human activity (SSDS, 2007).
Within the area of **sustainable mobility,** the launching of “Sea Highways”, as a competitive and high-quality alternative to road transport of merchandise, aimed -in line with the EU SSS policy perspective- to relieve the strong pressures experienced by road transport, especially considering exports. Finally, R&D&I, projects of innovation in sustainable mobility aimed to be promoted, in particular: research about clean technologies for vehicles, engines and fuels; the implementation of Intelligent Transports Systems for the management and control of transport systems, and the incorporation of new communication technologies in the transport sector.
The Spanish 2007 **National Energy Efficiency Action Plan** covers the years 2008-2012. Seven categories are used for investments and measures, for example agriculture, industry and buildings. The target for 2012 is an 11% increase in energy efficiency compared to 2008, which is higher than the 9% mentioned in the Directive on energy end-use efficiency and energy services (2006/32/EC). Among the challenges, the access to new equipment and technologies is featured (EU, 2012).
As far as the R&D&I actions to promote the use of clean energies are concerned, the R&D&I National Plan incorporated a new strategic axis exclusively on Energy and Climate Change, to prioritize and concentrate all actions in this area, stimulating the financial aids to R&D&I projects in clean energy Technologies (SSDS, 2007). Among the measures to increase the participation of **renewable energies**, some of the most important ones are: The Renewable Energy Promotion Plan (PFER) 2000-2010 which, in agreement with Law 54/1997 of the Electrical Sector, establishes objectives that will allow reaching, in 2010, at least a 12% participation of renewable energies in the total demand for primary energy.
The rather late established **National Integrated Waste Plan 2007-2015** contemplates, among other issues, the aspects related to the increase in the recycling and valuation rates, quality standards for compost in line with the European initiatives, incentives to the acceleration of autonomic and local plans in matters of controlled landfills that include biomethanization and biogas recovery in their procedures, supports to the selective collection of organic matter in origin and closing, as well as the sealing and restoration of uncontrolled landfills (SSDS, 2007).
Concerning **biodiversity**, in 1998 the Draft Law on Natural heritage and Biodiversity of the Spanish Strategy for the Conservation and Sustainable Use of Biological Diversity, represented a panorama change in the policy on biodiversity, while incorporating new instruments to face biodiversity loss and work lines inspired by the UNs´ Agreement on Biological Diversity, and other international commitments. One of this Law’s objectives was to limit territorial and urban uses that can seriously affect the environment, forcing to submit and to carry out plans for the arrangement of natural resources. In terms of protection of the most important habitats and species, the National Strategic Plan for Natural heritage and Biodiversity aimed to be prepared with the Autonomous Communities and parties in interest, contained a diagnosis of the situation, the objectives to be reached and the actions to be executed during the term. The Plan was expected to ensure the efficient management of Spanish protected areas network, adopting common directives for the management of the Natura 2000 Network as well as to incorporate the Spanish Strategy for the Conservation and Rational Use of Wetlands. In this line, a Network of Protected Marine Areas in Spain intended to be established in order to cover planning and management, including verification and monitoring mechanisms, as well as orientation criteria and strategies for the conservation of coastal and marine species included in

the National Catalogue of Endangered Species prepared with the collaboration of the regional governments and the Autonomous Communities (SSDS, 2007).
But only by the end of the decade (March 2010), did the Spanish government approve the Law 6/2010 on the modification of EIA, which simplified administrative procedures, as well as the National Strategic Plan for Natural Heritage and Biodiversity (2010). This Plan includes measures for the preservation of the Natural Heritage and Biodiversity which was included in the different sectoral policies. The Plan is harmonized with EC biodiversity-related initiatives, such as the EU Biodiversity Strategy, and international initiatives such as the Strategic Plan of Convention on Biological Diversity adopted in Nagoya. The government signed several Agreements with Autonomous Communities for the conservation of Natura 2000 areas, included respectively and the Valencian Community (EU, 2012).

Table 1.1: SD objectives and challenges in Europe and Spain

MAIN OBJECTIVES OF THE EU SDS: CHALLENGES AND ACTIONS UNDER WAY IN SPAIN			
Challenges of the EU SDS	**SDS-EU Targets**	**Principal actions in Spain***	**Actions on the path towards sustainability**
Sustainable transport To ensure that Spain's transport systems meet society's economic, social and environmental needs and, at the same time, to reduce the negative repercussions on the economy, society and the environment to a minimum.	• To reduce road and air transport. • To achieve a sustainable increase in artificial areas dedicated to transport. • To increase the share of rail goods transport. • To increase the biofuel- use share. • To increase R+D programmes for developing biofuels.	• Urban Environment Strategy. • National End-of-Life Vehicles Plan (2001-2006). • Strategic Infrastructures and Transport Plan (PEIT). • National R+D+i Plan 2004-2007. • Renewable energies plan 2005- 2010. • National Reform Plan.	• Consumption of biofuel rose by 107% in 2006 to 1.36% of the total energy used in transport. • Energy consumption should rise at rates similar to previous years. • Road transport, together with electric power generation, is the main GHG emitter. • A trend towards Imbalance in the distribution between the different modes of passenger and goods transport. • The transport sector is one of the major producers of emissions of acidifying substances into the atmosphere.

Source: EU, Integrated Assessment of the "Sustainability in Spain, 2007"– Report of the Spanish Observatory for sustainability (2007) / www.sd-network.eu

The 2007 SSDS also promoted actions to be adopted within infrastructures and **management of transport system** such as: voluntary agreements among the public Administrations and sector companies for the improvement of energy efficiency; implementation of **Environmental Management Systems** (EMS) in sector companies; use of the most efficient technologies and renewable energies in transport facilities; and installation of low-consumption and high-performance lighting fixtures in new infrastructures and external service equipment of the transport sector, as well as the renovation of the existing ones (SSDS, 2007).
Finally, from a competitiveness perspective, the national spending on R+D+I in Spain is gradually approaching the European average, although the level of private investment is still very low, reducing competitiveness. In 2005, gross expenditure on R+D as a percentage of GDP was 1.2%. Between 1995 and 2005 spending on R+D in Spain was catching up and approaching spending in Europe (EU-25) in relative terms. This convergence is the result of a faster rate of growth in annual expenditure on research and development in Spain of nearly 3.9%, compared to the average rates of growth in spending on R+D in Europe during the same period, which were around 0.3% per year (EU, Sustainability in Spain, 2007).

1.2 The Spanish national port policy – Types of ports

Spain is an EU country with 8000 km of coastline length. In addition to its geographical location functioning as a logistic hub in Southern Europe the country is considered as a strategic area in the international maritime transport.

The channel ports 70% of Spanish foreign trade and about 15% of inland transport.

More than 26 million people in 2007, used the Spanish port facilities for their travel; 59% of exports and 82% of Spanish imports passing through the ports of general interest, which represents 53% of the Spanish foreign trade with the European Union and 96% with third countries (Aznar, 2008). The direct, indirect and induced Spanish Port System is around 20% of GDP transport sector, representing 1.1% of GDP Spanish. It also, generates direct employment of over 35,000 jobs and about 110,000 indirect (www.puertos.esp). At the European level, the Spanish Port System plays an important role in the services of supplying ships, notably in services of "bunkering".

Source: Puertos del Estado-Spanish Port System pesentation, www.puertos.esp

- **The Spanish port model-The ports of general interest, as drivers of development**

The Spanish Constitution (Article 149.1.20) determines that ports of general interest belong exclusively to the State. In addition, the Law 27/1992 of November 24, State Ports and Merchant Marine, amended by the Law 62/1997 of December 26, distinguishes between the ports of autonomic ownership (mainly fishing ports, sports and shelter), which depend on the Government of the Autonomous Community where they are located, and state-owned ports. **Ports of general interest** are qualified to collect any of the following characteristics: carry out international commercial maritime activities; their hinterland significantly influences more than one autonomous regions; serve industries of strategic importance to the national economy; their annual throughputs and characteristics of their maritime trade activities classify them as essential contributors to the general economic activity of the State; their special technical or geographical conditions constitute essential elements in the safety of maritime traffic, especially for island regions.

The **Spanish State Port System** comprises the Public Organisation for State Ports (**OPPE**) and the **PA**s. The OPPE coordinates and controls 28 Port Authorities that manage 44 significant ports among which the main ones are Algeciras, in the South of the Gibraltar bay, Barcelona, Cartagena, Bilbao and *Valencia*. Each State Ports Public Authority is a body under the Ministry of Development assigned with the implementation of the governmental port policy. The Spanish Act no. 33/2010 of 5 August 2010, contains a major amendment to Act no. 48/2003 of 26 November 2003 on the economic regime and the provision of services in ports of general interest. The new law seeks to enhance the efficiency and competitiveness of Spanish ports and specifically regulates the financial autonomy of ports and the provision of port services. To this end, it contains detailed provisions on various types of port dues and port services, on the delimitation of port areas and on port labour. It provides the Spanish port system with the necessary tools to improve their competitive position in an open and globalized market, establishing a system of autonomous management of the PA, which should operate with business criteria. Within this framework, the management of the ports of general interest are intended to respond to the **landlord model**. The particular or exclusive use of public property is allowed under authorization or concession regimes (public sector contracting regime), whereas the port services, which are provided by private operators, depend on the private contracting regime. Yet, the function of ports goes beyond their traditional role as mere points for cargo loading and unloading and passenger transfer, to become commercial platforms where a whole range of activities generating added value for the cargo are provided, fully integrated into logistic and intermodal transport chains (Giner, et.al.,2010).

The **Spanish State Ports Agency** (Puertos del Estado) is responsible for the coordination and efficiency control of the efficiency of the Spanish ports of general interest. The Agency depends on the Spanish Ministry of Public Works and Transport and is charged with the execution of the Government's port policy. In addition, the following tasks are attributed to Puertos del Estado:

coordination with bodies of the General Administration which establish different kinds of controls in the port area and also, with the transport modes at a national wide scale; as well as training, research and technological development in the field of economy, management, logistics and port engineering and other related to the port activity. Even though the ownership of the ports of general interest belongs to the General Administration of the State, the autonomous regional communities appoint the President of the port authority and a significant percentage of members n the PA's Board of Directors.

- **PA's Responsibilities - port administration or entity in charge of port management.**

Spanish PAs have their own legal personality and property which are separated from those of the State, and they have full capacity and freedom to act towards the fulfilment of their goals, operating within the legal bounds that were set for private enterprise, including the acquisition of property and the making of contracts, except when exercising functions within the public domain as set by law. Among their various functions they are responsible for organising the use of the port's service area, including planning and programming of future developments, and developing studies and research on matters related to port activities and environmental protection (www.puertos.esp).
There is a significant connection between Spain's competitiveness and its transport system within which the need of efficient ports is strongly integrated. Therefore, the Spanish State Port System (SSPT) has promoted the use of management tools by the PAs in order to improve their decision-making process. A Strategic Framework has produced a strategic development model and performance criteria for the whole port system. A general process for strategic planning was established and enabled a general benchmark framework for the SSPT, strategic plans for individuals and deployment to be defined for every PA. The PAs were suggested to implement a series of management tools specified for PAs, such as Cost Accounting, **Environmental Management**, Process Management, a Balanced Scorecard, Competency Management, etc. (Giner, et.al.,2010, Rivella, et.al.,2006).

The **State Ports Agency** (Puertos del Estado) responded to port environmental responsibilities, and guided the PAs at a national level through the Spanish standardisation program in the field of ports (ROM Program), under the denomination of "ROM 5.1. Quality of coastal waters in seaport areas". The ROM 5.1. had the objective of tackling the problems of port water quality. What was made available by the sector's response, were the scientifically and technically robust methodologies which could contribute to port water management. This was considered both essential and urgent under the general scope that suitable port water management policies could be effectively implemented only if they were supported by policies based on scientific data derived from appropriate technology and methodology (Rivella, et.al.,2006).
The ROM 5.1 program reflected the philosophy of the Water Framework Directive. For this reason, it has been conceived as a first technical methodology for integral management of a port's water areas, management planning, the evaluation and environmental monitoring of infrastructure works, the activities and port operations (Puertos del Estado, 2005). Spain's PAs, beyond integrating environmental management policies and tools in their management, they have also incorporated communication tools for assessing and disseminating them. The disclosure of environmental information by means of environmental reports was regulated by the National Port System. The PAs had to annually review their environmental performance in their management area and these reports had to be disseminated to keep the entire port community informed. Since 2010, the law no.33/2010 has required the Spanish PAs to prepare a report on sustainability including annual monitoring of environmental indicators. The above amended port legislation in Spain has necessitated that PAs disclose environmental sustainability objectives and indicators for each port and issue an annual sustainability report. The reports are requested to be drafted based on a methodology which was also supported by guidelines setting out the objectives, scope and content of related managerial tools. The guidelines, once again, were provided to them by the National Port System.

- **The decision-making procedure for investments in Spanish ports**

The Spanish port system is economically self-sufficient and the expenses and investments in infrastructures are financed by the ports themselves, from the revenues of the Port Authorities. Specifically, in terms of investments, there is an operating procedure for decision-making which is carried out annually on the following basis: see box 1.1.

Box 1.1: Decision-making procedure for investments in Spanish ports

PROCESS APPLYING TO INVESTMENT DECISIONS IN SPANISH PORTS
• Each port authority draws up a 5-year Investment Plan, in which details are given on the necessary actions, their global amount and their scheduling. • The PAs send the proposed Investment Plan to a Puertos del Estado Investment Committee, which carries out specific monitoring together with each port authority. In the proposals, the most relevant investment projects are submitted to a cost-benefit analysis. • The Investment Plan is agreed between the PA and the Puertos del Estado Investment Committee. If there is a discrepancy not resolved at Committee level, a report will be issued regarding the matter. • The Investment Plan and the reports, which may exist, are integrated into the Business Plan, the document in which an agreement is finally reached on port development (aims and budgets) and made official, between Puertos del Estado and each PA. • The Investment Plan is incorporated in the port system, in accordance with current legislation.

Source: www.puertos.esp

The preservation, improvement and promotion of the Spanish coastline is a firm commitment of all Spanish ports. Security at ports and shipping is an objective of port policy. Therefore, the implementation of new systems for maritime navigation aids the Spanish coast and the development of measurement networks of ocean-meteorological parameters.
In addition, in order to achieve the benefits offered by the ports, quality and enhanced coordination among different agencies respond swiftly and efficiently to the demands of users. Many of the activities taking place in ports have endorsed relevant quality certifications.

- *In sum*, the new Port Law encourage Spanish ports to become "advanced landlords", thereby facilitating a more competitive business and social framework, and improving **environmental sustainability**, as it encourages managerial independence as well as financial and economic self- sufficiency amongst PAs (VPA, Annual Report 2010). It aims at two key objectives: to extend the general rules on cargo handling service (treated as a singular case so far), and to adapt the law to the European framework designed by the EU (Tovar, et.al.,2004).

1.3 Valencia Port – the port profile

The Valencia PA (VPA), known as Valenciaport (a registered commercial trademark), is a state-owned public entity responsible for the management of three (3) ports located along 80Km of the eastern border of the Spanish Mediterranean coastline in the Valencian Region, the ports of Sagunto, Valencia and Gandia. VPA administers the docksides and manages the port services.

PORT OF VALENCIA

56.62 mill. T. (2010)

Situated in the city of Valencia the port's total surface area in the year 2006 was 4,630,093 m^2, of which 2,364,831 m^2 were used for warehousing and 778,074 m^2 for roads. Currently, the Port of Valencia offers a berthing line of 8,793 m distributed amongst its sixteen quays and a jetty.

Source: PAV, Annual Report '06.

PORT OF SAGUNTO

6,845 mill. T. (2010)

The Port of Sagunto is located approximately 22 km to the north of Valencia. The total surface area of the port in the year 2006 was 1,612,266 m^2, of which 765,780 m^2 were used for warehousing and 82,877 m^2 for roads. The Port of Sagunto has 6 quays with a total berthing line of 2,529 m for its commercial operation

Source: PAV, Annual Report ’06.

PORT OF GANDÍA

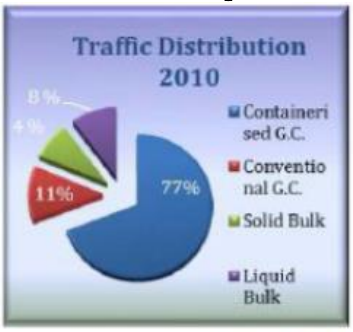
0,265 mill. T. (2010)

The Port of Gandia is situated approximately 65 km south of Valencia. The total surface area of the port in the year 2006 was 238,364 m^2, of which 103,023 m^2 were used for warehousing and 22,660 m^2 for roads. The Port of Gandia has a total berthing line of 1,299 m between its quays and jetties for carrying out commercial operations.

Source: PAV, Annual Report ’06.

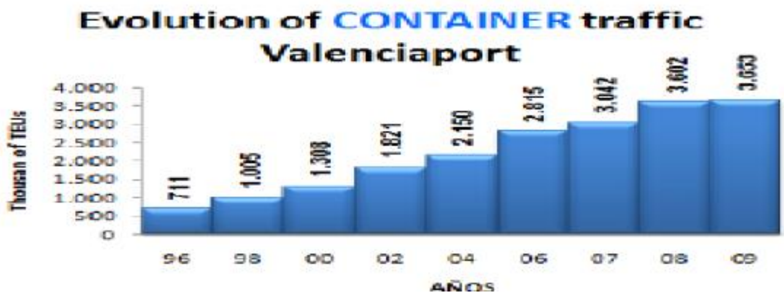
Valencia is one of the main industrial centres in the Mediterranean. 40% of foreign trade containers in Spain go through Valenciaport (Aznar, 2008). Container traffic is the leading actor of traffic distribution in Valencia port, making Valenciaport a leading port in container traffic at a national and regional level as well as at European and international level, ranking as the 1st Spanish port and the 1st in the Mediterranean, 5th European Port and 26th World Port.

Fig. 1.1: Valenciaport (VPA) – Its cluster port traffic distribution



Port	2010 thousands of tons	2009 thousands of tons	Difference %
Gandia	262 (0,4%)	252	6.20%
Sagnuto	6.868(10.7%)	6.843	0.36%
Valencia	56.893(88.96%)	50.689	12.24%
Total	**64.028**	**57.784**	**10.81%**

Source: VPA, Annual Reports 2009, 2010.



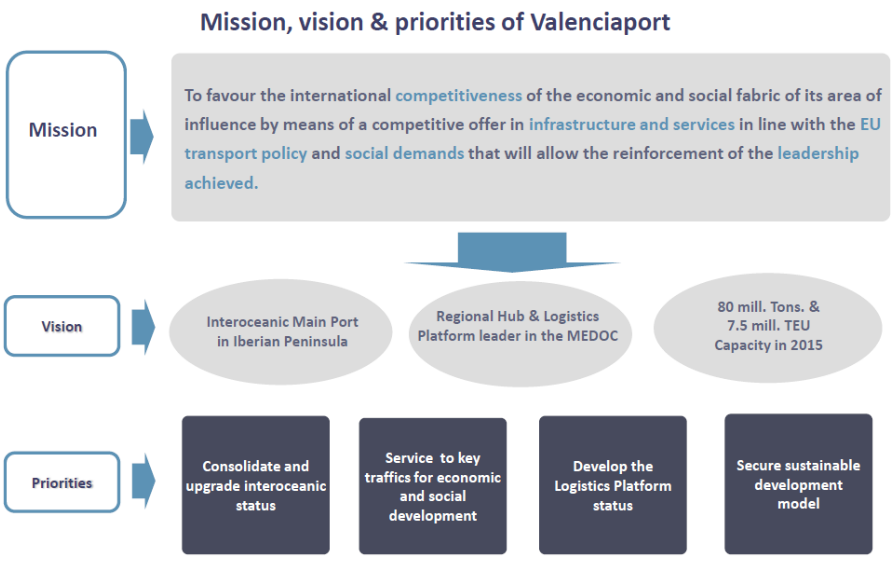
Source: Aznar, 2010

Valencia is the first and last stopover port for the major deep sea maritime services using regular lines in the Western Mediterranean. Thus, the Valencia cluster port is Spain’s leading Mediterranean port, in terms of commercial traffic, basically in containerized cargo, particularly because of its dynamic area of influence and of an extensive network connecting it to major ports around the world (Moreno et.al., 2009).

1.4 The port's reaction to changes in the port sector

Mainly its management autonomy and the proper use of planning instruments have allowed VPA to enhance its competitiveness and achieve a leading role in container traffic among the Mediterranean ports. In the 2000's this cluster port accomplished to provide comprehensive port intermodal logistic services following the customers' demand in the area of its influence.

Fig. 1.2: Valenciaport (VPA) Strategic Plan (2002-2005)

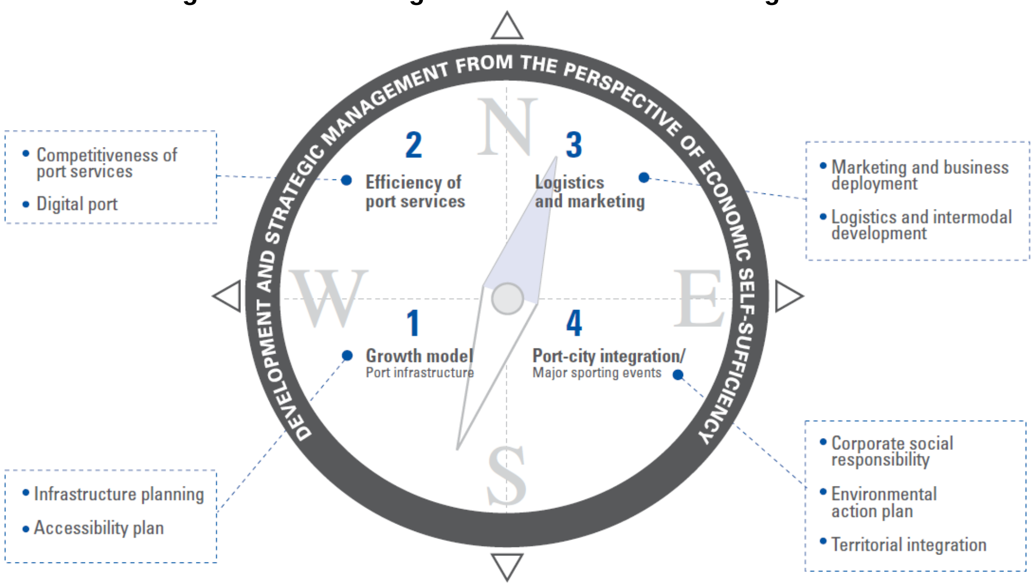


Source: Valenciaport, Annual Report 2010.

<u>VPA strategic plan</u> *(2002-2015)* was strongly positioned towards opportunities, while it prioritized its envisaged goals. The strategy development clearly emphasized the port's mission, vision and priorities. Both mission and vision, in line with the EU transport policy and social demands, have reinforced the port's logistic leadership in the Mediterranean region aiming to upgrade its inter-oceanic status and to develop a logistics platform status. The future goal is the port to be reinforced as a regional hub and to provide port services up to 68mill. tons and 4 mill. TEU capacity in 2015.

The Valencia PA (VPA) completed and approved its 2015 Strategic Plan in 2002. The Port Community, Port institutions as well as the economic and social bodies were actively involved, with the PA, in drafting the master lines of this Strategic Plan. The VPA's strategy deployment revised in 2005, is based on 4 strategic development axes: 1) growth model: port infrastructures; 2) efficiency of port services; 3) logistics and marketing; and 4) port-city integration, which are implemented in turn by means of 10 framework projects.

Fig. 1.3: 2015 Strategic Plan – Focus on 4 Strategic Axes



Source: Valenciaport, Annual Report 2010.

In recent years, growth at the VPA has surpassed the figures set out in the 2015 Strategic Plan. According to the latest traffic data, 4.2 million TEUs were handled in 2010, thus, exceeding the strategic growth objective for container throughput. In terms of total traffic, the VPA expects to reach

the 68 million tonne figure in 2011 (VPA, Annual Report 2010). In 2009, the VPA decided to update its Strategic Plan in light of the economic situation at the time the planned change in the legal framework which was expected to affect competitive relationships between ports in the Spanish system. It was decided that the 2015 strategic objectives, which had already been reached by 2010, would be reviewed along with the port policies on investment, trade, organisation and services. The updated Strategic Plan was completed in December 2010.
In 2004, the Board of Directors agreed to constitute two executive committees, one for Economic and Financial Affairs and another to monitor the Strategic Plan, with the scope to strengthen the port's corporate. The second Committee deals with every issue related to any of the various strategic axes on which the PAV's Strategic Plan is based, but also with any other matter that may be considered relevant and/or related to the Strategic Plan.

- **INTEGRATED MANAGEMENT IN VALENCIAPORT**

Giner-Fillol et.al. (2010) analyzed the management tools at the Valenciaport and identified specific managerial tools periodically used by the PA. The three management tools found were: 1) the Balanced Scorecard (Company Policy and Strategy), 2) the Competency Management (HR management) and 3) the Process Management (Improvement and Control). The authors pointed that *together, they complement each other sufficiently so that, they form an integral management system for the PA* (Giner- Fillol, et.al., 2010).
VPA uses Balanced Scorecard Management (BSC) as the main *management tool*. Its use aims to: improve and rationalise the strategic planning process (definition of objectives and strategic goals); align and allocate resources (operational budgets and objectives); carry out strategic monitoring (management indicators and coordination and decision-making committees). The benefits obtained through BSC implementation are: the creation of a series of strategic indicators and key operational indicators which reflect business growth from different viewpoints; the ability to foresee possible problems and the adoption of a more pro-active approach when working towards strategic aims; the follow-up of the deployment's degree and fulfilment of the Strategic Plan (VPA, Annual Report 2010). In 2010, the strategy was monitored using a new Value Map, and strategic objectives and indicators were updated in order to improve strategic management mechanisms (VPA, Annual Report 2010).

Efficient information management is a key factor in maintaining competitiveness for all the companies involved in the transport chain, (VPA, 2010) and thus, he Information Technology (IT) domain is advanced as management priority in VPA. The port has demonstrated its commitment to remaining at the forefront over the years, by implementing the most efficient information systems. Valenciaport was a pioneer in the Spanish port system when it implemented Electronic Data Interchange (EDI) systems and launched the Community Information System (SIC). The valenciaportpcs.net website is the result of a large process which aimed at the improvement of the port community productivity through Information Technology. Lavarda (2008) points out, that management in VPA is supported by new information technologies, that assist progress towards advanced reporting systems which are more efficient than traditional systems and additionally, these reporting systems are capable of offering solutions to the PA's information needs with less transaction costs.
In 2009, the Valenciaport was honoured with a global "best-in-class" cluster designation, following a review of operating standards within global maritime port clusters undertaken by the Global Institute of Logistics, while it was also recognized for its best practice cluster governance by the Institute. The VPA constantly secures its cluster **port services efficiency** aiming at improving port competitiveness though: specialized port terminals; advanced management models (quality labels); technological innovation (information services and telecommunications network, implementation of a transactional portal); and security and environmental protection (modernization of inspection services; ISPS International Ship and Port Facility Security; Environmental management and services: ECOPORT). Thus, the port management has incorporated environmental management among the port's efficiency priorities.

- **QUALITY MANAGEMENT IN VALENCIAPORT**

Quality management is one of the strategic factors taken into account by VPA. The PA specified two sides of port quality and its management: *internal quality management* in the PA itself and *external quality management in the port community*.

- **External Quality in the port community**

External quality pertains to quality management in the port community, where different groups (PA, freight forwarders, shipping agents, stevedores, hauliers, official services, etc.) are part of a single process which provides specific service to the customer, i.e. the shipping line, importer or exporter. As a result, the customer receives a rounded view of the quality of the service which aims to indicate the port's efficiency as a whole (VPA Annual Report, 2010).

VPA has advanced its own quality service brand. The **Quality Mark** is an Integral Quality System which guarantees the provision of several services according to quality standards, by means of the acquired agreements fulfilment. The quality system is regulated through a Foundation that is the owner of the Brand under the auspices of the Valencian Regional Government.

In 2007, the Quality Mark System became part of a Service Directive which includes the Procedures Manual and the User Rules mentioned above. The evolution of the Quality System means that all companies included in the Quality Mark are audited by an independent certification Body, checking that the system complies with specific standards and ensuring an agreed service quality. The *Valenciaport Quality Mark* began as an exclusive project, whose progressive improvement was turned into a commercial tool of the port's quality service development (Sapina, 2008). It has been implemented in the ports of Valencia and Sagunto. Both ports have Quality Committees whose members represent each port community in. These Quality Committees are responsible for identifying the key services requested by customers, also for establishing the standards which must be guaranteed to the customer and for ensuring that the members of the port community involved in the Quality Mark are committed to these standards. During 2010, the Valencia and Sagunto Quality Committees met on 10 occasions, 5 times in each port (VPA, Annual Report 2010).
As the main ancillary organization, the *Quality Mark Foundation* is a public entity belonging to the Valencian Regional Government, which set up specific Working Groups to carry out specific in-depth studies of any improvement opportunities detected. The Quality Mark has currently 168 member companies (147 in Valencia and 21 in Sagunto) 78 of which have been certified according to the new Service Directive (VPA, Annual Report 2010). *"The Quality Mark has become the catalytic project for the cohesion of the port community"* (Sapina, 2008).

- **Internal quality management in the PA**

Internal quality refers to quality management at the PAV itself. This is based on a principle of continuous improvement, using tools that promote teamwork and standardisation of processes.

Quality Management System - ISO 9001:2008 standard: VPAs Quality Management System is based on the ISO 9001:2008 standard that certifies key internal processes, such as shipping traffic management (which includes the berthing management process) at the ports of Valencia, Sagunto and Gandia, in accordance with the European ISO 9001:2008 quality standard. This system was certified in 1999 according to the ISO 9001:1994 standard, and it was updated in 2003 to meet the new ISO 9001:2000. In 2009, it was updated once again according to the ISO 9001:2008 standard. At the end of 2010, the PAV successfully passed the maintenance audit.

The Quality Mark Quality System: The PAV passed the first Quality Mark Service Directive certification audit for the ports of Valencia and Sagunto in 2006. Audits are carried out every two years and the process took place again in September 2010 with the PAV being awarded the relevant certificate thanks to compliance with 99.4% of general commitments and 100% of specific commitments.

The ANFAC-OPPE Quality System: The PAV also uses a certified Service Directive for New Vehicle Traffic, which ensures the quality of service for new vehicle handling. This quality system is backed by the Spanish Association of Car and Lorry Manufacturers (ANFAC) and the Spanish State-owned Ports Body (OPPE). In June 2010, the PAV successfully passed the New Vehicle Traffic Service Quality Certification process at the ports of Valencia and Sagunto, in line with the Service Directive.

Table 1.2: VPA Certified Quality Management Systems

Quality Management standards	Time of certification
ISO 9001:2008	1999 - according to the ISO 9001:1994 standard 2003 - updated according to the ISO 9001:2000 standard 2009 - updated according to the ISO 9001:2008 standard 2010 - maintenance audit
Quality Mark Quality System	2006 - 1st Quality Mark Service Directive certification audit for the ports of Valencia and Sagunto 2008 - 2nd Quality Mark Service Directive certification audit 2010 - 3d Quality Mark Service Directive certification audit
ANFAC-OPPE Quality System	2010 - New Vehicle Traffic Service Quality Certification process at the ports of Valencia and Sagunto

Source: VPA, Annual Reports

Finally, regarding the VPA's Terminal services, Terminal productivity mentoring systems, such as the 'Observatory of the Container Terminal Productivity' and the Container Terminal Quality Indicators, have been put in place.

- **OHSAS 18001 Certification for Health & Safety**

Since 2006, in compliance with the company's Occupational Health and Safety Policy, the relevant department has developed an Occupational Health and Safety Management System at every level of the organisation. As a result, health and safety were incorporated into all VPA's sectors. This was achieved by informing and training employees in the various different departments involved in health and safety management and by monitoring the planned procedures.
VPA's Occupational Health and Safety Department has chosen the OHSAS 18001 as a management system to satisfy legal requirements and to achieve continuous improvement in monitoring health and safety for employees. The PA has incorporated its commitment to occupational health and safety management in its policy framework of Corporate Social Responsibility (CSR).
In June 2007, the Port Authority of Valencia achieved OHSAS 18001 certification, for the ports of Valencia, Sagunto and Gandia. Since then, it has been annually audited, and the certificate was renewed in 2010 (VPA, Annual Reports 2008, 2010).

- **LOGISTICS AND MARKETING**

The implementation of Valenciaport strategic objectives allowed market-oriented management to expand its hinterland. The VPA's marketing and business deployment has the setting up of a commercial action plan and the adoption of a Commercial Directorate. In addition, the port's logistics development strategic axis has incorporated development of logistics parks, depots, as well as road transport service areas in the Valencia and Sagunto corridor.

The two main projects are: *ZAL Valencia*, and *ZAL Sagunto*. The ZAL projects aim to be connected with the national inland platforms network involving: Madrid, Zaragoza, Castilla-La Mancha, Castilla-León, and moreover to be incorporated within intermodal services expansion. Thus, future planning involves rail corridors development and rail services.

Fig. 1.4: Valencia, Sagunto ZALs - Port Logistic Parks

Features of the Valencia ZAL project
Total area: 68 hectares
Surface Distribution of Valencia ZAL:
•Logistic area: 309,865
•Roads: 181,140
•Green Space and equipment: 127,602
•Other uses : 33,672
•Tertiary Use and services: 31,493

Container Terminal connection
•Airport connection
•Inland platforms connection
•Access (V15, V30, northern access)

Parc Sagunto

Adjacent to the Port of Sagunto is planned
To be developed the ParcSagunt, the biggest business and technology complex in Europe.
(9.5 Mill. M2)

- VPA fosters *internationalization* via the **Valenciaport Foundation**.

The **Valenciaport Foundation** (VF) is an initiative of the Valencia PA (VPA), in collaboration with various other associations, companies and institutions. It founded in 2005, aiming to build-up cooperation among the VPA's cluster port, logistic operators and production sectors, as well as to develop key alliances of e-port, knowledge development, port quality (in terms of association). It provides research, promotion and commercial studies for the Valencian region, to further expand the reach of the logistics-ports community by serving as training and cooperation research centre. The Foundation is active in numerous cooperation and internationalisation projects in well over twenty countries, principally located in Europe, the Far East and Latin America. The principal objective of the Valenciaport Foundation is to form networks among the port-logistics community. This objective manifests itself in various lines of action among which:

- making the Valenciaport cluster more **dynamic**; promoting the development; launching and carrying out of **R&D projects** that improve the competitiveness of all companies operating in the Port of Valencia.
- creating networks in the **port-logistics community**; promoting cooperation in the sector and by getting closer and fostering dialogue with the civil society within the framework of a collective **social responsibility** strategy.

2.0 COPING WITH ENVIRONMENTAL ISSUES IN THE PORT AREA

2.1 The environment in the (3) ports managed by the VPA

The environment in the ports of Valencia, Sagunto and Gandía is managed by the Valencia Port Authority (VPA). Over the last decade, VPA has carried out different actions to monitor and control parameters affecting the quality of the environment. VPA's environmental department has made its priority objective to monitor air, water, and noise quality.

Following an accurate approach in tackling environmental priorities -hence monitoring-, the result of more than a decade's efforts was an **Environmental Network Monitoring System** and a network of instruments for the characterization of environmental issues. This network includes sound level meters, particle sensors, ozone meters, weather stations and an instrumental buoy for the characterization of water quality at the port. These measuring instruments are monitored through a SCADA system that allows knowing the occurrence of different environmental aspects in real time.

Fig. 2.1: Monitoring instruments in Valenciaport

Cabins used to locate the land based measurement equipment

Buoy used to monitor water parameters.

Source: www.valenciaport.com

VPA has initiated the design of an *Environmental Monitoring System* of different aspects in order to decide on actions aimed at improving the local environment, while it has been involved in port-city monitoring projects. The aim of this system was to take preventive and corrective actions according to the results obtained.

The system monitors air, surface water and sediment, dredging and noise. Air quality monitoring started in 2005 with the completion of an EU funded project HADA -Environmental Diagnostic Automatic Tool- under the Life Programme. Noise monitoring started with EU funded SIMPYC and NOMEPORTS projects, both under Life Programme in 2007-2008. The RECA project initiated water quality control. The environmental aspects, which are given most attention, are discussed more detailed below.

2.2 Port Development in Valenciaport – Valencia, Gandia and Sagunto enlargement

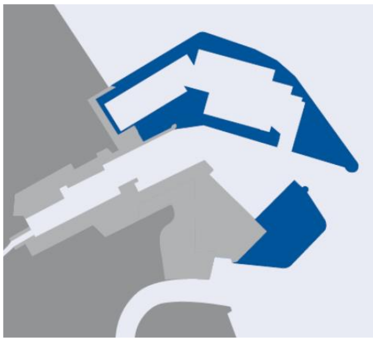
Axis 1 of the Valenciaport strategic growth model (2002-2015) has incorporated an extensive port development plan in its port-cluster. The model has two main planning objectives: *infrastructure* and *accessibility*. The aim of infrastructure planning is to establish a growth model and to improve the infrastructure in the VPA's ports, in order to successfully provide facilities to the estimated levels of traffic, thus preventing the bottlenecks developing in ports (VPA, Annual Report 2010).

Table 2.1: The VAP Growth Model- Port Infrastructure

Extension of the Port of Valencia

The project aims to expand the Port of Valencia and focus on consolidating the pot's profile as a deep-sea port.

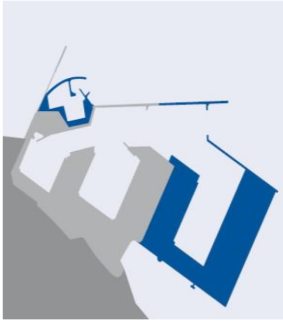
In 2008, having obtained a favourable Environmental Impact Statement, the Port Authority of Valencia started work on building the breakwater for the Port of Valencia's expansion project. In September 2010, the last breakwater caisson was put into place, thus completing its actual shape and size. Work on the breakwater project is still underway and should be finished in 2011.



Extension of the Port of Gandia

The Port of Gandia expansion project has two objectives. The first is to create a marina which will meet the expected growth in demand for moorings over the next 15 years, and the second is to build a new terminal in the commercial area of the port.

In 2009, the Environmental Impact Study was sent to the Ministry of the Environment and Marine and Rural Affairs to request the corresponding Environmental Impact Statement. The Ministry has requested the modification of the EIS. Thus, for the "Draft Project to Develop and Regenerate Gandia Beach", and the "30m extension of the South Jetty" project, corrective measures have been suggested the result of a **consultation phase involving a range of stakeholders**.



Extension of the Port of Sagunto

The expansion project at the Port of Valencia will be complemented by a project to extend the Port of Sagunto.

Having completed the public consultation phase, the draft project for the Port of Sagunto's expansion project and the Environmental Impact Study have been sent to the Ministry of the Environment and Marine and Rural Affairs to request the Environmental Impact Statement which is required before the project can go ahead. The Ministry has requested additional information.

Source: Valenciaport Annual Report, 2010.

Fig. 2.2: Image of Valencia Port after its expansion process (year 2010),
showing the land reclaimed from the sea, the Nazaret neighborhood and the Logistic Facility area

Port of Valencia (1980)

Port expansion the last 30 years (1980-2010)

Source: Valenciaport Annual Report, 2010.

<u>Accessibility</u> is one of the most important problems in Spanish ports (Aznar, 2008). In order to improve accessibility to Valenciaport by road, road infrastructure improvement was planned and was partly implemented by the Ministry of Development's General Directorate for Roads. In the future, this will provide a new access route to the Port of Valencia and will considerably reduce the distance for traffic coming from the north, whilst cutting the distance between the ports of Valencia and Sagunto. In addition, the Ministry of Development, aiming to enhance the competitiveness of the port cluster, has started the environmental assessment procedure for the Port of Sagunto rail link project, while in 2009, the port of Gandia was awarded the tender to construct a new access route (the project is assessed by the Ministry of the Environment and Marine and Rural Affairs) (VPA, Annual Report, 2010).

2.3 Air emissions and Air Quality in Valencia port

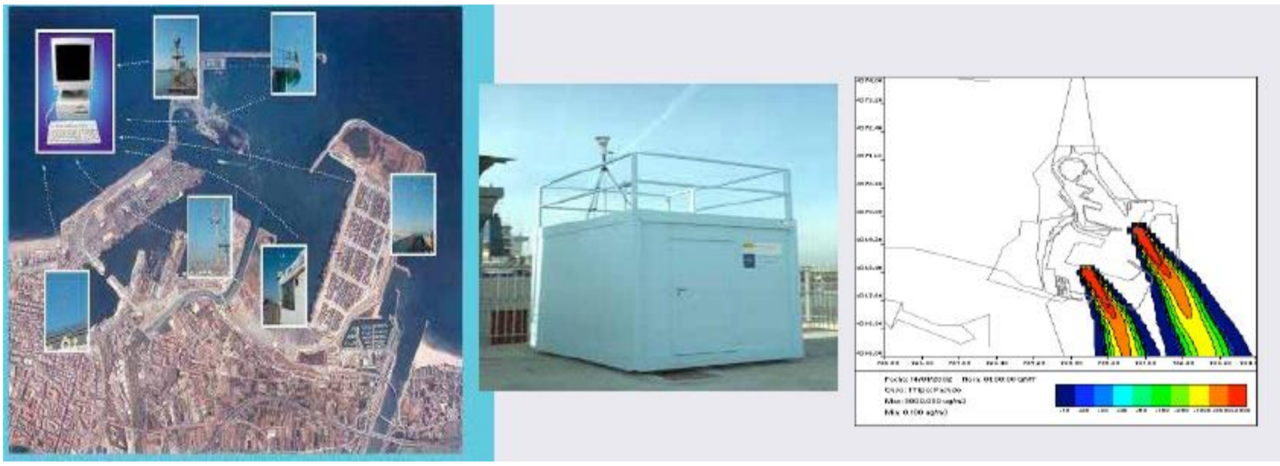
In the Valenciaport area, many different transport modes converge, handling many kinds of goods, which, at times, result in air emissions polluting to varying degrees.
Air quality is one of the objectives that the VPA's environment department has given priority. The VPA was involved in various lines of action, aiming to minimise emissions, which affect the atmosphere. Under this scope, it carried out surveillance and monitoring programmes of air emissions. Monitoring was carried out by measuring concentrations of various pollutants that affect air quality in the port area, e.g. particle concentrations (PM10), sulphur dioxide, nitrogen dioxides and carbon monoxide. Simultaneously, meteorological data has been recorded at a series of meteorological stations located at significant sites in the port area.
There was a clear need for *real-time atmospheric control* in order to foresee and simulate possible incidents of particle pollution in the port area. This requirement led to the development of the Environmental Meteorological Instrumentation Project (PIMA) in collaboration with the Public Organisation of State Ports (EPPE) and the Research Centre for Energy, Environment and Technologies (CIEMAT). The major objectives pursued by VPA through this project are: 1) monitoring meteorological conditions; 2) local weather forecasts; 3) monitoring the concentration of sediment particles and particles in suspension; and 4) air quality level forecasts.

Weather station on the automatic surface network

Sediment able and suspension particle sensor station installed in VPA

Since 2006, the Port Meteorological Instrumentation Plan (PIMA) has been used, providing an *air quality control network*. PIMA was involved in implementing the supervision of a network of Meteorological stations and Particle counters in order to determine the air quality in real time as well as to monitor and control different polluting parameters. Within that time VPA has been able to monitor and control the different parameters which affect environmental quality: NO, NO2, NOx, SO2 and CO gases, as well as PM10 particles. In order to carry out this surveillance, the VPA has an Air Quality Control Station, as well as three Meteorological Stations and two Particle Counters already installed as a result of the PIMA Project and strategically positioned throughout the port area. This initiative provides a clear view of air quality in the Port of Valencia and enables the PA to be aware of the atmospheric quality in relation to the suspended particles.

Fig. 2.3: Air pollution: Meteorological Equipment and particles dispersion model applications.



Source: VPA Annual Report, 2006

2.4 Water quality / VPA's Water Quality Control Network

The VPA's environmental action, focused on water quality monitoring, was triggered by the Water Framework Directive 2000/60/CE and the relevant Spanish legislation (Torres-Monfront, 2008).

The **RECA** project provided the PA with a water quality control tool: "Water quality network system in the port area". The project aimed at the awareness of water quality in real time as a result of close monitoring. The PA established a network of sensors in order to monitor the evolution of water quality in the port's quays. The monitored parameters are water temperature, chlorophyll, O_2, hydrocarbons, turbidity, salinity and others.

In addition, the VPA conducted studies in order to determine the evolution of water quality in the various port docks. These studies include monitoring hydrology, microbiology, plankton and benthic communities monitoring inside the port area over an annual cycle. Periodic analysis of sheltered waters allows water quality to be ascertained along with the early detection of possible pollution episodes (Torres-Monfront, 2008).

Fig. 2.4: Water quality control tool: Water quality network system in the port area

Parameters

- ✓ **Water temperature**
- ✓ **Chlorophyll**
- ✓ **O2**
- ✓ **Hydrocarbons**
- ✓ **Turbidity**
- ✓ **Salinity**
- ✓ **Directions and wave intensity**
- ✓ **Others**

Source: Torres-Monfront, 2008; Company, 2012

VPA has continuously improved its Water Quality Control Network, which is located, in accordance with the recommendations of CIEMAT (Centre for Energy, Environmental and Technological Research), at the Transversal de Poniente Quay. This location, on the port-city interface, has allowed the evolution of pollutants and their possible effect on the area to be determined, thereby allowing a quick response to finding solutions for possible air pollution episodes. Besides studying and monitoring water quality, the Water Quality Control in the ports of Valencia, Sagunto and Gandia collected floating and semi-submerged wastes, as well as prevented and handled pollution caused by fuel spills. In 2010, the effort continued regarding the update of its Water Quality Control Network in order to comply with the Water Framework Directive guidelines. The latter included the introduction of new water quality parameter measurements in all the docks managed by the VPA, (VPA Environmental Report, 2010).

2.5 Noise management

The EU Environmental Noise Directive (END) 2002/49/EC on the Assessment and Management of Environmental Noise requires that industrial port areas should be included in noise maps. Noise maps must be drawn by competent authorities designated by the Member States. The Directive, however, does not specify how to define these noise maps. Responding to this challenge, the NoMEPorts project (Noise Management in European Ports) has been the port sector's EC LIFE funded initiative, which targets at the management of noise generation that affects people living around and in proximity to seaport areas. The project has initiated the development of a Good Practice Guide to Port Area Noise Mapping and Management for port industrial areas (NOMEPorts/Layman's Report, 2008).

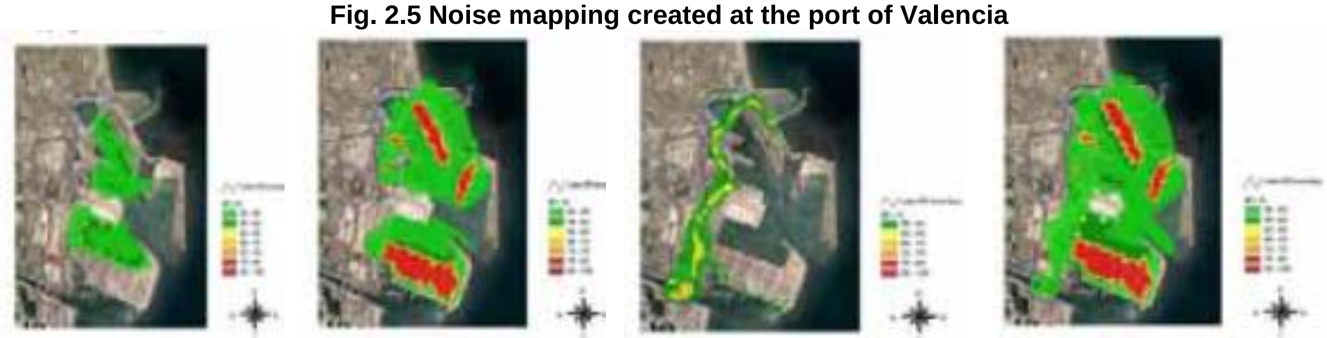
The NoMEPorts project was successfully developed for six project partners in EU port areas, among which was the port of Valencia. The project provided noise maps and action plans to mitigate noise problems in the Valencia urban area close to the port. More specifically, the project identified the situations that occur in the port related to potential sources of noise pollution, compiled noise maps of port facilities, analysed the results obtained from the noise maps and defined action plans. Finally, it simulated situations using a calculation software (Torres-Monfront, 2008).

In a preliminary study in the port of Valencia, the most noising port activities identified were: land transport traffic, container cargo activities, construction and demolition activities, as well as shipyard (vessel construction and repair). The NoMEports project concluded that the noisiest activities, such as container movement in the port of Valencia, are far from the city, but some noise measures of the roll-on & roll-off activities obtained levels between 60 and 65 dbA. *"The main noising source arise from the land transport traffic around the limit of the port, but it should be noted that port communications infrastructures affecting the port-city interface"* (Torres-Monfront, 2005).

Before the NOMEPorts project, VPA had taken measures for noise in the port area according to the Labour Safety regulations. During the project, the research steps initiated were: 1) inventory of local noise and geographic situation; 2) collection of noise data to be used with noise management system; 3) creation of noise maps with noise management system; and 4) analysis of noise maps and solutions (Torres-Monfront, 2005).

Noise data was mapped at the port of Valencia at five levels: industry (IPPC /no IPPC), road traffic, railway, ships. Action Plans also developed proposals for corrective measures to improve acoustics in port (i.e. acoustic barrier located between leisure area and commercial port). With the project's finalization VPA advanced a SCADA Toolkit aimed at noise management integration with the existing environmental control systems, through a software application, so that all the information is received in real time. In this way, the Emergency Control Centre of the VPA could immediately attend all emergencies in ports of Sagunto, Valencia and Gandia (Torres, 2008).

Fig. 2.5 Noise mapping created at the port of Valencia



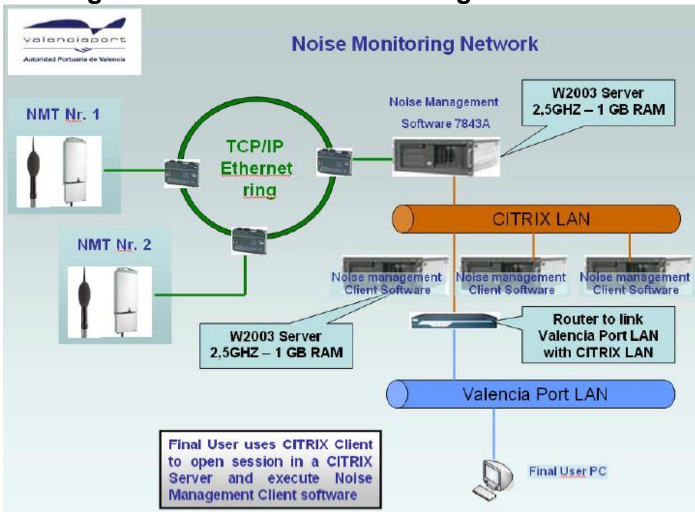
Shipping Noise **Industry Noise** **Road Traffic Noise** **Total Noise**

Source: Torres-Monfront, 2008

In 2010, VPA afforded the development of a <u>Noise Control Network</u>. This involved improving the existing predictive noise maps which monitor the different activities carried out in VPA ports and included the deployment of sensors (sound level meters) around the port facilities. In 2010, the

Noise Control Network installed three sound level meters in the port-city interface area at the port of Valencia (VPA, Environmental Report 2010). This monitoring system proved to be helpful in controlling noise levels produced by the port activities. If permissible levels are exceeded, corrective measures are immediately implemented.

Fig. 2.6: VPA's noise monitoring network



Source: Company, 2012

Through a router the VPA's Noise Quality Control Network is connected to CITRIX LAN and to Valencia Port LAN. Users open a session in a CITRIX server and they execute the Noise management client application.

2.6 Waste management on VPA's port areas

Although the VPA's management team sees waste management as an ongoing project the VPA itself is actually a pioneer PA in port areas' waste management. This is due to the existence of specific facilities according to MARPOL waste reception (waste from ships controlled by the International Convention for the Prevention of Pollution from Ships, MARPOL - Annexes I and IV) but also due to the existence of the VPA's Waste Transfer Center (CTR), where wastes generated in the port area are managed and segregated before delivery to an authorized treatment facility.
The port of Valencia has also implemented an updated **Waste Management Plan** in order to conform to the new legal requirements evolved from International Conventions, EU Directives or the Spanish legislation. The aim of these actions is to efficiently manage waste and facilitate their delivery and management by vessels calling at the port of Valencia.
A *waste group* has been formed, which comprises of the ports of Sagunto, Valencia, and Gandia as well as companies from the port community with the aim of coordinating waste management. Meetings have been called on a regular basis to study or tackle environmental waste issues and try to harmonise the waste management efforts of all representatives. In 2006, questionnaires were distributed in order to establish the degree of client satisfaction (vessels) regarding authorised service providers.

- **VPA's MARPOL waste reception facilities**

The Spanish Royal Decree 1381/2002 -on port reception facilities for vessel generated waste and cargo residue- was published on December 2002. This Royal Decree aimed to intensify the protection of the marine environment and improve the availability and use of port reception facilities for waste. The end goal of this Royal Decree was to reduce discharges of vessel generated waste and cargo residue into the sea, by impeding illicit discharges from vessels using Spanish ports but also by improving the availability and use of waste reception facilities in ports. As indicated in the aforementioned legislation, the managing entity of the port must approve and apply a waste reception and handling plan. For this reason, in April 2005 VPA approved of this very plan which was applied to all vessels that berth in the various quays of the Ports of Sagunto, Valencia and Gandia. Solid waste is selectively collected in containers available close to the vessels in quays, and liquid waste is collected either on land or by maritime means during the vessel's call. The procedure is as follows: notification at least 24 hours prior to the vessel's arrival, service request, transmission of the application, issue of the Marpol certificate and the transmission of services. In addition, VPA produced a leaflet about the reception and handling of wastes from vessels in ports under the PA's jurisdiction. The leaflet details the management plan which applies to all wastes - both solid and liquid- generated by vessels, procedures to follow, a list of authorised companies, relevant legislation and a report on waste collection.

- **VPA Waste Transfer Center (VTC)**

Already back in 2001, an area for improvement identified in the ECOPORT project (1998-2000) was the management of waste produced by port activity (loading, discharging, storage and handling) and not linked to the MARPOL convention. Hence the PA launched the idea of creating a Waste Transfer Centre which enables the port companies to remove their waste. The centre allows solid and dangerous waste to be selectively collected and, although located in the port of Valencia, it serves the total of the VPA's cluster port.
The VPA's Waste Transfer Centre (VTC) facilitated the management of non-urban waste generated by port installations and was the first centre of its kind built in port areas. The Centre started operating in the second half of 2004. With the VTC implementation VPA aimed to facilitate the collection and management of the waste produced on the cluster port premises and by the PA itself, as much as the associated administrative procedures. This innovative port project enables waste generated by port facilities to be collected, evaluated, managed and later transported to their final destinations where they are adequately processed. For managing their waste in a convenient way and in accordance with the existing legislation different kinds of companies located in the cluster port have access. They will also benefit from the savings offered by economies of scale. Future plans include the creation of similar facilities for waste management in the port of Sagunto.

- **Recycling program**

The VPA has encouraged the recycling of batteries, paper, glass, plastic, oil, etc. under its recycling program (VPA Environmental Report, 2006). By the end of 2010, recycling of televisions and screens, fluorescent tubes and compact bulbs, batteries and PET packaging was in place (VPA Environmental Report, 2011).

- **Improved waste storage conditions.**

Generated by the port cluster, an inventory of hazardous and non-hazardous waste, was created. A study was made for each emitting source but also for the best locations for containers. The containers were then located at the chosen sites (VPA, Environmental Report, 2006). Thus, the collection and storage of hazardous waste has been improved.

Fig. 2.7: Photographs of waste storage facilities.

Previous Situation **Situation in 2006**

Source: VPA Environmental Report, 2006

- **Sewage network at the Port of Valencia**

The sewage network in the port of Valencia carries wastewater generated at the port of Valencia away into the municipal network. The network has been designed to use a vacuum sewer system, which has environmental benefits over traditional gravity systems and will allow greater flexibility for future modifications to be carried out. The budget for the project was €4 million and construction works were completed in 2010 (VPA, Annual Report 2010).

2.6 Emergency Situations
Spillages constitute another important aspect in Valenciaport. For this reason, the VPA has implemented an Emergency Control Centre to provide urgent action in case of spillage. Water quality is continuously monitored, along with the hydrology and biological activity of port waters.
The VPA's Emergency Control Centre has attended to situations of risk and emergencies in the cluster port. Since 2006, preventive procedures have stemmed from the Solas agreement, the ISPS code and Community and the Spanish legislation on the subject. Extensive training procedures encompassed specific actions for improving staff performance in the Emergency Control Centre. VPA applied a series of preventative actions to avoid emergency situations, while it used material both for land-based or maritime-based emergencies and offered staff training to ensure that the effects caused by emergency situations are corrected or minimised.

2.7 Biodiversity
VPA produced 'The guide to Birdlife in the Port of Valencia' aiming to provide information on the wide variety of birdlife that lives in the port area. It provided experts with some initial information on which further studies and observation can be based, and it also helped the general public identify species that can be seen in the skies over ports during various seasons of the year.
The idea for the guide was the result of the Ecoport project. The publication of the guide fulfilled two objectives. Firstly, it responded to the public's demand for information on biodiversity in the port area. Secondly, it fulfilled its commitment to facilitate suitable training and awareness of the staff supporting its Environmental Policy implementation.

2.8 Dredging – Management of dredged material
From time to time, VPA performs maintenance dredging operations, in response to the access and manoeuvrability requirements of the cluster port and, as a consequence, of the accumulation of sand and lime deposits in the entrance channels to the ports and at the construction of new quays.
During the last decade, dredging operations were required for different types of port works based on the characteristics of the works involved. VPA carried out monitoring programmes to observe turbidity caused by the dredging activities. Although, in general terms, turbidity didn't occur in the sheltered waters of the port, the environmental monitoring programmes systematically ensured that the water quality remained acceptable in the surrounding areas during dredging operations.
Likewise, works that require dredging operations are also subject to the legal procedure of environmental impact assessments, and the monitoring process was carried out- as defined in the studies and statements of the EIA- to ensure that the environment was affected as little as possible.
VPA put into practice a civil engineering research agency in Spain that is the CEDEX recommendations, which were applied in all cases to ensure that the dredged materials were adequately managed. In most cases, during the last decade, no special treatment was required based on the results obtained, in terms of quality.

3.0 RECURRING THE PROBLEMS: THE PORT MANAGEMENT EFFORTS

3.1 VPA's management efforts towards greening
Since the mid 1980's concern for the environment, in terms of EIA implementations, as much as quality issues have been the primary considerations in VPA's management. After the late 1990's, there was a growing awareness of the need to conserve and protect the environment, and particularly in the interest of SD in port community (VPA Environmental Report, 2006). As such, the PA's full commitment to environmental protection created several green initiatives over the years.
The Valenciaport has drawn up an Environmental Policy and implemented a series of tools to maintain a balance between highly increased port activity and environmental protection. Its initial Environmental Policy was an outcome of an internal project which concluded in the year 2001 and constituted an innovative step forward of the obliged reference at a European level.

3.2 VPA's ECOPORT(s) projects

The VPA's most prominent environmental initiatives, in terms of EMS implementation, was **ECOPORT I** project (1998-2001) and its consecution **ECOPORT II** (2006-2008).

ECOPORT-An environmentally friendly Port Community
(LIFE98/ENV/E/000426)

The **ECOPORT I** project was conceived in 1997 and it was carried out from 1998 to 2001. It was financed jointly by the VPA and the EU, through the LIFE Program (DG XI). The project which developed a system for implementing environmental management systems (EMS) in port communities, aimed to meet the European policy requirements in relation to the sustainable transport development and environmental respect.

It embraced specific *port environmental actions*:
water and air quality, waste management, communication – awareness, international co-operation and R&D projects.

The aim of the Valenciaport **ECOPORT I project**– *"Towards an Eco-friendly Port Community"* was, to develop a methodology that would enable port areas to adopt EMS and meet the new EU requirements for a sustainable and environmentally-friendly European Transport Policy. VPA invested, mainly in terms of human resources, by implementing the project which was carried out in its three ports. The project particularly aimed at EMAS implementation in the VPA cluster port. This strategic scope encompassed three (3) areas: 1) ECOPORT System (EMS); 2) training; and 3) dissemination. It was an innovative and ambitious project which facilitated, in line with the VPA policy, continuous improvement in terms of Quality Service and Environmental Respect, (Sapina, 2008).
The ECOPORT I project detected a series of unmet requirements that have benefited from the analysis provided by the project's created model. These requirements, were enclosed by the companies themselves and by the PA, as a supplement to the project, pertaining: 1) allocation of human resources in participating companies specifically for environmental related matters, 2) Legislative Information System on the environment of the total Valencia port community, 3) enhancement of emergency measures in relation to air pollution, 4) project for installing a Waste Transfer Center, which has been approved by the Port Authority' s Board of Directors (Orejas & Torres-Monfront, 2001). Furthermore, the project developed a system of indicators in order to implement a sustainable environmental management for industrial harbours and ports, (Lam & Notteboom, 2012). It was completed in January 2001, and afterwards the obtained tools were used within the Valencia port community. VPA and the pilot companies within the programme, continued working on the implementation of the produced EMS.
The ECOPORT project fully integrated the environmental variable into its operations and this constituted a qualitative change in the VPA's green focus. The main outcomes of the project are presented in following table 3.1.

Table 3.1: The main results of the ECOPORT I project (1998-2001)

VPA's EMS model	An implementation model for Environmental Management Systems applicable to all companies within the Port Community.
VPA's EMS model diffusion	The necessary structure for the appropriate dissemination of project results, encouraging their application at both national and international levels, as well as providing specific material in environmental courses.
	The publication of an "Environmental Management Systems Implementation Guide for Port Installations".
	Training for specialists in environmental management for port installations.
	The dissemination among European Union Port Communities.

Source: VPA Environmental Report, 2006

After the projects' completion, the VPA was highly recommended as a *"point of reference for other port communities"* in their way towards greening (ESPO, 2005), as it was acknowledged that it had established the bases for implementing an Environmental Management System (EMS) in industrial ports (Peris-Mora, et.al.,2005).

ECOPORT II project (2006-2008): VPA launched the ECOPORT II project in order to study the possibility of implementing the Eco-Management System framework, produced by the ECOPORT project, in its port community. The project indented to implement eco-management initiatives able to construct EMS for all the companies located on the port premises managed by VPA. The final goal was ISO 14001 or EMAS certifications.
During the project's implementation period, several meetings were held among companies representing the Valencia Port Community. A five-level system was initiated to identify the current level of environmental management implemented in each company. VPA provided a check list, in order to create work groups based on the fulfilment level of the project's environmental requirements. During the project's meetings with the attendance of all companies taking part in the project, the levels were assigned to each company and plans were organized to provide support to the organizations, not only in order to maintain the level assigned but also in order to move up to the next level and finally achieve certification. The project's outcomes were used in the VPA's port community and they were reinforced after the project's completion. By the end of 2010, 36 companies were participating in the project, 14 of which had already obtained certification. Several of these companies continued to work together to create common environmental objectives through a joint working group called: *"The Ports of Valencia, Sagunto and Gandia's Environmental Committee"*. The following table determines the number of companies assigned to each level:

Table 3.2: ECOPORT project in VPA's port community

Valencia Port Community			Certified companies	Level 1	Level 2	Level 3	Level 4	Level 5
year	meetings	Total companies						
2006	2	28	11	6	8	1	0	2
2010	several	36	14	4	6	6	4	8

Source: PA Environmental Report, 2006; 2010.

The VPA's Ecoport II project Environmental Committee was appointed with the project's follow- up, and with the task to set its sights on future actions and approve the creation of environmental training documents. Various environmental awareness and information issues were sent to the VPA's port community companies via e-mail and through the Ecoport portal.
Regular working meetings of the Environmental Committee and companies at the same level as much well as with companies certified with a standardised EMS were held annually, informing about the results achieved in terms of objectives and targets, indicators, responsibilities and deadlines related to the EM implementation and Monitoring Programme. Each year at the end of December, the Environmental Committee held a final meeting in which future initiatives were planned, and the actions carried out within the year were assessed. This initiative was reinforced through the VAP's participation in two other projects: 1) ECO- LOGISTYPORT project, and 2) Ecoport-Lex.

Table 3.3: VPA's Collaborative projects supported the ECOPORT II project

2009 - 2010	ECO-LOGISTYPORT	**SME's Training on EMS implementation & Energy management** • Aimed to extend the ECOPORT model to logistics companies in the Valencian Region.
2008	Ecoport-Lex	• An **environmental legislation information system** applicable to all port activities.

The ECO-LOGISTYPORT project was a collaborative research project (Spanish Biodiversity Foundation, Valencia Polytechnic University, ITENE Transport and Logistics Research Centre), focused on the EMS implementation and improving energy efficiency in small and medium-sized companies in the port logistics sector of the Valencia Community. The Ecoport-Lex was carried out in collaboration with a law firm specialized in environmental law.

3.3 VPA's R&D projects

Since 2000, the environmental R&D actions of VPA aimed to respond its environmental policy can be grouped into two project categories: 1) **internal** and 2) **collaborative R&D projects**.
The port carried out initiatives which focused on improving environmental aspects in the ports managed by the PA. It participated alone or in conjunction with other ports or European entities in projects not only with the scope to find solutions on port environmental problems, but also to facilitate the adoption of unifying criteria for establishing European legislative standards.

The use of technological innovation -either carried out directly using the organisation's own means or in collaboration with other companies and institutions- was progressively incorporated in the PA's port activities that also played a vital role in the produced projects in the area of R&D. One demonstration of the strong commitment to R&D projects, was that the VPA destined both the financial and the human resources for promoting research and developing technologies. The projects completed in the era of R&D are presented in the following table 3.4.

Table 3.4 : VPA's PARTICIPATION IN PROJECTS

Internal R&D projects		Collaborative R&D projects	
PIMA	**Port Meteorological Instrumentation Plan** • Implementation and monitoring of a Network of Meteorological Stations and Particle Counters.	**EU/ECOPORTS PROJECT**	**Development of a series of EMIS** Eco-management & Information Tools in line with ESPO recommendations, aiming to help any EU PA interested in improving environmental performance. Supported by the EU/V Framework.
RECA 2003 2004-2005	**Water Quality Control Network** • Tackling pollution from oil spills.	**NoMEPorts** 2005-2008	**Noise management in EU ports.** Supported by the EU/Life Programme.
ECOPORT I (1998-2001)	**Valencia Port EMS program conception** • methodology to simplify the subsequent implementation of an EMS.	**SIMPYC** 2004-2008	**A System for Port-City Environmental Integration.** Supported by the EU/Life Programme
2000-2003	Port Environmental Indicators System Supported by the (PROFIT) Programme of the Spanish Ministry of Science and Technology. • **Environmental Indicator System for the Spanish port system**	**SECUR – MED** 2004 - 2007	Interregional and trans-national project on maritime safety and environmental conservation in the W. Mediterranean. • best practice exchange in West Mediterranean. Supported by the Interreg IIIB Medoc Programme 2000/2006.
ECOPORT II 2006-2008	**Towards an Eco-friendly Port Community.** • The Implementation of an Eco management System in most companies in the ports of Sagunto, Valencia, Gandia.	**ELEFSINA BAY 2020** 2007-2008	A collaboration for an environmental improvement in port-city relations. Supported by the EU/Life Programme.
2002 - 2005	**Automatic Tool for Environmental Diagnosis** • Noise & Air Pollution Control System. Promoted by the EU/Life Programme.	2005 - 2008	Risk management for the traffic of hazardous goods in the Mediterranean. Supported by the Interreg III Program.

Source: VPA Environmental Report, (2005; 2006; 2007; 2008; 2009)

○ VPA's Internal R&D projects

In 2003, the VPA's commissioned the **RECA project** and its Safety and Environment Department requested for a water quality study by the Marine Biology Laboratory of the University of Valencia.

In 2003, the study involved monitoring hydrology, microbiology, plankton and benthic communities. The research concluded that monitoring of some water quality parameters was needed, in order to exploit available data to prevent potential events of hypoxia or anoxia, and phytoplankton blooms in certain inner quays in the port area. VPA commissioned a second water quality monitoring campaign (2004–2005) which determined: 1) nutrients as an essential parameter in the assessment of possible eutrophication events in port waters, 2) their biological communities, and 3) their impact on human life.

Both studies were triggered by the Water Framework Directive, that was gradually incorporated in the Spanish legislation (Spanish Law 62/2003/ 31-12-2003). The Directive directly affected the water quality management in all Spanish ports, requiring acceptable water quality levels in all coastal waters of the European Union by the year 2015. The required water quality standards

introduced changes in the formulation of assessment criteria and classification of the types of impacts on biological systems. The standards imposed difficulties because of the complete lack of sufficiently long and complete time series of physiochemical and biological parameters in the areas of study,(VPA, Environmental Report, 2005).
Thus, the VPA's RECA project and its conducted water quality monitoring studies represented vital groundwork in support of any management initiative on water quality and the marine system in the port of Valencia in general, and fulfilled the objectives of the Water Framework Directive at a reasonably short period of time.

The **INDAPORT project** (Environmental Indicator System for Ports) (2000-2003) was funded by a Programme aiming to Foster Technological Research, (PROFIT) of the Spanish Science and Technology Ministry. VPA was the project's pilot port, and the project was managed by the Spanish State Ports Agency (Puertos del Estado). The INDAPORT produced an Environmental Indicator System, which would allow environmental conditions and their evolution to be determined as precisely as possible. Furthermore, a model was created capable to reproduce the system in other port environments.
It was one of the first two EU research projects on port Environmental Performance Indicators (EPIs). The other one was the 'EPCEM Environmental Performance Indicators in European Ports' project (2003) commissioned by EU-ECOPORTS and produced by the IVAM, University of Amsterdam. These two projects had been the source for information available for the European ports until 2010. In March 2010, the Finnish Ports Association and EcoPorts Foundation (EPF), carried out a collaborative workshop entitled *'Environmental Performance Indicators for Planning and Operation',* with the scope to further inform about port EPIs and as accurately as possible about the environmental conditions and alterations in the port areas.

The **HADA project** (2002-2005) (Automatic tool for Environmental Diagnosis) was an EU Life programme as it was already mentioned in 2.1. VPA in collaboration with other Spanish ports, developed a monitoring system of air and noise pollution in port environments linked to a decision-making system. Thus, the HADA project produced a **Noise & Air Pollution Control System.**
Triggered by the up-coming enforcement of the EC Directive 1990/30/EC on 2001, the project required the PAs to control certain particle concentrations and the Annex VI of the MARPOL Convention (international convention for the prevention of pollution from ships) underlined the need to monitor the limits of NOx, SO2 and BTX gases emitted in port areas. VPA along with eight other Spanish ports took part in the HADA project (Automatic Tool for Environmental Diagnosis).
The project was managed by the Spanish State Ports Agency (Puertos del Estado) with the external assistance of the Valenciaport Foundation (IPEC) and aimed to verify the compliance of the Spanish port authorities with European Directives and international agreements regarding port zones. Its main objectives were to: 1) design a system for air quality control in port areas; 2) create a system for monitoring and reducing noise levels; 3) develop a particle emission model; 4) create a real-time decision-making and response system for taking action in the event of irregular situations. Moreover, the project also planned a cost-benefit analysis of particle contamination reduction systems.

- **Cooperation at an EU level**

Cooperation via the EU -ECOPORTS project
During the ECOPORTS project, which was financed by the EU-V framework programme and involved the participation of 150 EU ports, VPA was responsible for one of the project tasks:

- to develop an Implementation Guide for EMS in port communities.

Throughout the project, the VPA has maintained close co-operation with its project task partners: Associated British Ports (ABP); Civitavecchia Port Authority; Livorno Port Authority; Marseilles Port Authority; Tenerife Port Authority; Rinfuse Terminal (Port of Genoa), to ensure that the project's outcome would be based on real experiences. Moreover, during the project, the VPA organized several workshops (with the aforementioned PAs) in order to make a detailed analysis of the EMS development Guide, allowing suggestions to be made in relation to the project objectives' fulfillment.

- The ECOPORTS Implementation Guide for EMSs in port communities, along with the Implementation Guide for EMS in Port Facilities, aimed to serve as a point of reference for all EU ports, and to give rise to a standard implementation guide for EMS in ports and port facilities.

NoMEPorts project (2005-2008): As aforementioned, (see section 2.5) the **project** was based on the EU Directive 2002/49/EC on the Assessment and Management of Noise. and provided a common harmonized approach in the field of port area noise mapping and management. VPA reaped the following benefits from the project's participation: 1) training in noise management and use of software tools; 2) VPA's noise map creation at 5 detail levels, 3) action plan proposals, which incorporated planning and management solutions in order to reduce noise annoyance of people around the port of Valencia areas; 4) the PA demonstrated and optimized software system for noise mapping and management in the port area; 5) recommendations for specification of EU Directive 2002/49/EC and other noise policy.

- **Cooperation at EU/regional Mediterranean level**

The **SIMPYC project** (2004-2008)- Environmental LIFE Programme.
Foreseeing the establishment of a cooperation network among various cities for the exchange of experiences and technical knowledge, the SIMPYC project aimed at reaching solutions that improve the port-city relationship.

This project, besides the VPA, included the participation of other ports (Toulon and Leghorn), the city authorities of Valencia, Leghorn and Toulon, as well as the Valencian Regional Government and the University of Valencia amongst others. Although the project tended to demonstrate the socio-economic importance of ports, it mainly aimed at the coordination of different administrative bodies (port and city authorities) in environmental management processes at port-city interfaces.
The project's objectives included the development of joint port-city environment, monitoring initiatives with particular emphasis on the atmospheric (from sediment-able particle emissions) and noise pollution as well as the impact of the port-city interface on the landscape. The SIMPYC project fostered raising awareness of the need to facilitate relations between citizens, municipal government and the PA with regard to environmental matters. Additionally, the project implemented an action plan that addressed the relations between ports and cities in small commercial and fishing harbours and marinas. It coordinated action between PAs and City Councils and addressed the environmental management needs of the fishing ports and marinas located in small municipalities, through EMS standard implementation based on EMAS requirements and ISO 14001 standards.

The project's results included, among others, the establishment of an indicators' system that renders real time information about the environmental situation at the port-city interface and the results of the corrective measures applied. The SIMPYC project provided a reference guide for environmental improvement in fishing ports and marinas and aimed to be distributed to other ports in Spain and at an EU level. With respect to the project's dissemination, the VPA's Environmental Bulletin, published three times a year since 2000, was a source of environmental news after the project's completion. These publications devoted a section on port-city relations with relevant environmental issues.

Fig. 3.1: VALENCIA PORT-CITY INTERFACE

 **Different neighborhoods and users of the port area affected.**	• After the project's diagnosis, particles PM10 is the most significant environmental aspect of the port originated by dust during the load and unload of goods (clinker and coal). • The water quality of Valencia has reached a bath quality water qualification in the nearest beaches.

Source: Torres-Monfront, 2008

The SIMPYC project produced a port-city interface Environmental Action plan and a model for a port-city coordination instrument. The proposed model introduced: 1) a conception of a "consortium" instrument to be implemented; and 2) coordination tools such as: working groups, data interchange procedures, etc. (Torres-Monfront, 2008). The project emphasized that coordination is a *must*.

In implementing its fourth strategic development axes the VPA, incorporated the suggested projects in its port-city management scheme.

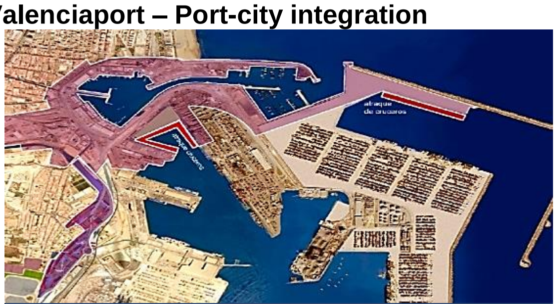
Port-City integration major sporting events:

An urban plan was implemented for the management of the space used to host these events.

Fig. 3.2 Social development in Valenciaport – Port-city integration

Marina Juan Carlos I:

1.1mil. m^2 open to yachting and public use.



Source: Aznar, 2008

The Valencia Consortium 2007 Governing Board (CV07), based on the consensus reached between the different authorities involved, and the VPA, launched an international ideas competition to put forward a plan for the usage of the port and of the municipal spaces in order to achieve a reused waterfront. Since Valencia was selected as the host city of the 32nd America's Cup, the Valencia Consortium 2007 used the sailing event as the main task in reshaping the port-city waterfront. The result of this reorganization was that new infrastructure was built and new water sports facilities were established for public use. Nowadays, the Juan Carlos I Marina is a port site with places for people to meet and it has recreational areas which aim to host cultural, business, sporting and leisure events. In 2007, the Valencia America's Cup, attracted large audiences from all over the world. In the same line, in 2006 an agreement between VPA and Gandia Town- Council opened the way for the re-development of the Port of Gandia, from a business, people, sailing, sport and fishing perspective.

In 2010, VPA participated in the "**People Around Ports**" survey, led by the Port of Rotterdam with the support of the European Sea Ports Organisation (ESPO). The project included fifteen different ports exchanging experiences about how to bring ports and their surrounding areas into closer contact and promote these areas as attractive working environments (VPA Annual Report 2010).

The ‘Valencia practices’ that were put forward were used by the ESPO as case studies to illustrate and draw up the “Code of Practice on Societal Integration of Ports” published in July 2010.

The **SECURMED Project** (An Interregional and Transnational View of Maritime Security and Environmental Protection in the Western Mediterranean) (2004-2007) was financed by the EU Interreg IIIB programme. The main task was to study port security systems that had been implemented in the regions taking part, and to share experiences in order to guarantee adequate environmental management of port environments.

The **Elefsina Bay 2020** Project (2007-2008) was funded by the EU Life programme. The project supported SD and EMS implementation in ports located in Elefsina Bay (GR). The main actions of the project were to reduce pollution and the risk of maritime accidents involving dangerous goods, and to integrate ports and cities into areas of archaeological interest by creating pedestrian zones.
VPA consulted and supported EMS implementation, based on the experience gained through the Ecoport model and knowledge obtained from various environmental projects at a national and international level. Apart from the Valencia Port Authority, project partners included: Elefsina Port Authority, Elefsina City Council, Aspropyrgos City Council, Ditiki Attiki City Council, the University of Athens, the Foundation for Port Studies and Cooperation (FEPORTS), Mediterranean SOS Network, HELLENIC Ship Yards and TITAN Cements.

The **MADAMA Project** (2005-2008) was also financed by the EU Interreg IIIB programme with the main aim to understand, define and harmonise all actions related to monitoring and protecting the hazardous goods chain in the Mediterranean. The project actually studied different systems that control and monitor hazardous goods passing through the Mediterranean and apart from the Valencia Port Authority, it involved the participation of the Regional Department of Public Works and Transport of the Balearic Islands, the Aristotle University of Thessaloniki and the regions of Tuscany, Emilia Romagna, Provence- Alpes-Côte d’Azur, and Crete.

EUROPHAR EEIG (participation). VPA as a member of the EUROPHAR European Economic Interest Group since 1997, was also involved in several further proposals for green EU programmes. The EUROPHAR Group members includes the PAs of Marseilles and Genoa, as well as other Spanish, French and Italian companies and organisations which promote safety and environmental protection in ports. In 2010 EUROPHAR promoted two projects: 1) the AQUAPORT project entitled “A New Approach on Water Quality Control and Monitoring in Port Areas”, and 2) the PASCAL project on “Early Detection of Biological Agents through Sensor Network and Sensor Fusion.”
Since 2007, the Valenciaport has taken part in the EU Economic Interest Group **EUROPHAR** involving in a range of projects such as: **AQUAPORT** (New Approach on Water Quality Control and Monitoring in Port Areas), **PASCAL** (Early Detection of Biological Agents through Sensor Network and Sensor Fusion), and **SUPORT** (Security Upgrade for Ports).

3.4 VPA’s CORPORATE SOCIAL RESPONSIBILITY (CSR)

The VPAs 2015 Strategic Plan aims to *encourage* international competitiveness in economic and social affairs (within its area of influence) by means of competitive prices and infrastructure quality, which is *“in line with EU transport policy and social requirements*” (Aznar, 2008).
VPA’s strategy promotes integration of **environmental actions** and **Corporate Social Responsibility** (**CSR**) as one of its four axes. The PA “*is committed to integrating Social Responsibility into its everyday activities aiming to establish a balance between commercial growth and sustainability*” (VPA Annual Report, 2010). Environmental considerations are important elements in the VPA’s corporate strategy. Thus, “*social considerations or the interests of all parties concerned to be taken on board as essential, without ignoring current environmental legislation*” (Aznar, 2008).
In this strategic axis development, the port has incorporated the *stakeholder involvement*. VPA identified three major groups of concern which in turn include other stakeholders: 1) internal group:

the PA's own staff; 2) port community: customers, public inspection bodies, companies and industry associations, both at home and abroad; 3) citizens: society as a whole, public authorities, the media, etc., (VPA Annual Report, 2010). The PA has maintained over the years a constant and responsible relationship with most of its corresponded stakeholders through a wide range of formal and informal channels including working meetings, information sessions, conferences, seminars, forums and other events. There were also communication channels within the organization, such as the VPA's staff's Intranet.

The VPA's Strategic Plan adopted in 2002, was guided by the consistent main philosophy of moving on towards becoming a clear example of an advanced landlord, (Ferrer & Giner, 2010). Over the last decade, the Valencia PA has worked to this direction and has proven its position as leader of the Valenciaport cluster, designing a business model shared with the port community. This business model acknowledged the different interests of all stakeholders in the VPA cluster port and logistics centre and advanced the deployment of strategic actions.

VPA's strategic actions called for and strongly supported synergies in the whole cluster port, in order to improve the quality and efficiency of the port services, investing in improving the inter-operability of infrastructures and services linking the (3) ports of Valencia, Sagunto, and Gandia to its regional hinterland, whilst preserving the environment and working towards better port-city integration.

3.5 Eco-efficiency and Climate Change Mitigation in Valenciaport

VPA's Eco-efficiency initiatives have organized in order to fulfil the PA's Environmental Management System and *to "add more value to (port) services through environmental and economically efficient procedures which would consume less row materials, reduce waste and generate increasingly less pollution"* (Torres-Monfort, 2010).

The port worked in parallel different kind of projects to create specific emission reduction targets for various actions. In general, the VPAs total Ecoefficiency Action Plan has analysed the following aspects presented in the table 3.5.

Table 3.5: VPA's Ecoefficiency Action Plan

aspects	Eco-efficiency Action Plan
electric energy consumption	Eco-efficiency VPA's Building Assessment: Characterization of consumption Qualification energy of buildings Identification of potential savings energy, economic, Environmental and technical feasibility. Public area lighting – Eco-efficiency Assessment Cold-Heating Control System and Facility
resource consumption	Fresh water consumption plan Paper consumption (base year 2008) Fuel consumption (base year 2008)
renewable energy	Promotion of renewable energy: • Evaluation for installation of wind generators – assessment of the landscape impact • VPA's fleet replacement by hybrid vehicles • Evaluation of the possibility of power supply to ships in port – cooperation with ship-owners
sustainable mobility	VPA's Plan for sustainable mobility (PMS) - Action Plan: • management of strategic mobility generated by the port • promotion of the use of public transport, of mobility in bicycle and movements on foot • promotion of the rational use of the motor vehicle (light and heavy) • educations of the port community in the field of mobility
port facilities efficiency	Various R&D projects: EFICONT project; ECO-LOGISTYPORT project. E4Port project, GREENCRANES project; GREENBERTH project
Green House Gas Emissions	CLIMEPORT project Mediterranean ports; contribution to climate change mitigation

Table 3.6: Port facilities efficiency various R&D projects

Year	Project	Subject
2009 - 2010	EfiCont	**Energy efficiency at Container Terminals**
2010 - 2014	**E4Port**	**Energy Management System implementation at EU port facilities**

The **EFICONT Project**, Energy Efficiency in Container Terminals (2009-2010) was a national R&D project, aimed to improve energy efficiency in container terminals through an in-depth analysis as well as through the indicators' identification to enhance energy and environmental efficiency in their operations. The project was in line with the objectives of the National Strategic Plan for Infrastructure and Transport (PEIT) and the Ministry of Public Works.
Throughout the project, the VPA participated in meetings in order to monitor progress related to the tasks as well as to the objectives' fulfilment, and it finally drew up a report on potential action plans for the improvement of energy efficiency in its activities.

- **Climate Change Mitigation**

In 2009, triggered by the need to fight against the GHG emissions on port facilities, VPA together with five other European seaports initiated a **CO2 FOOTPRINT CALCULATOR** project (2009-2012).

2009 - 2012	climeport	**GHG emissions assessment.** **Carbon-footprint reduction Action Plan in EU Med ports**

Since 2009, the **CLIMEPORT Project** (2009-2012) has been the Mediterranean ports' contribution to climate change mitigation, -funded by the EU's MED Programme. The MED Programme (2007-2013) promotes EU transnational cooperation between enterprises and institutions of the northern coast of the Mediterranean financing projects in priority areas within this geographical area.
The Valenciaport leads the ports of Algeciras, Marseilles (F), Leghorn (I), Koper (SL) and Piraeus (GR) in this project which aims to analyse the potential for the greenhouse gas emissions' (GHG)reduction by evaluating the impact and influence of port area activities on climate change so as to increase the quality of life in cities adjacent to ports. The project has introduced "best practices" which reduce the environmental impact, aiming to develop solutions that improve the climatic conditions by means of actions in maritime and inland transport, through energy saving and efficiency as well as by implementing the world port climate declarations. Thus, it has also initiated carbon footprint calculations.
The project developed a methodology to obtain an accurate estimation of a port carbon footprint, taking a comprehensive inventory of GHG emissions as the starting point. This system allows monitoring Energy and Climate Change Mitigation which is considered to play a relevant role in ports as well and it indicates the way to present results in a comprehensive manner.
The method is classified into 4 levels: level 1 (the port as a whole), level 2 (port activities), level 3 (services and processes) and level 4 (port equipment and machinery). This way of classifying the information collected by the participating ports, has allowed us to know the main impacts of ports as well as to implement measures and solutions in those operations with greater impact (Company, 2012). The project's proposed indicator (tons of CO2 equivalent per ton of cargo handled) is considered as a key element in tracking and controlling the measures to be implemented in terms of reducing GHGs.
The CLIMEPORT project also aimed to produce an on-line tool called ECOABACUS (at a validation stage). ECOABACUS was designed to facilitate the calculation of the ports' carbon footprint, that could be used to control energy consumptions.

4.0 EMS IMPLEMENTATION & CERTIFICATION IN VALENCIAPORT

4.1 Environmental Management System (EMS) in VPA

The EU/LIFE programme was instrumental and of vital importance to the VPA's introduction of environmental management systems (EMS), particularly the Eco-Management and Audit Scheme (EMAS). The VPA's ECOPORT project established a methodology to simplify the subsequent implementation of an environmental management system. The port considered that EMAS provided the framework and the structures which could promote environmental protection in its port community.

Since 1998, the VPA's staff has been assigned with exclusive responsibilities in the field of environmental protection. Defining the project's scope was the main difficulty at the beginning, while infrastructural and technical limitations had to be improved. Moreover, gaps of knowledge regarding environmental management were identified. Thus, the collection of data was a major obstacle; the staff did not act as cooperative as preferred because they did not feel involved in the implementation process and the top management had to be convinced (according to EMAS) to make the environmental policy and statement publicly available (VPA ECOPORT-News, 2000).

The ECOPORT model provided a detailed, step by step, methodology for implementing EMS in a port organization, backed by detailed managerial tools and implementation guidelines. This followed key stages: 1) firstly a voluntary adherence to the environmental commitment, embodied in framework structure; 2) an initial diagnosis of the effects of the company's activities on the environment; 3) an environmental plan and draft documentary support (manual, procedures and technical instructions); 4) assessment and annual monitoring, aiming at continuous improvement. The final phase suggests the issuing of an Environmental Statement based on the requirements and recommendations of the EMAS Regulation 1836/93.

As the project involved various companies from the VPA's port community the ECOPORT model suggested a series of basic criteria to make up Environmental Statements. The latter aimed to be used as a reference by companies and organisations located in the cluster port that choose to be certified under the EMAS standard. VPA strongly encouraged its port community members to joint efforts towards greening, aiming at the collaboration of all concerned. Thus, the ECOPORT model indicated its main objectives forming VPA's initial Environmental Statements (box 4.1).

Box 4.1: VPA's Environmental Commitment

- Go beyond legal compliance related to significant environmental aspects associated with port activities as far as it is technically and economically viable.
- Prevent and minimise pollution that port activities may produce.
- Establish appropriate environmental port objectives.
- Encourage respect for natural resources and their rational use.
- Promote public participation, training and communication in environmental issues within the Port Community.
- Introduce environmental management into the management systems of companies operating in the ports. Encourage vessels using facilities and services to take part in the environmentally friendlier maritime transport management.

Source: Orejas & Torres-Monfront, 2001

The VPA's Board of Directors approved the port's first **Environmental Policy** in 2000, which was modified in 2006. The Policy detailed environmental principles on a general level and those required for improving the port area. These in turn, determined the different actions to be taken by the port in the form of environmental actions and/or initiatives.

Since the ECOPORT model initiation, the VPA has participated in several projects: internal projects to improve environmental aspects, as well as collaborative R&D ones, which aim at seeking solutions for its cluster port related environmental problems or addressing its greening commitment as reflected in the port's Environmental Policy. For the VPA's people its EMS *"constitutes the best tool for preventing possible pollution episodes in the interest of SD"*, (VPA Annual Environmental Report, 2006) (see table 4.1).

Table 4.1: VPA's Environmental Policy implementation Good Practices

	POLICY ACTION LINES	VPA good practice
1	Environmental Management Development	ECOPORT I AND II
2	Integration of Environmental Considerations into the Planning , Organization, Management and Conservation of the public area	Environmental Integration of Port Expansion
3	The Systematic and periodic Analysis and Evaluation of the company's activities, products and services that can interact with the environment	• Environmental Monitoring Network • Carbon Footprint Calculation
4	The Rationalization of natural Resources / Energy	Energy Efficiency System EFICONT
5	Compliance with relevant legal requirement Trying, to go further than just the strict compliance of rules	ECOPORT-LEX
6	Prevention or Reduction of emissions, Waste, Noise, or general Waste arising from port activity	Emergency Control Center
7	Use and encouraging the use of the best technologies that are available and viable in each activity	Cooperation European projects
8	Providing adequate training and awareness to personnel to help implement the Policy	ECOLOGISTYCPORT

Source: own elaboration

The initiative was strongly supported by another LIFE project, the INDAPORT project (2002–2004). After the initial VPA's EMS implementation, the establishment of environmental performance control mechanisms was recognized as necessary, with the scope to determine the status and changes of the port environment. Thus, it was made clear that the establishment of a *system of indicators*, in order to implement the port's EM, was critical (Peris-Mora, et.al., 2005).

The INDAPORT project (see pp:25) was carried out by using VPA as a base, intending -*afterwards*- to be extended to other Spanish and European ports. The project produced a total of 17 pressure /state indicators, chosen for the VPA's environmental policy implementation, some of which were multi-dimensional, (Peris-Mora, et.al., 2005). The indicators took account of a series of parameters, including emission sources, noise levels, etc. VPA used the project's results "to get the most accurate possible knowledge of the state and evolution of its ports", (Salina, 2008).

VPA has enhanced its EMS with a *real-time monitoring system* of different environmental aspects. Ever since the HADA project (2002-2005), the PA has set up a Noise and Air Pollution Control System and it has been controlling air quality and noise levels in the total cluster port, by means of monitorizing and modelling. Thus, through its system of meteorological stations it monitors air quality parameters (NO, SO, CO_2, and PM10 levels), uses the CITRIX server in its noise control network and its water quality control, monitors hydrology, microbiology, plankton and benthic communities inside the port area (within a year cycle). VPA has long been focused on environmental integration, integrating its EM into its energy management (see table 4.2). Since 2008, a specialised centre has controlled and monitored the consumption of energy and water.

Table 4.2: Monitoring Networks and systems integration

emissions	Environmental Integration (EMS) : Air Quality Network – Meteorological Instrumentation Plan Water Quality Control Network Noise Quality Control Network
Eco-efficiency	Environmental Integration (EMS) : Network to Monitor Electricity Consumption

Source: own elaboration

Since 1998, the port has continued to maintain a solid commitment to integrate environmental management with port activities. Carrying out various environmental projects using different local, national and European funds and partner networks, allowed its own activities and processes to be improved from an environmental management perspective. In this respect, and based on almost 15 years of efforts, the VPA's EMS integration benefits the port management to: 1) obtain information measures in real time; 2) to take decisions prior to environmental problems; 3) respond instantly; 4) to comply with Environmental Legislation (European and National); as well as to 5) know the efficiency of plan actions implemented (Torres, 2008).

- **VPA'S EMS PERS - ISO 14001 - EMAS certified**

VPA initiated its EMS according to the ECOPORT model in 2000. Although, it considered as more valuable and *"more global solutions"* (Salina, 2008), the ISO14001 and EMAS standards and PERS, SDM (ESPO/EPF tools) of equally significance and use, it pursued accreditation and verification of its EMS with all possible alternatives.

In 2003, the VPA was the first Spanish PA to be awarded with the PERS standard certification the ESPO/EPF supported environmental certification exclusively aiming at the port industry- and in December 2006, when it received PERS re-certification, it was the sixth of the (24) EU ports already certified.
In 2005, the VPA implemented procedures and technical instructions, based on ISO 14001, and in response to the commitments undertaken in the Environmental Policy, it was certified according to ISO 14001/2004 in 2006. In April 2007, it obtained validation and verification of its environmental declaration based on Regulation (EC No. 761/20010). In January 2008 Valenciaport received EMAS registration with special focus on the management and infrastructure services in the ports of Sagunto, Valencia and Gandia. VPA was the first Spanish, and the second European PA to obtain EMAS certification. Since then, Valenciaport has continued to develop its own Environmental Management System, while in 2008 it received the Eco-Excellence Award.

- VPA's green strategy deemed essential to achieve environmental improvements at the Valenciaport with other two key tools which included: 1) on-going environmental training for the PA's staff and its port community, and 2) regular reporting.

  - **Reporting**

The Valenciaport was very aware of the important role that environmental information plays in a green strategy communication. The port was proactive in its approach to <u>external communication</u>, maintaining a good relationship with the media, issuing publications, holding seminars, giving presentations, organising courses etc., all of which are aimed at increasing the amount of information on environmental matters available to the public.
The initiation of EMS implementation encouraged the port to produce periodic reports containing a description of its environmental activities. The first issue of the VPA's <u>Environmental Report</u> was published in 2001 with the aim to provide information on the environmental commitment of the ports of Sagunto, Valencia and Gandía, and detailed information about VPA's environmental programmes.
The main body of the report was divided into six principal areas within which detailed information, on environmental issues (the majority of which have been quantified) related to each of the VPA's activities, was presented, including: 1) air quality control, 2) waste control, 3) quality of port waters, 4) considerations in emergency situations, 5) consumption of natural resources, and other activities.
Through the years, VPA maintained a direct relationship with organisations, customers, and other stakeholders interested in the port's environmental activities and published annual Environmental Reports.
In 2005-2006, VPA sustained a collaboration agreement with the Port Institute for Studies and Cooperation (FEPORTS) for carrying out projects such as '*Communication of Environmental Actions of the Port Authority of Valencia and Maintaining the ISO 14001- implementation in the Port of Valencia and its application to the ports of Sagunto and Gandia'*. The aim of this agreement was to produce the Annual Environmental Report, environmental newsletters, good practice guides, website updating, the information and communication plan of the port on the implementation of ISO 14001, and progress reports on the results obtained from the aforementioned implementation.
Since 2007, the Environmental Impact Statement, which is validated by an independent auditor in compliance with EMAS standards, has been included in the annual report, while an Environmental

Newsletter with national and international circulation, is published every four months. Most of them include: 1) a review of environmental issues, 2) a contribution to the port industry from a specialist in environmental topics, 3) news in brief related to environmental issues in ports 4) legislation update and agenda.

- Of particular importance for the port's dissemination activities were also publications of various subjects: (**Aznar, 2008; VPA Environmental Reports, 2002-2010**; see box 4.2):

Box 4.2: VPA's Environmental Reports – Publication on environmental issues

- **Good Practice Environmental Guides**:
  Good Practice Environmental Guide for Offices, Workshops, Haulage and Bulk Goods (2002)
  Guide for Good Environmental Practice in Ports: Road Transport (2004)
  Good Environmental Practice in Ports: Handling and Storing Bulk (2005)
  Good Practice Guide in Ports: Offices and Workshops (2006)
- ECOPORTS Conference Proceedings Books, 2000 and 2003
- **Annual Environmental Reports 2001-ownward**
- **Guide for the Implementation of Eco-Management Systems in Port Facilities**
- Environmental Newsletters (every 4 months)
- Guide to Birdlife in the Port of Valencia
- Guide to Flora and Fauna in the Port of Valencia
- Leaflet on Environmental Initiatives in the Port Authority of Valencia
- Leaflet on the Reception and Handling of Vessel-generated Waste in ports under the jurisdiction of the Port Authority of Valencia
- Informative posters on waste management in offices and workshops

Source : Aznar, 2008 ; VPA Environmental Reports, 2002-2010

In 2006, VPA published a 'Guide for the Implementation of Eco-Management Systems in Port Facilities', on lessons learned throughout the ECOPORT Project 'Towards an eco-friendly port community'. The guide addressed environmental issues in ports managed by the VPA through designing a methodology for implementing Eco-Management Systems of facilities located in its cluster port. The Guide provides a consultation tool to those responsible for this type of system in the ports of Spain and Europe. It introduced the environmental problems generated by each port activity and suggested documents that must be drawn up for this type of eco-management system.

Particular importance was given to communicating the management's environmental plans to all company staff and members of the port community. Internal environmental communication was a key tool of EMS development -as it intended to be both interactive and bidirectional-, which provided an opportunity for discussion and consideration of the different proposals and suggestions.

Furthermore, VPA has communicated its actions, capabilities and accomplishments on its website (at www.valenciaport.com), and has actively taken part in experience exchange programmes by participating in working groups, conferences, forums as well as in national and international workshops focusing on different port environmental issues.

- **Training**

VPA has regarded *environmental training*, for its own staff and all members of its port community, as a strategic approach towards creating port personnel increasingly conscious of the port's environmental implications. As a result, permanent training systems and awareness courses were established on an annual basis.

Of premium value were the training courses organised in VPA's facilities -as part of the ISO 14001 and Ecoport II implementation project-, based on carrying out of its ECOPORT model in the port companies. In 2005, during the ISO 14001 implementation, the port developed an environmental training plan which allowed all employees to identify their environmental problems and how to best minimise and control them (VPA Environmental Report, 2006).During the time period of 2003-2005, the staff training in the VPA's Emergency Control Centre focused on two basic approaches: 1) actions to upgrade staff performance in the Emergency Control Centre; and 2) carrying out exercises and emergency drills. Both these aspects were clearly linked to each other, while VPA considered drills as an extremely useful training tool for the Emergency Control Centre.

In 2005 with the EU ECOPORTS project completion, VPA -which was responsible to develop a Guide for the EMS Implementation of port facilities and port communities- organised several workshops in collaboration with: Associated British Ports (ABP), Civitavecchia PA, Livorno PA, Marseilles PA, Tenerife PA and Rinfuse Terminal (Port of Genova). The workshops allowed the Guide's dissemination, while important feedback was provided by suggestions of the participants (VPA Environmental Report, 2005)

Training on environmental protection and resource optimization were implemented since energy efficiency was integrated in the port's EMS. In 2009 VPA's Chief Executive Officer, Mr. Ferrer, highlighted the contribution of R&D (particularly the Ecologistyport project) towards improving skills and qualifications of different port companies' staff in order to implement EMS and energy efficiency systems as much as the value of the "Ecoport Guide in Implementing an Environmental Management System by Stages in Port Facilities" (VPA, Newsletter No59, 2009).

VPA's green training experience was disseminated outside Europe as well. The most profound case was the following: In September 2005, VPA, the Grupo Alatec and the Valenciaport Foundation were awarded an 11-month contract for 'Improving Environmental Management in Ports of the Gulf of Honduras', which borders with the countries of Belize, Guatemala, and Honduras. The objective of the consultancy service was to improve eco-management in the regional port network consisting of five ports in the Gulf of Honduras by assessing environmental risk, preparing investment plans and identifying, designing and supervising pilot projects. Technical assistance was also focused on the pollution prevention of port operations, as well as emergencies in the five ports. Furthermore, in 2009, VPA launched an environmental legislation data base. This port environmental legislation system is called Ecoport-Lex (see section 3.2, p:23). The data base is offering a consultancy service on environmental legislation to the port community companies of the ports of Sagunto, Valencia and Gandia.

4.2 VPA's competitiveness and innovation

Since 1988 VPA launched the **Valencia Port environmental protection program** aiming to implement EMS in the ports managed by the PA and making major steps towards greening.

Table 4.3: 1985 – 2000 Environmental Program: from reactive position to a proactive approach

Year	Key Actions
1988 - 1989	EIA done & EID granted for Valencia Port South extension.
1990 - 2000	Environmental Surveillance Plan during construction works implemented.
1990 - 1994	Contingency Plan for passage of Dangerous Goods developed.
1994	Emergency Control Center established. Firefighting Network implemented. MARPOL wastes Collection encouraged. Storage and Treatment Center established. Selective Collection of some Solid Wastes starts.
1998 - 2001	ECOPORT model for EMS implementation in ports.

Source: own elaboration

The PA has preordained both financial and human resources to develop its self-constructed ECOPORT model on EMS implementation in the port communities. During the model's progressive elaboration, R&D was initiated. Thus, R&D initiation was one of the keys to successfully implement responsible environmental policies. Innovation has been one of the key values of the VPA's 2020 strategic plan. The main R&D lines -regarding the port's greening- have been concentrated on sustainability, energy and port-city integration. A strong indication of the PA's management commitment to foster innovation is the setting up of the Valenciaport Foundation (see section 1.4, p:13). The port improved its environmental knowledge, by taking part in both cooperation and innovation projects and through collaboration and experience exchange at both national and European level. A notable point is that the VPA has made extensive use of funds from various EU & Spanish programs in order to conduct cooperative R&D projects to implement best practices, which in turn resulted into a fully-fledged and integrated EMS implementation. VPA focused on practicing environmental management in its cluster port based on environmental rather technical standards. It managed to rationalize different port environmental initiatives and their common information requirements into an integrated environmental management program. Audits, reports and even its EMS, have been considered as tools that form the elements of this program (VPA, 2002)

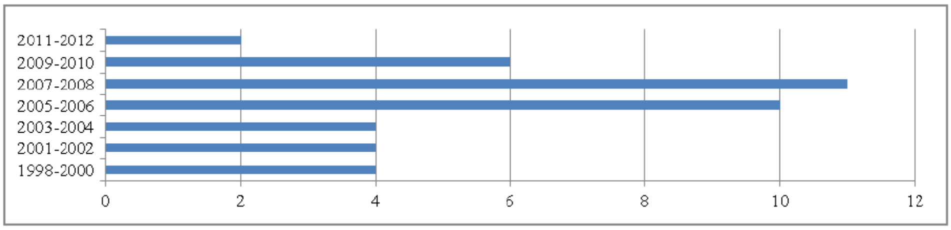
Table 4.4: 2000 – 2010 Environmental Program: towards Environmental Sustainability

Year	Key Actions
2000-2008	**Environmental Policy adopted**. (Revised in 2006) - AIVP Charter for sustainable development of Port Cities (2006) - World Ports declaration for a better climate (2008)
2001-2010	**Plans & programs to assess, prevent, control and correct Environmental Effects using best available technology.** **-** Water, Air & Noise control networks. Hydrocarbon pollution control - Solid Waste segregation facility (2005) - Integrated Monitoring & Control Center (2008)
2001-2010	**Efficient use of resources & energy.** - Water, paper, green areas, mobility, fuels, electricity - Carbon footprint (2009) - Eco-efficiency & GHG emissions abatement plan (2009/2010)
2001-2010	**Awareness & Training.** - Web page, intranet & numerous seminars, workshops & courses **Communication to society.** - Numerous Conference lectures & more than 70 documents published - Annual Environmental reports since 2001
2001-2010	**ECOPORT EMS implementation in Port Community.** - VPA EMS certified: PERS (2003), ISO 14.001 (2006), EMAS (2007) - 42 companies engaged; 22 certified ISO 14.001 up to 2011

Source: own elaboration

The PA's management has considered **environmental management** (EM) as among the port's competitiveness advantages, as well as port-city integration and environmental training (Sapina, 2008).

Fig. 4.1: VPA's participation in R&D that enhanced its Environmental Policy
Temporal comparison graph



Source: Borriello, 2013.

Since its Environmental Policy initiation in 2000, VPA has progressively enhanced its EMS implementation through knowledge transfer by taking part in various R&D projects. "The biennium 2007-2008 was the most profitable period" (see fig.4.1), (Borriello, 2013). Most of these projects were in collaboration with other Spanish or Mediterranean ports.

4.3 VPA's ECOPORT model of EMAS

Since the late 1990's, it has been increasingly urgent for the EU ports to develop detailed environmental management strategies. The Environmental Management System (EMAS) -promoted by the CEE regulation 1836/93 which allowed industrial companies to implement EM and audit on a voluntary basis- offered one of the most useful tools. The main attraction of the system was that, whilst it remained a voluntary code, it provided a systematic, objective and well-documented evaluation of the management function, compatible with other EMSs and regulated at a European level (ECOPORT/LIFE programme, 2001). Based on continuous improvement, it provided a strong tool for the development of an integrated-knowledge management system, addressing all kinds of port operations.

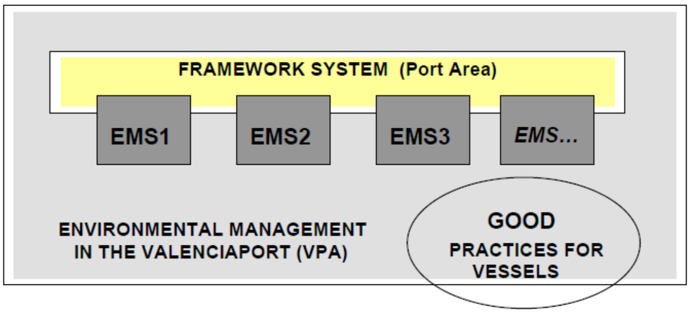
VPA considered that EMAS registration was the best tool to prevent or reduce the possibility of pollution and that EMAS provided the framework and structures to improve the motivation of the port's staff and the organisation of the company with better internal and external communication, staff training and greater involvement of the top management (EU/EMAS case studies, 2008).

Back in 2001, the ECOPORT Project of the Valenciaport facilitated a methodology for EMS implementation to be drawn up along with the design and actual implementation of an EMS Model that can be applied to port facilities. Thus, the ECOPORT Model of port Environmental Management System (EMS) was based on two wide areas of action: 1) the *Model Structure* and 2) the *Framework Structure*.

VPA - ECOPORT Model of EMS	
Model Structure	**Framework Structure**
1ST AREA OF ACTION companies and organizations which, having joined the VPA - ECOPORT Model, participate therein and subject themselves voluntarily to the rules and monitoring systems of the Model.	2ND AREA OF ACTION the overall structure that would allow the environmental management of the port area including different members of the Port Community.

Source: Orejas & Torres-Monfront, 2001

The ECOPORT Model Structure ensures the same rules of the game for all participants and provides the same systems for drafting procedures and instructions; it also safeguards the use of the same indicators to value the system's suitability. The Framework structure allows the port area to be (environmentally) managed as a whole.



Source: Orejas & Torres-Monfront, 2001

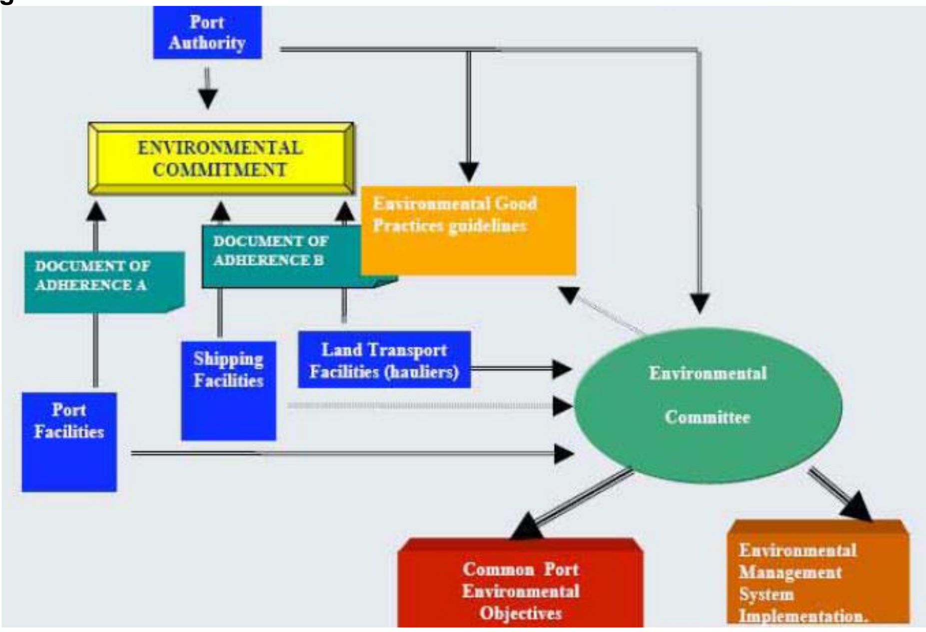
The graph gives an outline of the connection between the framework Structure and each of the EMS developed in each participating company according to the Model Structure. A mention should be made here to the connection of the ECOPORT Model with the vessels moored in the port as this is included in the Framework Structure.

Thus, the ECOPORT model of EMAS united two levels of action. Firstly, it created -on an individual basis- a model structure, in which companies and organizations participated and voluntarily agreed to abide by the model's rules and monitoring systems. Secondly, it provided an umbrella framework for the development of an overall environmental management strategy for the whole port area, including different port community companies.

The VPA's ECOPORT **Model structure** provides a detailed, step-by-step, methodology for port EMS implementation. After the key stage of a voluntary adherence to the port's environmental commitment -which embodies a port company in the framework structure-, an initial diagnosis of the effects of the company's activities on the environment follows. Next, the company develops an environmental plan and draft documentary support (manual, procedures and technical instructions), which is then tested out on a trial basis before being fully implemented. The circle is completed by the Audit and Monitoring stage. In the project, this was called Assessment and Annual Monitoring, and aimed to associate the companies with the improvement process continuation through suggestions for change. A key-point within the project was a company's Environmental Statement. Although this was optional in the project, recommendations were offered as a reference for the companies, based on the requirements and recommendations of Regulation 1836/93. The **Framework Structure** aims to provide a joint image for the port area and establish similar environmental standards for often competing companies. It encourages them to make use of economies of scale by developing joint approaches. This "Environmental Code of Conduct" involves a declaration of Environmental Commitment from the port, the drawing up of an Environmental plan with a common auditing element, a set of general standards and guides as well as the development of an environmental management structure.

The Valenciaport ECOPORT Project is the first European case of the EMAS introduction in port communities and as such, an innovative step in terms of port management. Since this initiative, the VPA has been convinced of the importance for such a complex organization as the *Port Community* having a common umbrella which provides advantages like: 1) offering a joint image to the surrounding port area; 2) establishing similar standards in companies which often compete within the port; and 3) making use of the advantages of economies of scale and synergies created when similar companies face similar problems jointly (Orejas & Torres-Monfront, 2001).

Fig. 4.2 VPA's ECOPORT Model for Port Areas – Port environmental structure



Source: Sapina, 2008

The VPA experience, concerning both ECOPORT Projects, confirmed that the effective implementation of the framework system requires a period of maturity, and that the participating companies need time to adapt to the requirements of environmental management. Therefore, a slow adaptation ought to be secured, so that companies starting out from a less advanced situation may follow the guidelines provided by this structure (Orejas & Torres-Monfront, 2001). The ECOPORT II project concluded to EMS Guidelines for a port area model introducing the framework structure (see fig.4.2) and specifying a 5-levels approach towards the port company EMS implementation. The project provided a detailed description of minimum requirements on how to complete each stage of each level, (Sapina, 2008). The general objectives of the ECOPORT project aimed at *"providing the companies involved in port management with tools which have allowed them to systematically, objectively and periodically evaluate their performance"* (Sapina, 2008).

Table 4.5: VPA's ECOPORT EMS Model – Assessment program

	Assessing	Proposing
Annual Monitoring of the implemented EMSs	Extent of compliance and success of the environmental objectives, as well as an analysis of the causes and results of the deviations detected	Actions necessary to correct them
	"Center's" legal compliance	Legislative requirements in the local Spanish Autonomous Community, national and EU legislation and international standards in the port sector.
	Effective EMS implementation, taking into account aspects such as policy compliance.	Effective implementation of procedures and technical instructions and, if necessary, the fulfillment of auditing and environmental declaration times and requirements.
	Extent of the match to the ECOPORT Model	

The project's dissemination focused on the local, regional, national and EU level, involving raising awareness of environmental problems in the port industry, publicizing the advantages of EMAS systems implementation in a port context, as well as disseminating and transferring the results of the project, particularly in the Mediterranean Region. On the training front, a series of seminars and short training courses were used to raise the key issues and publish results. This included regular project news bulletin, brochures and leaflets and the publication of key EMAS tools: A Guide on Environmental considerations for port companies and organizations. Finally, the ECOPORT conference in Valencia 2000 and 2003 succeeded in bringing together delegates from a large number of EU ports. The VPA's ECOPORT Model, enables port community objectives to be unified with regard to enhancing environmental behaviour in the port area. Although, the project promotes the idea of a port "supra-system" that monitors the gaps arising from the simple environmental control of each company in the port area, it also recognizes each port's unique management and culture. Consequently, "this is why the ideas conceived in the Port of Valencia cannot simply be transferred, this type of system has to be made to measure" (Orejas & Torres-Monfront, 2001).

5.0 CONCLUSIONS

In Spain, 59% of all exports and 82% of imports are transported by sea. This represents 53% of Spanish foreign trade with the European Union and 96% of Spanish foreign trade with other countries (VPA Annual Report, 2010). A highly dynamic actor among the actors in the national port system, is the *Valenciaport* (VPA), which manages a cluster port involving the ports of Valencia, Sagunto and Gandia. The port faced a significant traffic growth particularly in its Container Terminal that positioned it as the largest port in the Mediterranean area and the fifth largest port in Europe in 2010 (ESPO, 2011).
The business growth, although it was a positive outcome, produced environmental pollution. The main environmental impacts in Valenciaport, were aspects related to waste, spillages and emissions. The PA carried out different actions to monitor emissions and control parameters affecting the quality of the environment in all three port areas that it managed and focused its efforts on improving water, air, and noise quality, and adequately managed waste, making the best use of natural resources. Through the years, these actions were progressively triggered, by updates in legislative obligations at a national and European level, but they were also strongly enhanced by the following fact: *the port voluntarily opted to broaden its environmental commitments by continually incorporating new challenges*.The VPA's Strategic Plan, adopted in 2002, firmly laid the foundations for Valenciaport to become a well-developed example of an advanced landlord model committed to sustainability. Since 2000 the PA's environmental perspective also aimed to improve the activities of companies in the Valencia port community towards greening. The port's ECOPORT I project (1998-2001) initiation, aiming to meet European policy requirements in relation to sustainable transport development and environmental respect (Torres-Monfront, 2003), it introduced the ambitious objective of EMS implementation in its port community. This individual green proactive scope constituted a major effort in finding new ways to reconcile port activity with environmental protection. The ECOPORT I project was the beginning of series R&D initiatives which gave the green light for its own environmental management processes to be improved. It enabled the VPA, not only to gradually raise the awareness of its employees about the importance of environmental protection, but also to implement green measures and to facilitate on-going improvements by establishing criteria to prevent environmental problems (VPA Environmental Report, 2008). Valenciaport took on the challenge of creating a cleaner and safer port environment by making a joint commitment with the companies which form part of the port community. The project's training phase provided specific materials and courses to the port context and created a team of experts in the field. The main achievement was that, thanks to the circulation of the ECOPORT I project results, VPA managed to create an "ECOPORT spirit" in the port community of Valencia. The project's impact was considered positive, not only for the companies within the Valencia port community but also for other Spanish ports and entities related to them (Peris-Mora, et.al.,2005).

The VPA's ECOPORT I project was the first European case of the introduction of EMAS in port communities, and as such an innovative step in terms of port management. This noteworthy environmental initiative became a benchmark in Europe (ESPO, 2005; Peris-Mora, et.al.,2005), and its European impact is demonstrated by the fact that it is cited as one of the examples of good practices developed in ports within the EU/ECOPORTS project (ESPO, 2005). It was a great success -for both the project and the circulation of its philosophy within the sector at the EU level- the port's integration in a proposal counting on the support of a large number of European ports, (via EU/ECOPORTS Project), with the mission of trying to transfer the designed system to other ports in the Europe. As a consequence, the project found new fields for innovation in EM in ports, some of which have been the object of a new proposal to the VPA's ECOPORT II (2006-2008) LIFE Programme. The ECOPORT II proceeded to an integrated EMS implementation according to the EMAS standard. The outcome of VPA's commitment in EMS implementation was the attainment of various environmental certificates, such as the sector specific PERS in 2003, the certification of ISO 14001/2004 standard at the beginning of 2006, and the certification and validation of the EMAS II Regulation in the early 2008, which are among the most prestigious certificates in Europe.

VPA devoted considerable effort and resources to fulfil environmental objectives by designing tools for controlling and monitoring environmental quality (e.g. air, noise and water quality, etc.) and by establishing methodologies that will encourage companies to remain committed to environmentally respectful activities (e.g. Environmental Management Systems). Since its first Environmental Policy in 2000, the VPA has increased its commitment to environmental management, allowing its EMS to progressively mature and incorporate new challenges. VPA used a lot of resources of different kinds and implemented well-defined actions that progressively enhanced its Environmental Policy. The use of data and information are critical in developing an efficient EMS. The port over the last decade has proven a series of good practices by advancing strategic environmental planning through an adopted and coordinated by EMS implementation, which subsequently has strengthened and updated the port's capability for achieving the planned objectives. Its green strategy was ensured by a long-run vision while confronting the port greening complexity at the port community level.

VPA was involved in the design of Environmental Monitoring System from different aspects. Thus, operationalizing its strategic objective on port-city integration VPA was very proactive in the design of Environmental Monitoring Systems in order to decide actions aimed at improving the local environment (Torres, 2005; Torres, et.al., 2008). An essential part of that aspect was the significant boost the VPA has given to monitoring activities involving technological innovation, either directly carried out using the organisation's own means or in collaboration with other companies and institutions. Finally, efforts are also made to identify the training, communication and awareness needs of port users and society in general, which are then fulfilled through specific actions (e.g. annual environmental reports, training, etc.).

A large part of the VPA 'green port' outcome lay in improving knowledge by taking part in cooperation and innovation projects. This involvement had two facets, the more innovative aspect and the fact that the VPA shared its findings with interested third parties. Thus, collaboration and experience exchange were both essential at a national as much as an EU level. VPA using EU funds, mostly through the LIFE programme, implemented clean-up operations, monitored their impact on its cluster port, implemented EMS and engaged its port community and the city in the life of the port of Valencia, as part of its integrated approach to environmental management. The ECOPORT I and II projects originated new fields for innovation in EM in ports. The aforementioned and several other projects guaranteed that in the Valenciaport port greening was taken into consideration and was further promoted in both the cluster port and its port community. As a concluding remark it is necessary to highlight that none of them would have been possible without the VPA's and its port's community willingness to grow as an integral green cluster. In its port community greening, VPA is engaged in a key leadership role showing that ports have an important role to play in accomplishing a sustainable freight transport network and that green port network initiatives can be achieved.

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- *Position of People interviewed or contacted via questionnaire*:

Sapina Garcia Rafael	VPA - Director of Liner Shipping and Port Operators
Torres Monfort Federico	VPA - Director General Port Service, Safety & Environment
Diez Orejas	VPA - Environmental Policy Manager
Peris Rafael	VPA - Company’s technical assessor / project manager MEDprogramme

ANNEX 4

CASE STUDY 4: PORT OF ROTTERDAM

PORT OF ROTTERDAM –
Exploring the "green port" potential in the **"BIG" PORT** of a **PIONEER COUNTRY** – why & how?

ABSTRACT

The port of Rotterdam (PoR) is one of the most important ports in the international scene. For this reason, it is of particular interest to investigate how the Port Authority (PA) manages environmental problems and implements Environmental Management (EM). In the case-study the main environmental issues in the port area are introduced, and furthermore, due to these recurring issues, the port management efforts are presented. Finally, the described efforts are discussed in the light of the port's application for the ESPO/Ecoports's PERS certification verification. The port of Rotterdam was PERS certified in 2008. Because of the port's scale, dealing with environmental problems is clearly related both to the port area and the regional agenda. In this respect, this case-study has also focused on the PAs efforts as part of collaborative environmental projects and plans.

CONTENTS

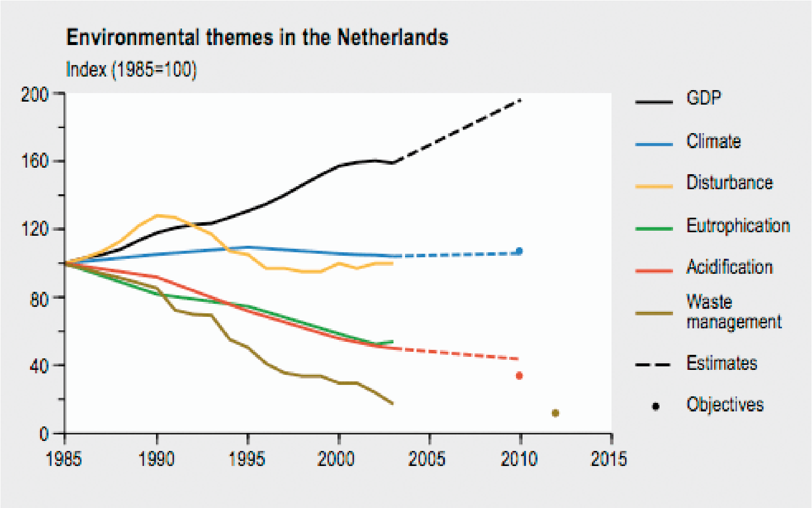
1.0 INTRODUCTION

According to Schrijnen (2003), spatial location and the Dutch trading spirit are the primary factors that created the main port of Rotterdam, although the main port strategy has become, at least temporarily, the victim of the enormous transformation of urban and rural areas in the Netherlands. He points that: *"the choice was inevitable, as was the further transformation of the west of the Netherlands from a collection of stand-alone cities to a multicultural metropolis, one where urban bustle has made way for a cohesive whole and with the cultural landscape as the bearer of a sustainable delta",* (Schrijnen, 2003:50).

1.1 The Netherlands - the "green" national context up to 2010.

With life-threatening environmental problems, brought on by congestion and heavy industry, the Netherlands was a microcosm of the threats still facing much of the planet, but in the late 80's the country was the only nation in Europe (apart from New Zealand in the rest of the world), which actively pursued the "green planning" approach. According to the Research Renewal Institute (RRI) and its *"Green Plans in action"* reports, in the Netherlands *"all the elements of successful green planning have come together to make environmental recovery a reality"*[2]. The report argues that the country possesses one of the most advanced frameworks for achieving sustainability of any industrialized nation: the National Environmental Policy Plan, or NEPP.

In collaboration with the National Institute of Public Health and Environmental Protection (RIVM), the Dutch government presented, in 1989, the thematic approach of its 1st National Environmental Policy Plan (NEPP1), (VROM, 1988-1989). The first major breakthrough came out, when government planners developed the concept of "themes" or general categories under which all environmental problems could be subsumed, (International Sustainability Indicators Network/ISIN, 1991). There were eight (8) *key themes*: climatic change and depletion of the ozone layer, acidification, eutrophication, diffusion, waste disposal, dehydration, squandering, and disturbance. The different themes were related to specific target groups such as transportation or agriculture aiming at pollutants' reduction.



Source: Netherlands Environmental Assessment Agency (MNP)

As an additional management tool, the government defined a five-level model of geographic scale on which environmental problems (and their solutions) occur: local, regional, fluvial (watershed), continental, and global. Given the fact that continental and global problems are beyond the scope of the Dutch government to solve, the NEPP promoted *active international diplomacy*. Additionally, the government identified specific 'target groups', namely the economic sectors that most contributed to environmental problems.

The NEPP was designed to be a comprehensive, ecosystem-based policy integrating all areas of environmental concern[3]. It entailed 223 policy changes and transformed the way that the Dutch government, businesses, and society approached the problems of environmental degradation. In

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[2] http://www.rri.org/green-plans-netherlands.php

[3] http://www.rri.org/green-plans-netherlands.php

addition to the national plan, each of the twelve Dutch provinces was requested (based on the 1993 Environmental Management Act) to develop long-term strategies with the primary responsibility to implement and enforce governmental policies and supervise municipalities and water boards. Thus, provinces and municipalities were the main institutions to apply the NEPP, and the Dutch Minister of Environment (VROM) had the coordinating and catalytic role in the implementation process, (De Jongh, 1996).

- **NEPP's management principles and policy implementation**

The national environmental policy in the Netherlands was the outcome of increasing social and scientific concerns and was initially based on the results of the crucial report commissioned by VROM. The *"Care for tomorrow"* report (RIVM, 1989) was aiming to reveal the country's environmental condition and to update environmental concerns. Until the first NEPP, the environmental law enforcement had not been very strong in the Netherlands. In 1992, the first National Enforcement Program (NEP) was developed. It aimed to find ways to address environmental infringements. The governmental entity responsible for enforcement is VROM, with the Inspectorate for the Environment being in charge. The National Coordinating Committee for the Enforcement of Environmental Legislation defined the duties for provinces and municipalities regarding enforcement, while more government funding was devoted to strengthening the country's enforcement programs. In addition, in 1993 the Dutch Environmental Management Act (EMA) was a milestone towards integration of the existing environmental laws. Its purpose was to set up standards for environmental plans, as well as, to address enforcement issues and quality goals.

The NEPP was based on the articulation of objectives and responsibilities as the key management principle, which stressed that society, as a whole, should play a role in achieving sustainability (RRI, 2001). In order to do this, environmental concerns had to be incorporated into all **decision- making** procedures, another important principle of the Dutch plan. The Dutch have placed environmental issues high on the public agenda, with great focus on global climate change, air and water pollution (Howarth et.al, 2001). The government made efforts to involve the public and other groups in its decision-making process, which turned very beneficial for the national environmental policy. Among the strategies designed to assist in this process, there was a focus on environmental education for all citizens and improved information dissemination throughout society. NGOs were another significant force in the NEPP process. Obviously, the Dutch government saw the value in receiving input from NGOs; even to the point of funding those organizations' projects.

The NEPP's management approach was vitally based on a flexible use of different policy instruments. Instead of relying on one type of instrument, such as regulations, the government used a mix of measures to achieve specific goals. This variety of tools included regulations, voluntary agreements, and economic instruments. Voluntary agreements, or covenants, between the government and various industry sectors became a 'hallmark' of the NEPP process.

Covenants have been civil agreements between businesses and the government and another way the Dutch authorities have worked in partnership with industry over environmental issues. In establishing a covenant, each business is empowered to devise each one's strategy for reaching target goals (De Jongh, 1996). The use of non-regulatory instruments does not mean that regulations were abandoned, but instead, regulations became the basis upon which innovative measures, such as covenants, were constructed. The covenants did not replace the licensing procedures, but were considered as management tools on top of the "normal" licensing. The Environmental Management Act (1993) required licenses to be updated every four to five years, and since the covenants were worked out by firms in corporate and facility upgrading plans, these plans were considered as fitting in the licensing procedures for updating, while joint monitoring was deemed as an important element in the overall implementation process (De Jongh, 1996).

The NEPP was designed to be an ongoing process rather than a static plan, so it was revised every four years into three progressive variations reflecting the growth, lessons learned, challenges, and new objectives, as the careful monitoring and feedback regarding environmental conditions and the effects of policy which allowed the government to respond quickly.

- NEPP2, published in 1993, reviewed the progress made under NEPP 1 and identified those areas in which additional measures would be required in order to meet the established targets.

- NEPP3, adopted in 1997, was a major step forward, integrating the knowledge gained during the first eight years of the process and reflecting an increasingly sophisticated approach to environmental management (RRI, 2001).
- NEPP4 - *"Where there's a will there is a world-Working on Sustainability"*, published in 2001, outlined seven persistent environmental problems and set the agenda and the strategy for dealing with these problems: 1) loss of biodiversity, 2) climate change, 3) over-exploitation of natural resources, 4) threats to health, 5) threats to external safety, 6) damage to the quality of the living environment, and 7) possible unmanageable risks.

NEPP4 has taken a long-term perspective (2030), focusing on transitions to sustainability in three areas: 1) energy efficiency; 2) agriculture and biodiversity; 3) natural resource; and has taken environmental management in the Netherlands to a new level, making **quality of life** concerns into a core theme. In the preparation of the NEPP4 the Central Economic Planning Agency (CPB) evaluated part of the progress made. The government endorsed most of the CPB's recommendations; those conclusions played a prominent role in the policy formulated in NEPP4.
In 2001, the Dutch Cabinet established the **National Strategy for Sustainable Development** (NSDO): *"What choices must the Government make?"* This strategy included, once more, measurable goals and objectives for the country as a whole, for specific geographic regions and target economic sectors. It was the most significant environmental policy document since NEPP4. While it wasn't a new "Green Plan" for the country, it was a document focused on how the country was going to achieve environmental goals within the context of both the NEPP and the European Union (EU) standards.

- *Transition management as key to sustainability policies in the Netherlands*

Transition management provides a governance paradigm for addressing persistent problems. According to this paradigm, transitions are processes of socio-technical evolution in which economic, institutional and technological structures develop interactively and change drastically in the long-run. According to Kemp and Loorbach (2005), in the Netherlands sustainability is believed to require fundamental changes in the functional systems, and transition management prescribes ways in which society-wide and complex system innovations can be guided and thus, it helps to create new business in areas like energy, agriculture and transport.
Two major elements of such a transition approach are the stimulation of technological innovations in market niches through participative involvement of companies, research institutes and civil society and the creation of challenging visions, (ECN-Energy Research Centre of the Netherlands, 2006). A mechanism of self-correction, based on policy learning and social learning, is part of the transition management which is considered to offer a framework for policy integration (Kemp & Loorbach, 2005). Dutch policy makers got interested in transitions and the transition paradigm was identified in the NMP4 as a key element in working toward a sustainable future.

In summary, the intention of NEPP was to create a sustainable environment within 25 years and although, not a law in essence, it was the main driver of the Dutch environmental policy. It was supported by innovative environmental management approaches, with a reliable fiscal commitment, and strategic governance (RRI, 2001). It served as a blueprint for similar plans in several other countries aiming at positive environmental action for sustainability, as well as, for the EU's 5th Environmental Action Program (Liefferink, 1999). The actual motive behind the plan was the philosophy that living in a sustainable environment is actually possible without unacceptable negative consequences in society (VROM-NEPP4, 2001), while its approach can be understood as a partial return to the corporatist roots of the Dutch political system, after a more contentious period of the 1970s and early 1980s (Liefferink, 1999).

Box1.1: The NEPPs' success

Dutch NEPP - Achievements and Known Impacts
• Extremely successful. Impressive results. • Has transformed the entire national policy. • All target groups have achieved or are close to achieve their target levels. • More than 100 covenants were signed. • Proved "absolute decoupling" of economic growth from environmental pressure. • Brought greater awareness about sustainability.

Source: http://www.sustainabilityindicators.org – Date Accessed 10/4/2010

In the last two decades, the Netherlands developed some major projects, aiming to be transformed from an industrial and agricultural economy into a distribution country connected to main-ports, in terms of services and knowledge economy *“leaning more towards urbanisation”*, (Scrijnen, 2003). At the same time, the NEPP policy plan became widely known abroad as a national green plan ‘success case’ (see Box1.1) and the country has been considered as one of the EU pioneers in the environmental filed.

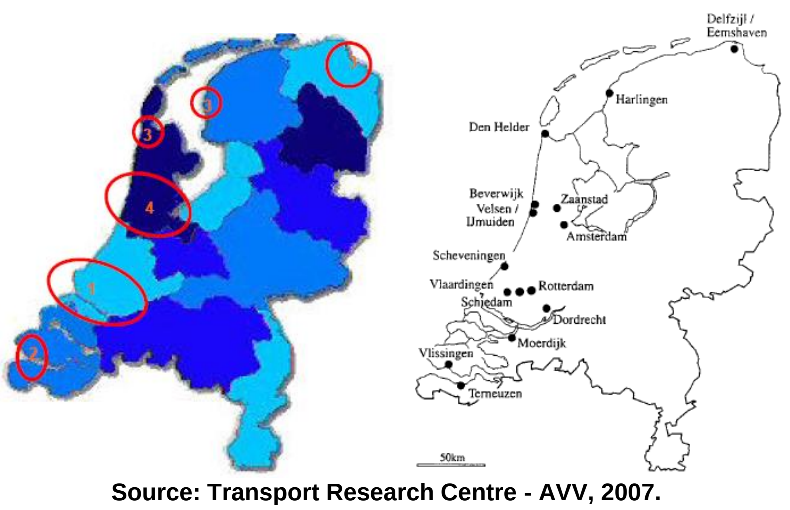
- *Environmental law and policy enforcement*

As a final point in this brief description of the Netherlands national governance framework, it should be noted that it has three tiers of government: central, provincial and municipal. Responsibilities are divided over these three tiers, and the largest cities, in particular, enjoy a high degree of autonomy. Therefore, the city of Rotterdam can make important decisions to cope with environmental issues. Since the provincial authorities are responsible for areas such as environmental management and enforcement, spatial planning, energy supply, they have an important role to play as well. Due to the specific situation in the Rotterdam region, the environmental management has been organised together with the city of Rotterdam and the 15 other cities in the region by ‘shared *Environmental Protection Agency*’, the **DCMR**. To improve the cooperation in the region, the 16 cities work together in the inter-municipal partnership ‘Stadsregio Rotterdam’. This partnership has an official legal basis, and environment is one of the topics of collaboration.
The four main tasks of the DCMR – licensing, enforcement, monitoring and advising- cover the performance of the environmental policies as formulated by the state, the province and the municipalities. DCMR coordinates the regional environmental policy monitoring in the region by correlating indicators, and policy objectives environmental monitoring shows whether the policy is on course or not. Different monitoring networks have been created around the port area and the Agency took over a significant responsibility for the implementation of the regional ROM-Rijnmond plan (see p:14) by giving environmental permits and controlling commitment to the rules and regulations for the companies in the port area and beyond; guiding on environmental management; and more importantly by measuring the quality of the environment in the Rotterdam region. DCMR uses it to check compliance with regulations. *“Without these networks, it would be very difficult to check the compliance of regulations”* (DCMR, 2009).

1.2 The Dutch seaports

The Dutch seaports play an important role in the international freight transport networks, due to their position in respect to the economic centres in Europe and the infrastructural access to the ports, (Transport Research Centre - AVV, 2007). The Netherlands has 18 ports, distributed over 4 seaport regions: Rotterdam Rhine–Meuse delta (1), Scheldt basin (2), Northern seaports (3), and North Sea Canal area (4) (Fig.1.1).

Fig. 1.1: Map of Dutch seaport regions – Dutch seaports location



Source: Transport Research Centre - AVV, 2007.

The Dutch seaports are of major importance for the Dutch economy (see Box.1.2). Therefore, the government has chosen to strengthen the role that the Dutch seaports fulfil in the national economy.

Box 1.2: Economic significance of Dutch seaports.

In 2004 and 2005, the Dutch seaport regions performed better than the entire Dutch economy in terms of labour and added value, (Transport Research Centre - AVV, 2007). In 2005, they showed a trend in the growth of added value of 5.9%, compared to 1.5% for the entire economy, as well as, they demonstrated a more than average growth in productivity and were responsible for 4.2% of the Gross National Product (based on 2002 prices) in 2005. The seaport regions provide 1.7% of the entire employment in the Netherlands and the direct added value of the Dutch seaport economy was 20.3mil €.

Source: *"Havenmonitor-Harbour Monitor 2005 report",* Buck Consultants International and Rebel Group, commissioned by the Ministry of Transport, Public Works and Water Management, (2006).

○ Rotterdam Rhine – Meuse delta

The largest national port area is the Rotterdam Rhine–Meuse Delta, incorporating the ports of Rotterdam, Schiedam, Vlaardingen and Maassluis, which all have a close management relationship with the Port of Rotterdam Authority (Havenbedrijf Rotterdam, HBR). The ports of Dordrecht, Moerdijk and Scheveningen also belong to this area. The Port of Rotterdam (PoR) is the main continental port and the largest port in Europe but also one of the most important in the world: in 1998, it handled 315 million tons of goods. In 2006, 388 million tons were transhipped in the ports of the Rotterdam Rhine-Meuse delta, accounting for the 76.5% of the total transshipments in Dutch ports and this is set to reach an estimated 480 million by 2020, (Ministry of Transport, Public Works and Water Management, 2006 – www.verkeerenwaterstaat.nl)

○ Type of ports, overall legislative and seaport policy framework

In the Netherlands, different port structures are encountered. Most seaports are administered by *port authoritie*s (PAs). These are municipal entities, a combination of municipal and provincial entities ("Havenschappen") and several private ports in the Netherlands. The Rotterdam municipal port management was given the status of a legally independent entity in 2004. The 100% shareholder is the Rotterdam municipality. The operation of municipal ports is integrated in municipal administrations. The ports of Delfzijl/Eemshaven and Moerdijk are operated by a statutory body called "Havenschap" (Harbour Board), in which municipal and provincial authorities are represented. Some former "Havenschappen" merged into one entity.

Dutch PAs are responsible for the management of the port, which includes: leasing of the land, attracting business to the port, earning port dues, considering safety, managing vessel traffic, etc. PAs are member of the Dutch National Ports' Council (NPC), which is an advisory board for the Minister of Transport authorities, but it also represents members of the private sector and relevant ministries. The NPC is not a national seaports association. A variety of national legislation on port related issues exists: on safety, security, customs, pilots, social, environment, etc. However, an overall port law, does not exist. The port sector in the Netherlands is very dynamic. The most important change was the corporatization of the Port of Rotterdam

In November 2004, the Dutch Minister of Transport, Public Works and Water Management submitted the memorandum entitled *"Zeehavens: ankers van de economie - Seaports: anchors of the economy"* to the Second Chamber. This memorandum described the seaport policy for 2005-2010, and worked out in further detail the *"Nota Mobiliteit - Mobility Memorandum"*. The Seaport Memorandum made a distinction between two seaport functions: main port of cargo throughput; and place of business for industries and services. This explicit distinction made between the two functions is also confirmed by the literature. An interpretation of the figures in table 1.1 could consider the added value growth as a positive evolution for the 'place of business' function. Employment is decreasing for both functions.

Table 1.1: Development of direct seaport-related employment and added value, Per sector 2002-2005 (index 2002=100)

Main sector and sub-sector	Employment (index 2002=100)				Added value (index 2002=100)			
	2002	2003	2004	2005	2002	2003	2004	2005
Main port of cargo throughput	100	98	95	97	100	95	102	108
Place of business	100	98	96	95	100	103	110	116
Total	**100**	**98**	**96**	**95**	**100**	**99**	**107**	**112**

Source: *"Havenmonitor-Harbour Monitor 2005 report",* Buck Consultants International and Rebel Group, commissioned by the Ministry of Transport, Public Works and Water Management, (December 2006)."

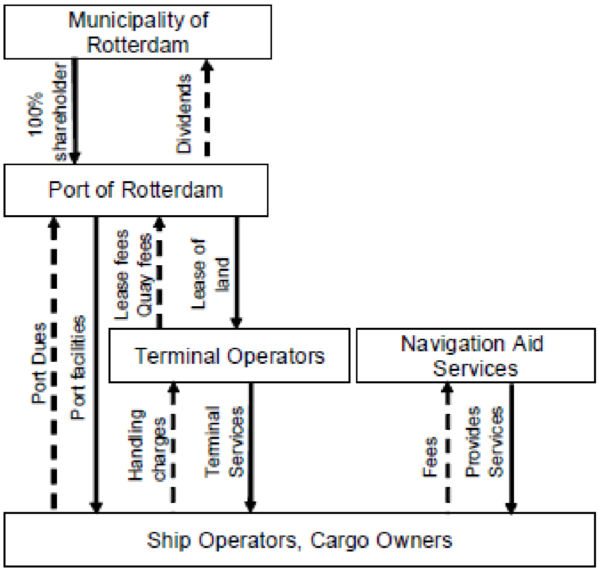
- **Decision-making procedures for investments**

National law is decided by the national parliament. Local law and Port laws are issued by the local (municipal/provincial) council. There is a national overall port policy (planning). This forms part of the national transport plan or sometimes of a specific national port plan (e.g. for the next decade). Day to day decisions on (smaller) investments are made by the local authorities or the port management. Very large investments (like the Maasvlakte II in the port of Rotterdam or the Betuwe rail connection) are decided by both national and local government. These procedures are very sophisticated and take a very long time (years to decades). They include economic impact studies, environmental assessments, financial agreements, EU-acceptance, etc.

1.3 Port of Rotterdam – the port profile

In July 2003, the City of Rotterdam decided to privatise its municipal port authority (on 1th January 2004) by transforming it to a so-called 'government corporation' named: **The Port of Rotterdam** (PoR). Just like other companies, PoR will have to give account of its economic, social and environmental performance, in consideration of its corporate image, (De Langen, 2004). The port is administered by a port company (*Havenbedrijf*). The port company fulfils the functions of the port authority, deals with the strategic management and planning of the port and it is responsible for its operational management and marketing. Contrary to neighbour countries, -Belgium and Germany-, where all major seaports are granted with legal and financial autonomy (ports of Antwerp and Hamburg), in the Netherlands only Rotterdam is granted with legal and financial autonomy. In the case of Rotterdam, the port company is an independent company acting under private law, but its shares are entirely in the hands of the Municipality of Rotterdam. The land of the PoR was not transferred from the municipality of Rotterdam to the port authority. Companies make use of the land based on perpetual costless leased arrangements. Fig.1.2 shows the governance structure of the port of Rotterdam. In 2005, PoR developed its Business Plan 2006-2010.

Fig. 1.2: Governance structure of the port of Rotterdam



Source: Institute of Shipping Economics and Logistics (ISL), 2006

Statistics:

Surface: 10,500 ha
Commercial sites: 4,900 ha
Employment in the port: 71.300
Throughput 2007: 407 mil. tons
37,500 seagoing vessels
130,000 inland vessels

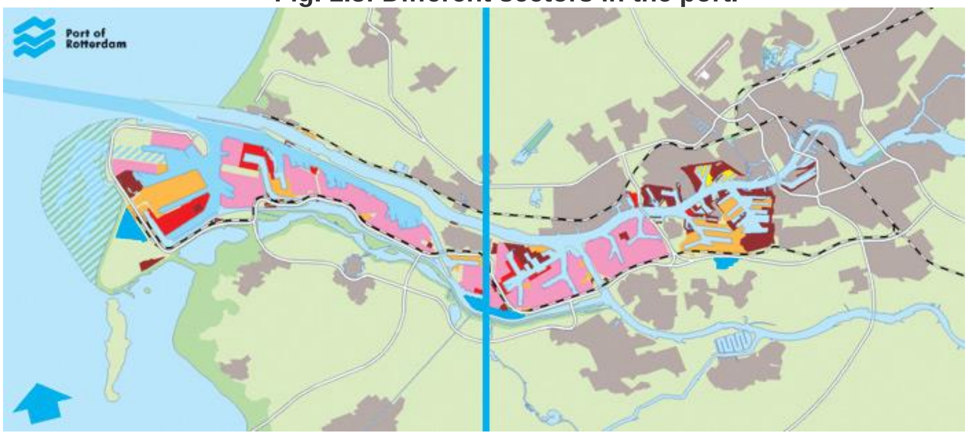
Port entry to the city > 40 km
Source: Port of Rotterdam – Port statistics (2007)

The Rotterdam Port Authority (Havenbedrijf Rotterdam NV) is the manager operator and developer of the port and industrial complex. In its role as developer, the Rotterdam PA makes sure that the companies in the port area have sufficient space at their disposal. The PA also invests in the improvement and constructions of infrastructure (new roads, railway lines, quays, barge connections and underground pipelines). Some 36.000 deep-sea ships and 133.000 inland waterways vessels are called at the port each year, and in its role as manager of the port, the PA ensures smooth and safe shipping traffic using 31 radar stations as part of its Vessel Traffic Management (VBS) system, (PoR web, accessed December 20006).
One of PoR's primary activities is to provide efficient port infrastructure for the port community. This involves providing infrastructure for each port entity as well as the more public infrastructure.The port is a hub in the international goods flows and a business location for industry and logistics services, as the port area consists of a large industrial complex and it is an important transit position, because of its location at the Rhine and Meuse Delta. Rotterdam is a cluster port whose value added in 2007, was calculated at EUR 12.8 billion, representing approximately 10% of regional GDP, confirming that the value-added creation by port and port-related industries can be substantial (Merk & Dang, 2013).

- **Lay-out of port area**

The Port of Rotterdam is the largest seaport in Europe, handling 400 million tons of goods each year and the gateway to a European market of more than 500 million consumers. Thanks to its high-level infrastructure and convenient location, it is also home to several hundred different industrial companies. The port and industrial area stretches over a length of 40 kilometres and covers 10,000 hectares, where all imaginable types of goods are loaded, unloaded and distributed via different modes of transport.
The port handles, various cargo flows, like chemicals, ores, liquid bulk, dry bulk, vehicles, general cargo, refrigerated cargo, food and containers simultaneously, as they are handled by specialized companies. The different activities in the port are also sometimes categorized into sectors (see Fig.1.3), such as: storage and handling (dry bulk, liquid bulk, containers and general cargo); distribution (adding value to cargo); transport; industrial sector; marine and business services.

Fig. 1.3: Different sectors in the port.



General cargo Liquid bulk Dry bulk Food Other activities

Source: Port of Rotterdam

The most important activities of the port currently take place close to the North Sea, 40Km from the centre of Rotterdam. More than half the port's total transhipment takes place there on the Maasvlakte. Now, the port and industrial complex of Rotterdam is one of the most important petro-chemical centres in the world, along with Houston and Singapore. The port leads the way in the transhipment of oil, oil products, containers, fruit, coal, ore and scrap metal. Quite the opposite, the old and new segments of the port are diverse. The potential new demands that the two areas could accommodate and the different opinions articulated have become, since the 1990s, the central issues in debates over the port's future.

Container sector: The port's 'sea gateway' was gradually undergoing transformation when the container entered the scene in the mid-sixties. The first container ship arrived in Rotterdam on 5

May 1966 with 226 containers on its deck. The container revolution led to the setting-up of ECT, the Europe Container Terminus, with its Home Terminal in Eemhaven. Container traffic developed rapidly. By 1968, the port of Rotterdam was handling around 65,000 containers (TEU), in 1969 121,000 and in 1971 around 250,000. In the mid 1960's the demand for more container space initiated the first Maasvlakte, which was built by reclaiming land from the North Sea through dykes and sand suppletion. The port area extended to 10.000 hectares in total, accommodating a new oil terminal, an ore and coal transshipment company, and a new container terminal, (Hupkes, 2003). The one million TEU milestone was achieved in 1978 and by 1985 2,7 million TEU had passed through the port of Rotterdam. Ten years later, this number doubled and by 2000, this figure had increased to 6.5 million TEU, (Hupkes, 2003). The Maasvlakte features various big companies and some smaller ones. Maersk, Europe Container Terminals (ECT) [a member of the Hutchison Port Holdings group (HPH)] and Euromax are three big container terminals located here. They can all accommodate the world's largest ships.
In September 2008, works started on the 'Second Maasvlakte' or 'Maasvlakte 2': the existing area was expanded and in 2013 the new harbours in the Maasvlakte 2I as scheduled, were opened for commercial use. By spraying sand in the North Sea, the port of Rotterdam was extended by some 2.000 hectares.

Energy centre for trade and distribution: Five ultramodern refineries in the port convert crude oil into a wide range of fuels. Rotterdam is also an important supplier of electricity. The power plants located in the port – based on coal, natural gas, total energy, wind and waste incineration – have a combined capacity of 3000 megawatts, (PoR, 2008). There are 20 independent tank storage companies in the port. In total, they provide 27 million m³ of tank storage capacity. Partly thanks to this, Rotterdam is a prominent trade and distribution centre for bunker and fuel oil in particular, whilst energy transport across the European market is highly intended to be clean and safe, by promoting pipeline, inland shipping and rail use, (PoR Annual Report, 2008).

- **The Port of Rotterdam international position**

In 2000, the direct gross added value of the Port of Rotterdam and industrial area amounted to 6.2 billion euro, which was 1.7% of the Dutch Gross National Product, (PoR, web accessed: 2/3/2005). In 2004, the ports of Shanghai and Singapore surpassed the Port of Rotterdam as the largest ports in the world as they were measured by the total tons of cargo handled: *"Port of Rotterdam grows in 2004, but drops claim to 'world's largest' title"*, (The Associated Press, web accessed: 30/12/2004). The port can be considered the economic engine of the Dutch economy, adding into consideration its potential indirect economic impacts. With an annual throughput of more than 400 million tonnes of goods, Rotterdam is by far the biggest seaport in Europe and the main gateway to a European market of more than 500 million consumers.

- **The structural aspects of a competitive position**

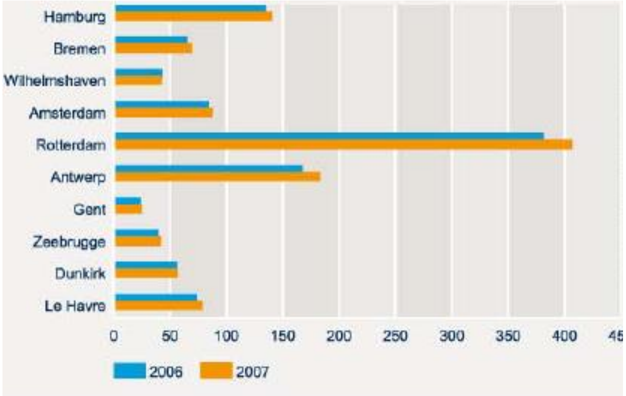
According to Kreukels and Wever (1996) there are structural factors in the case of Rotterdam that are often used to explain its strong competitive position: its connection to the North Sea; its location at the mouth of the most important European inland waterway (River Rhine); and its (geographic) location within Western Europe.
Unquestionably, the growth of the port of Rotterdam is related to the River Rhine and the port's(geographic) location of Rotterdam in Western Europe. The Rhine created a comparative advantage for Rotterdam, as much as the deep link to the North Sea and explains the higher share of inland shipping in the modal split for the transport of goods than in all other ports in the Hamburg-Le Havre range, and the Rotterdam's character as a port for bulk goods. But not all products entering the port are bulk products, and as the port has already for years tried to increase the volumes of non-bulk goods, the River Rhine has been much less a comparative advantage, compared to road and to a lesser degree rail infrastructure, which have become much more important, (Kreukels & Wever,1996). Within Western Europe, all ports located in the so-called Hamburg-Le Havre range can be seen as competitors within the same continent. They are all focused on the same hinterland, i.e., Western Europe. Rotterdam dominates this scene as well (see Table 1.2/Fig.1.4). Antwerp and Hamburg follow at a respectable distance.

Table 1.2: Total throughput in the Hamburg–Le Havre range ports: 1980, 1990, 1995 (million tonnes)

	1980	1990	1995
Hamburg	62.4	61.4	72.1
Bremen	27.0	30.2	31.2
Amsterdam*	22.4	47.0	50.3
Rotterdam	276.8	287.9	294.3
Antwerp	81.9	102.0	108.1
Ghent	18.4	24.4	21.6
Zeebrugge	10.7	30.4	30.6
Dunkirk	41.1	36.5	39.4
Le Havre	77.4	54.0	53.8

Source: Rotterdam Municipal Port Authority

Fig. 1.4: Total throughput in the Hamburg-Le Havre range 2006-2007



Port of Rotterdam – Port statistics (2007)

The favourable (geographic) **location of Rotterdam in Western Europe** is, at least, partly related to the arguments given above, but according to a study carried out in 1995 for the Dutch Ministry of Economic Affairs, this location within Western Europe is not unique at all (Van Klink, 1996). The study calculated transport costs for a fictitious (Euro)plant, distributing its products to all markets in Europe (weighted by the economic mass of each region) and named the normalized outcome: the *'relative transport efficiency'*. As it can be seen from Fig. 1.5, Rotterdam's geographical location does not automatically pave the way for a competitive port.

And yet, even for containers that are predominantly transported by truck and for which it has, as a consequence no clear 'natural' advantages, Rotterdam is by far the biggest port in the Hamburg-Le Havre range (see Table 1.2/Fig.1.4). The port's competitive position can be attributed more to Rotterdam's character as a deep-sea port. Rotterdam has unrivalled nautical accessibility - access for 12.500TEU and above/draft 17.0m (Maasvlakte 2, draft:20.0m) - compared to Hamburg (8.500TEU / draft:14.50m), and Antwerp (4.500TEU / draft:12.80m) in the Hamburg-Le Havre range (PoR, web accessed: 28/3/2005). The history of the port is, even today, directly related with the history of its *connection to the North Sea*. In the 1960's, the North Sea entrance to Rotterdam was deepened and the so-called Euro-channel, a 3km wide and 72 feet deep entrance to the port, allowed Rotterdam of that time become a 'deep sea' port, very competitive for bulk goods. In order to remain globally competitive, the Government granted the permission to a series of dredging projects in the late 1960's and 1970's. The results were the arrival of much larger transatlantic containerships, inspiring the creation of a container transhipment company, Europe Combined Terminals (ECT) and an opportunity for the port's competitiveness, now Europe's primary port not only for bulk cargo but also for container handling. In addition, the Rotterdam-Antwerp Pipeline (RAP), -put into use in 1971-, is an illustration of Rotterdam's improved competitive position. Rotterdam became the port of entrance for crude oil and Antwerp has been the crude oil hinterland of Rotterdam.

1.4 The port's reaction to changes in the port sector

Although important, it is too simplistic to explain Rotterdam's competitiveness only by the above-mentioned factors. Other factors should be taken into account as well.

- **Policy aspects of a competitive position**

Kreukels and Wever (1996) claim that the policy pursued in the port was also of significance. Historically, the policy undertaken by the PA and the Municipality of Rotterdam focused on strengthening the competitive position of the port. In the first half of the 20th century, this occurred with the construction of two petroleum storage distribution facilities and one refinery. After World War II and the port's reactivation, the character of the port changed. Rotterdam expanded westward, on new premises built between the city and the North Sea. The investments made to optimize the accessibility of Rotterdam from the North Sea, and investments focused on attracting new, growing port-dependent industries: oil refining and the production of (petro)-chemicals, which were strongly promoted by the coalition between the municipality of Rotterdam and the PA, turned out to be very beneficial for the port and the city of Rotterdam, (Van Walsum 1972; Van Klink, 1996).

After the 1970's, Rotterdam became a strongly congested and heavily polluted region, and the long-lasting coalition between the PA and the City Council gradually put less emphasis on economic issues and focused more upon environmental aspects (Kreukels & Wever,1996). In the 1980's, while Rotterdam was seriously hit during the economic recession, and the port was not any more a job generator for the city and adjacent areas -especially, when the shipbuilding sector that employed many people gradually disappeared- the Dutch government started building up its 'mainport' strategy. The two 'mainports' – the port of Rotterdam and the airport of Schiphol – were considered as gateways to Europe, strategically appointed as the main hubs of good's flows and facilitators for the Dutch economy (Kolk & Van der Veen, 2002; Edelenbos, et.al.,2008). The result was that in the late 1980s and the early 1990s, the port's policy was focused on upgrading the infrastructural and logistical node (van Duinen, 2004), and the Rotterdam's city administration committed itself to a new investment programme. Eventually, the Rotterdam Municipal Port Management (RMPM) *'Port Plan 2010: Future Vision of a Mainport*' programme found political agreement in 1992, and intended to stimulate the economy of the city and the region of Rotterdam.

In the late 1990s, the port's main reaction to changes in the port sector was easily recognizable in the 'Port Plan 2010'. Responding to changes, the municipal PA of the port prioritized -similar to other European ports- issues, like: internationalization process; hinterland connections; and change from quantity to quality and it was strategically positioned to invest a lot in logistics and information technology. In the 'Port Plan 2010' programme, the priorities for the necessary investments were extensively described, and were identified as the point of reference for the port's future (see Table 1.3).

Table 1.3: *'Port Plan 2010: Future Vision of a Mainport'* variants; strategic aspects; and objectives

Variants	• The strategic vision of the Port Management: 'Mainport'-Rotterdam - a nodal point for inter-continental and intra-European flows of goods. • Extensive analyses of trends in logistics, industry and trade. • Goods Flow Model 6 (GSM 6), presented in August 1990. • East European supplement, published in February 1991. • The Port's Business Plan of September 1992.
Strategic aspects	▪ from quantity to quality: value added as central aspect. ▪ optimum accessibility. ▪ restructuring of existing sites; development of new premises; availability of extra land.
Objectives	
Promotion of port's activity	▪ Increase added value and employment. ▪ Rotterdam Distri-port – upgrading hinterland connections. ▪ attention to goods flows - a 'mainport' for them.
Optimization of space usage	▪ clustering of functions. ▪ restructuring the older port areas. ▪ cooperation with other Dutch ports, and industrial areas outside Rotterdam.
The environment in the agenda	▪ environmental regulations. ▪ Sustainable development concept introduced to port's development. ▪ first attempt to internationalize environmental policy.

Source: 'Port Plan 2010: Future Vision of a Mainport' 1991/1992 draft versions.

The Port Plan 2010 was conceived at a macro level and had a strong quantitative basis. Thus, in autumn 1996, the Business Plan (1997-2010) was adopted by the Municipal Council of Rotterdam, supporting the plan with a qualitative based analysis. Focusing on the maintenance of the port's leading position, it described the strategic policy of the PMPM in the economic environment of the 1990s and explained what that environment could mean for the port's strategic planning and programming (Doe & Schoenmakers, 1998).

Since 1992, the port of Rotterdam has been publishing a Business Plan every four years. The first Business Plan (1992-1996) made clear market choices for the growth sectors containers, distribution, food and chemicals. Concern for the environment was introduced as a requirement, while shortage of space in the port area was announced as a pressing issue. The 1997-2000

Business Plan placed the port and industrial complex in a global context; thus, the complex aimed to have an increasing impact beyond the port itself. Under the motto *"from port landlord to mainport manager"* (Kreukels & Wever,1996; Doe & Schoenmakers, 1998), the emphasis was placed on the commercialization and positioning of the RMPM as a pro-active and managerial player. In 1999 the municipal authority decided to create a more effective port management, which included broadening policies on land issue, tariffs, employment conditions and investments.

In the beginning of the 2000s, Rotterdam's competitive advantage as a container port related to its nautical accessibility was questioned due to both the sector's competition, and environmental aspects related to infrastructure demands (Kuipers, 2002). The 2001-2005 RMPM's Business Plan focused on the topics of space, networks and positioning, making use of a large network in both the political/administrative and commercial fields. The port's target concerning a functional port region and a commercial focus which goes beyond the Rotterdam region, continued to increase. The lack of space in the port and the industrial-complex, became a sensitive problem; and in the meantime, sustainability issues became an integral component of the Port Management's overall policy.

In 2005, the PA implemented major internal changes. Following the introduction of the new top and management structure on January 1st, reorganizations were set in motion within a number of departments. The organization was aimed to be downsized by 10 to 15% based on the new Business Plan (2006-2010) and in spring 2006 Action Plan was submitted to the Works Council for approval. Attention was given to management development, internal and external communication and preparations for the introduction of a system for enterprise resource planning (ERP) in mid-2006. All these activities aimed to create an even more efficient, professional, transparent and commercially-oriented PA, (PoR Annual Report, 2005:15). The 2006-2010 Business Plan, entitled *'Client in view, land in sight'*, was adopted by the PoR's shareholders in December 2005. The main objectives set out in the Business Plan were once more to enhance the competitive position of the port, with targeted choices for certain segments; to provide space so as to allow businesses to further develop by better utilizing the existing space and infrastructure, ensuring extra space in time; and finally, to maintain at the very least the level of efficient, safe, clean and secure handling of shipping. Directly following from this, an important task of the PA was to create the optimum preconditions for the development of the port and living environment involving broad support to accessibility, safety and the *environment* (PoR Annual Report 2005, pp:16).

The PA is still today actively engaged directly and indirectly in organizing its hinterland connections and the related distribution networks. By alliances with other ports (for instance, with Flushing and Moerdijk) and with inland terminals (for instance, with the nearby terminal of Nijmegen, and the Duisburg terminal in Germany), PoR is positioned towards multimodal and intermodal transport with more emphasis on inland navigation and rail, and much less on short sea transport in addition to road transport.

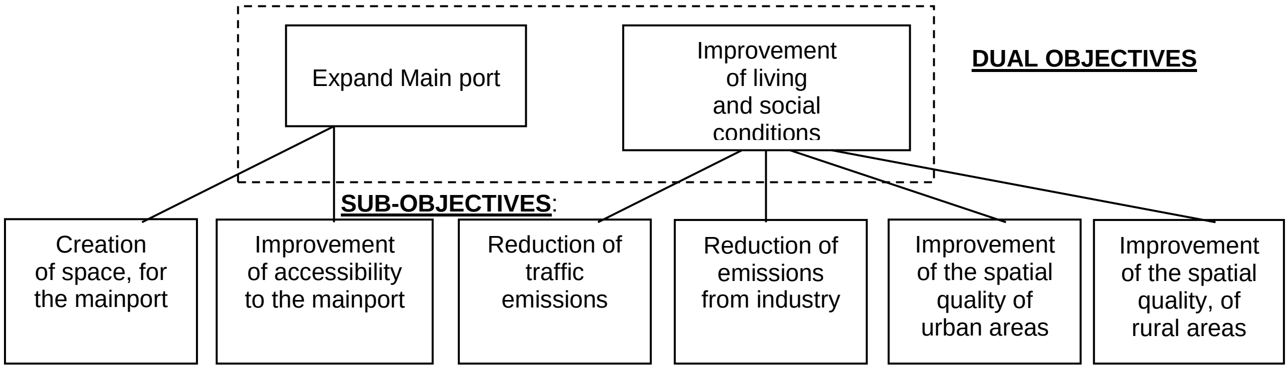
- The **Port Plan 2010** with regard to the **ROM-Rijnmond plan**

The port managed to further cope with its leading position compared to other European ports, when the approval to opt for the container sector, was reaffirmed with the support of the Port Plan 2010, within the ROM-Rijnmond framework.

The initial draft of the 'Port Plan 2010' received negative reactions based on the expected negative impact of the port's further expansion with regard to congestion and environmental pollution (Den Dunnen & Schut, 1994). As a result, in 1992, the Municipality of Rotterdam suggested starting a land-use and environmental plan: the so-called **ROM Plan for the Rotterdam region of Rijnmond** (ROM), as a complement to the 'Port Plan 2010'. The local and national authorities found themselves promoting, at the same time, the same plans for physical planning and environmental protection for nationally strategic locations, which was initially considered the way of mounting pressures from stakeholders, (Kreukels & Wever, 1996).

The responsibility for the ROM Plan was given to various actors, including VROM and other ministries; the Province of South Holland; Rotterdam Municipal Authority; 14 other municipalities located in the Rijnmond area; and the business sector.Three sectional documents were published on the problem areas; The Main Port Target Scenario, the Spatial Arrangement Target Scenario; and the Environmental Objectives Report. The goals for Rijnmond up to 2010 were identified in these documents and after an extensive analysis, the parties involved concluded that the realization of a ‘dual objective’ for the region was feasible, (Dijkstra, 2004). The needed efforts were crystallized into a number of specific projects, which were described in the **ROM-Rijnmond Plan of Approach**. The ROM-Rijnmond Policy Covenant was signed on 9 December 1993. A total of 23 parties, ranging from local government and industry groups to national government, signed to cope with the problems and it was agreed that the ROM-Rijnmond Plan of Approach would be carried out collectively). The ***ROM-Rijnmond project*** was based on the initial policy covenant; it was running until 2010 and had *two objectives*: expanding the main port and improving the living and social climate of the wider area. *Six sub-objectives* (see Fig.1.5) derived from the two main objectives that were detailed in quantifiable and desired results through the 47 ROM-Rijnmond projects included in the Plan of Approach.

Fig. 1.5: Sub-objectives that contribute to the realization of the dual objective



Source: Dijkstra, (2004) “ROM-RIJNMOND: Programme Management in Practice” pp:92

According to Baas and Boons (2007), the aim of the project was to reinforce the Rotterdam port and industrial area as *‘international gateway’* and to upgrade the living quality of the city, by integrating the environment in the physical planning of the Rijnmond region. From the six categories of projects three can be distinguished, as exclusively oriented towards living and environmental issues and were identified as an important bridge between the Port Plan and the ROM-Rijnmond Plan (Kreukels & Wever,1996; Dijkstra, 2004).

ROM-Rijnmond at its earlier stage, had all the characteristics of a project, -determined by factors such as: time, money, quality, information and organization- and by having a beginning (Start Covenant) and a defined result (Plan of Approach); but according to Dijkstra (2004), eventually there was a clear call for a higher, more abstract level of programme management and **ROM-Rijnmond** turned to be a *programme*, that was running for a long period of time, involving factors crucial for the successful running of a programme (see Table1.4).

Table 1.4: ROM-Rijnmond programme - success factors

Implementation organization	Cohesion of the programme	Progress controls
○ Collective recognition of the region’s problematic nature; ○ All the parties involved in the Implementation Organization; ○ Collective efforts to find solutions.	An Objective-Means-Hierarchy defined the connections between the: • dual objectives; • sub-objectives; • the desired results and the projects.	Monitoring of the results based to selected indicators at four levels: • project level (47 projects); • desired results level; • sub-objectives level; and • dual objectives level.

Source: Dijkstra, (2004) “ROM-RIJNMOND: Programme Management in Practice” pp:92-94

After fifteen years of implementation, in 2010, the programme was still functioning in a dynamic environment, and has fulfilled the important means of communication between the actors engaged and the agreements made ahead. Regarding the Rijnmond region the ROM-Rijnmond has formulated the targets for land use and for the environmental quality, confronting the objectives (including the mainport strategy) and the environmental targets, while it helped in locating bottlenecks and indications of how to solve these.

In sum, the ROM-Rijnmond project was an integrated spatial plan for the region around the Rotterdam city, which had a particular focus on ways of accommodating the need for the Rotterdam mainport expansion. Its overall institutional design was an ideal type Dutch arrangement for consensual decision-making. The planning approach was reinforced by a formal project organization created by the Dutch government to realize the port’s expansion and undertake the necessary environmental compensations (Skelcher, et.al., 2008).

2.0 COPING WITH ENVIRONMENTAL ISSUES IN THE PORT AREA

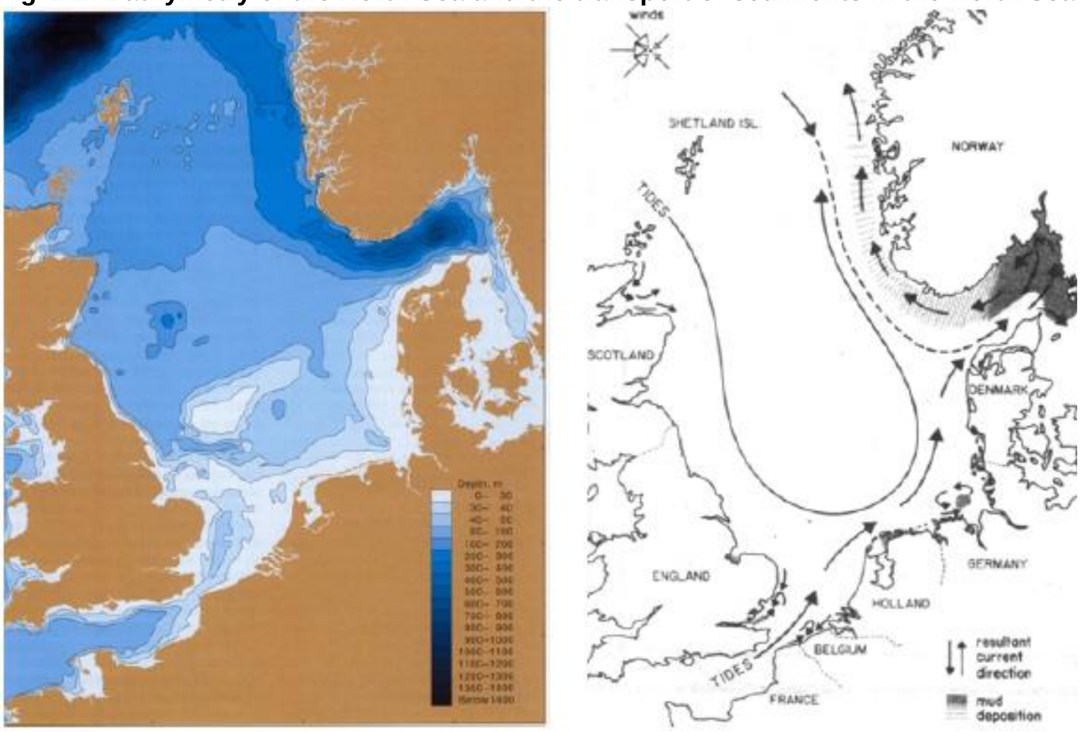
In the case of the Port of Rotterdam (PoR), all possible environmental problems in a port area (land & sea), that have been classified by the ESPO-Environmental Code of Practice (2003), can be identified: soil contamination; air and water pollution; noise; environmental problems related to dredging and disposal of dredged material, port development, port waste and biodiversity conservation.

2.1 DREDGING & DISPOSAL OF DREDGED MATERIAL

- *The port of Rotterdam - Interface between Rhine Catchment Area and North Sea*

The port of Rotterdam is located in the Rhine estuary and it is a sedimentation area, being the interface between the Rhine and the North Sea. Marine sediments accumulate, through tidal action, mainly in the western port areas, whereas the eastern port areas are mainly influenced by fluvial sediments, transported by the Rhine. Settled sediments spend a comparatively short time in the port areas before they are removed by dredging and repositioned to the marine environment, where they are mixed with sediments already present there and continue their transport in the coastal environment of the North Sea; sediments are transported in a northerly direction (Fig. 2.1). Part of the sediments is deposited in the shallow areas like the Wadden Sea.

Fig. 2.1: Bathymetry of the North Sea and the transport of sediments in the North Sea



Source: Eisma, D., (1988) "*Suspended matter and sediment transport*".

Most of the sediments to be dredged derive from the marine environment and only approximately half of the river sediment settles in the port. The other part of this fluvial sediment finds its way into the North Sea (Eisma, 1988). In the 1970s, the negative effects of inputs in the river catchments of the Rhine - through *point* and *diffuse* sources - became apparent. A large number of national and international organisations became involved or were installed to regulate discharges into the freshwater and marine environment, and since that time measures have been taken and priority chemicals for control were identified.

High concentrations of heavy metals (Cu and Zn); micro-pollutants such as: polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs); pesticides and mineral oils; originated mainly from sources in the Rhine catchment area (Fig 2.2) were the criteria for the relocation of dredged material to the North Sea. The **International Commission for the Protection of the Rhine** (**ICPR**) had an active part in improving the quality of the river by establishing quality targets, international monitoring programmes and action programmes for prioritised substances. The implementation of emission control occurred on national level.

Fig 2.2: **Rhine catchment** and selected **monitoring stations**

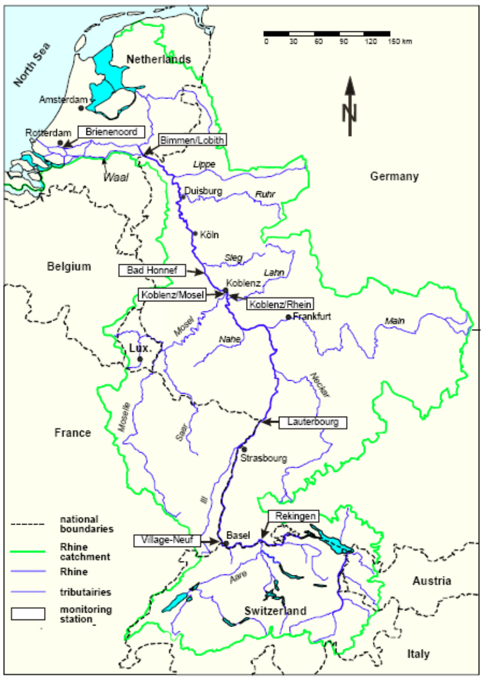
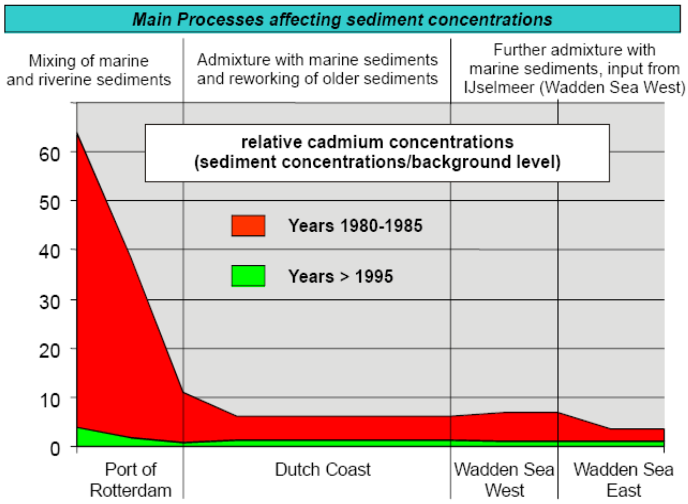


Fig 2.3: The relative **concentrations of cadmium** (measured divided by background concentrations)

- in the port of Rotterdam,
- the Dutch coast and
- the Wadden Sea.



Source: GKSS Research Centre, *"Dredged Material in the Port of Rotterdam",* 2001.

The efforts at an international level resulted in a strong decrease, particularly of heavy metals and PCB inputs in the marine environment. In fact, the latter compounds were banned from use. The large changes in concentrations are shown in relativity to background values(Fig.2.3). The concentrations of cadmium were selected, since this heavy metal showed the highest elevated concentrations in the 1980s. In the early 1980s, the concentration in the eastern parts of the port of Rotterdam was more than 60 times the background level, decreasing to slightly more than 10 in the Europort in the western port area. Addition of more marine sediments along the coast and in the Wadden Sea, caused a further decrease. The values in the Eastern Wadden Sea were 2.5 times the background level (see Fig 2.3).

Disposal of dredged material: The Rotterdam Municipal Port Management (RMPM), since the 80's, had to deal with the fact of the riverside suspended solids sedimentation in the port and 15 to 20 million m^3 of sediments were dredged per year - to maintain adequate port facilities and the necessary depth (between 10-25m)-being in a state of flux (as most port authorities), with the regulatory efforts needed and the (scientific) assessment of dredged material quality. The relocation of this dredged material to the North Sea, the preferred disposal option, was regulated by a set of chemical criteria, the so-called "*Sea/Slufter limits*". This classification system was revised in 2002-2004, and a limited set of bioassays was evaluated, supplementing the chemical parameters. Dredged material exceeding these limits, mainly sediments from the eastern port areas (and partly from the Botlek area), had to be disposed in a confined site, the **Slufter** (Figure 2.4). This special depot has been operating on the Maasvlakte, since 1987 and it is owned by RMPM and the Ministry of Transport, Public Works and Water Management.

Fig 2.4: The Slufter – a confined disposal site for contaminated dredged material

Source: Vellinga & Eisma, (2005).

The amount of the dredged material reached 20 million m^3 of sediment each year in the port area. More than 90% of this material was not contaminated and disposed at sea, as the amount of contaminated dredged material was decreased due to the initial efforts of the port municipal authority, which focused on controlling initial sources of contamination (Vellinga, & Eisma, 2005).
Until 2010, the remained contaminated part was still stored in the Slufter. However, since the beginning of the decade, the Rotterdam port authority wanted to make beneficial use of the dredged material rather than store it in the Slufter, (Vellinga & Eisma, 2005). The initial attempts had begun in 1992, when the sand was separated, but in the 2000's some clay was made from the dredged material and studies were carried out into thermal immobilisation and into the possibilities for the actual use of the dredged material. The Slufter was considered only as a temporary solution by the RMPM, whose policy aimed, instead of solving the problem at the source, at preventing contamination, even in the 1980's, (PoR, 2001), and it thus launched the '**Rhine Research Project**' (**POR**) in 1984.

- **Dutch-German Exchange** on Dredged Material (**DGE**) (1999-forward)

The Netherlands and Germany have large river systems, with important hydrological and shipping functions where dredging is essential; moreover, both countries have large (sea) harbours (such as Hamburg, Bremen/Bremerhaven, Rotterdam and Delfzijl), which receive large amounts of sediments both from the sea, through tidal processes, and from upstream areas through rivers. Therefore, both countries are equally subject to the cross-national (European) dimensions of dredging. Against this background, the competent governmental authorities in the Netherlands and Germany started a **Dutch-German Exchange on Dredged Material** (**DGE**) in 1999. The parties that participated in the DGE were various ministries, government agencies, institutions and PAs. The Port of Rotterdam was highly involved (as it represented the communities of Dutch cities).
The DGE started as an informal bilateral platform for exchanging knowledge, information and experiences in the field of *sediment management*. The subjects under investigation were legislation, risk assessment and sediment treatment. The results were put down in thematic reports and the platform achieved an increased understanding of management of dredged material both at policy level (national) and practical (project) level. Since its beginning, the objectives of DGE comprise: continue existing exchange of information; enhance co-operation on specific issues; develop joint strategies on dredged material destinations while producing guide documents in the field of dredged material management based on the experiences in the Netherlands and Germany:

- DGE Part I: Dredged Material and Legislation (April 2003);
- DGE Part II: Treatment and Confined Disposal of Dredged Material (September 2002);
- DGE Part II: Sediment and Dredged Material Management (September 2003).

And finally, a guide document focused on demands derived from the Water Framework Directive and International Conventions for the protection of the marine environment, which suggested the use of biological methods for sediment and dredged material management.

2.2 Air quality problems

- *Air quality problems related to NO2 and PM*

The port of Rotterdam is a logistical hub for sea and inland going ships that attracts a lot of road traffic (both freight and private vehicles); its industrial area includes four oil refineries and a variety of petrochemical and other industries, power plants, and waste incinerators. The spatial mix of a relatively high population density with major traffic routes, both for vehicles and ships, and industrial areas, causes air quality problems, mainly related to NO_2 and PM.
Despite considerable improvements, in the last 30 years, air quality in Rijnmond in the early 2000s was still giving cause for concerns. Parts of the Rijnmond region were in danger of becoming 'closed off'. Air quality EU regulations pose a threat to plans and projects. Examples included the second Maasvlakte and the North section of the A4, as well as smaller-scale building plans. In the line that, air quality can adversely affect public health and moreover, *"the exceeding of the limit values produces a real risk that spatial and economic developments will be unable to take place*" (Rijjnmond Regional air Quality Action Programme, 2005), the issue was high on the agenda of the various administrative bodies in the Rijnmond region.

o Air quality Rotterdam - Rijnmond area in mid-00's

According to the European Air Quality Standards (drawn up as shown in Table 2.1) and the results of model calculations and measurements in the Rijnmond region, the limit for particulate matter (PM10) was breached on a large scale across the region and in spite of the anticipated improvement, it was expected that in 2010 the limit values for NO_2 would still be exceeded, (Rijnmond Regional air Quality Action Programme). Even in 2005 it was "particular important to implement measures at source", (Rijnmond Regional air Quality Action Programme, 2005).

Table 2.1: European Air Quality Standards

Particles	Type	Value	To be achieved by	Exceedances
NO2	yearly average	40 µg/m3	2010	-
Particulate matter (PM10)	yearly average	40 µg/m3	2005	-
	daily average	50 µg/m3	2005	35 days per year

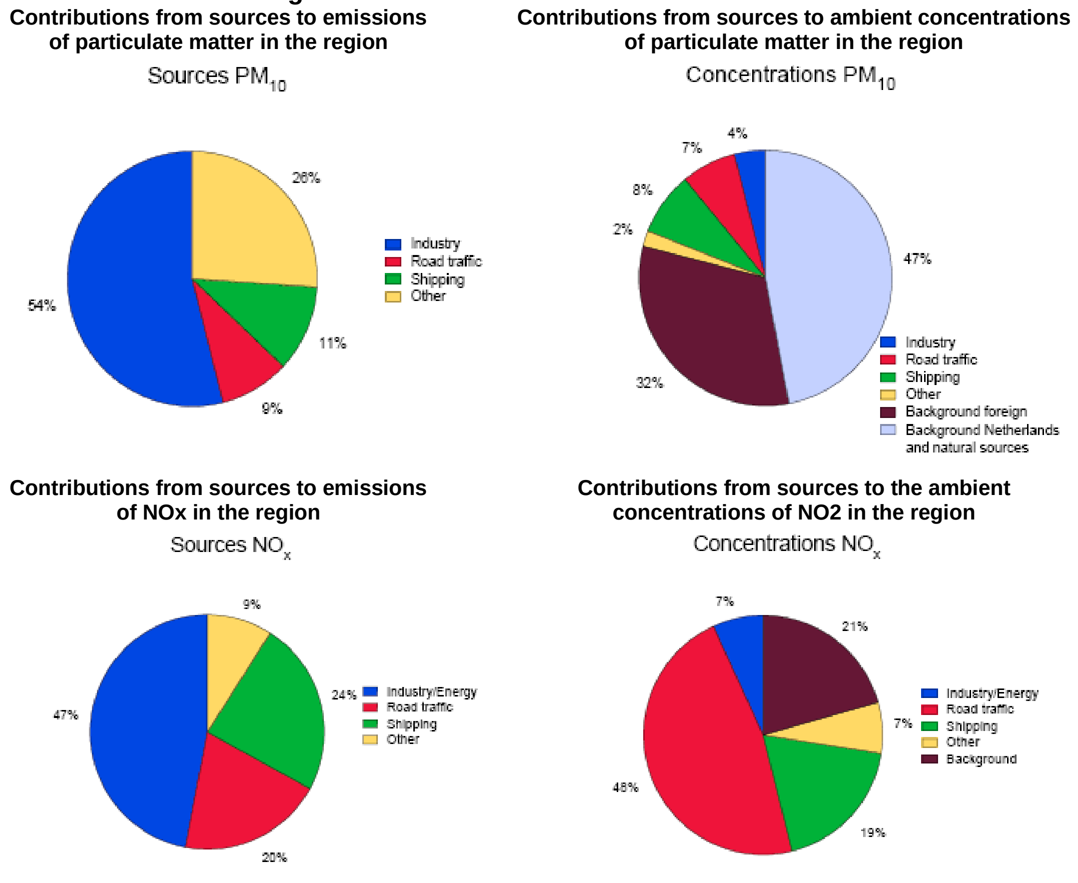
Source: Rijnmond Regional air Quality Action Programme, p:5

Particulate matter: The concentrations of particulate matter in the region were fluctuating around 40 mg/m3. The exclusion of 'sea salt' (an adjustment to the Air Quality Decree in August 2005) meant that the limit was only exceeded at a limited number of locations. However, large-scale breaches of the 24 hour /daily limit value occurred (Rijnmond Regional air Quality Action Programme, p:5).

Nitrogen dioxide: During that situation, the limit value for nitrogen dioxide (which came into force on 1 January 2010) was exceeded primarily along major arterial roads, in parts of the urban centres and in the Botlek and Pernis industrial areas. The concentrations showed a slight downward trend but it was expected that -if no additional measures were taken- exceedances might still have occurred at a large number of locations, particularly along major arterial roads (Rijnmond Regional air Quality Action Programme, p:6).

To define the *sources* (Fig 2.5) of air pollution and the *area's* (Fig 2.6), which exceed the air quality limits, the following figures are presented:

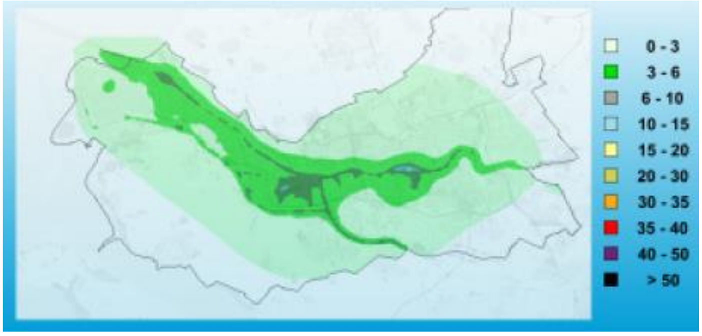
Fig 2.5: Sources PM10 and NOx illustration



Source: Rijnmond Regional air Quality Action Programme, 2006

Fig 2.6: Air quality – Rotterdam-Rijnmond area

Contribution from shipping to PM 10 – limits in Rotterdam µg/m3



PM10-limits:

Average per annum: 40 µg/m3
Max. 35 days' average: 50 µg/m3

PM 2,5-limit (2015)
Average per annum: 25 µg/m3

PM 10 levels in Rotterdam µg/m3

NO2-limut (2010)
Average per annum: 40 µg/m3

Source: Houben, R., *"Air Quality and climate change: involvement of Port of Rotterdam Authority"*, 2nd HAQCC Conference, Rotterdam, 2008.

○ Port of Rotterdam - **Rijnmond Regional air Quality Action Programme**

Due to the problems posed by poor air quality, the DCMR Rijnmond Environmental Agency was commissioned in 2005, to develop the Rijnmond Regional Air Quality Action Programme, through a Top Management Steering Committee on Air, comprised leaders from all participating parties under the ROM-Rijnmond Executive Council (BOR). The programme was carried out in close coordination with the participating administrative authorities and other parties such as members from the business community.

Table 2.2: The combination of Air quality programs in Rijnmond

a/a	**PLANS** drawn up by parties form the ROM-Rijnmond Executive Council (BOR)	published
1.	Rijjnmond Regional air Quality Action Programme	2005
2.	Rotterdam's Approach to Air Quality	1 November 2005
3.	Air Quality Master Plan (developed by BOR)	7 December 2004
4.	Air Quality Plan of Approach by the Rotterdam Metropolitan Region	12 October 2005
5.	Plan of Approach to Air by the Rotterdam Port Authority	8 November 2005

Source: Rijjnmond Regional air Quality Action Programme, p.p.2

The package of measures in the regional action programme was drawn up primarily by five *task groups* chaired by Rotterdam Metropolitan Region, Rotterdam Port Authority and DCMR Rijnmond Environmental Agency. The five task groups were divided into the following groups; road traffic, shipping, railway, industry and households (see Table 2.3):

Table 2.3: Package of measures in the regional action programme

Task group	Chair
Road traffic	**Rotterdam Metropolitan Region (**H.P. de Bruijn)
Shipping	**Rotterdam Port Authority (**M. Prinssen)
Rail traffic	**Rotterdam Port Authority (**T. Hempenius)
Industry	**DCMR Rijnmond Environmental Agency (**H. Knippels)
Households	**DCMR Rijnmond Environmental Agency (**A. de Buck)

Source: Rijjnmond Regional air Quality Action Programme, p.p.5

Efforts from the five task groups resulted in a hundred different strategies, thirty-four of which were selected as most promising. The proposed strategies aimed to affect air quality both in a local and regional manner. Local measures included strategies, such as shore side power for ocean-going vessels and low-emission zones in urban centres. Regional measures included pushing for stronger EU regulations. The 34 promising strategies are prioritized for implementation through a *phased approach*, which included immediate, short-term and long-term implementation, (see Table 2.4).

Table 2.4: Phasing of "promising" measures

Category	Feature	Achieve measure / effect	No. of measures
Already implemented		Before 2010	5
I	Implementation in 2006	Before 2010	6
II	Research in 2006 If research results are positive: implementation in 2007 (or in 2006)	Before 2010	17
III	Research / lobby aimed at the long term	After 2010/2020	6

Source: Rijjnmond Regional air Quality Action Programme, p.p.:18

There are a number of recommended strategies that aimed to reduce emissions related to goods movement. The following strategies were related to port/maritime activities.

Table 2.5: Recommended strategies relate to port/maritime activities

Shipping
▪ Support for existing and future policies and legislation; ▪ Shore side electricity; and ▪ Development and implementation of emission control technologies.
Trucks and Road Haulage
▪ Intelligent loading; ▪ Clean vehicles; ▪ Clean vehicle technology.
Rail
▪ Conversion of diesel to electric long-haul locomotives ▪ Cleaner EU emission standards for locomotives

Source: Houben, R., *"Air Quality and climate change: involvement of Port of Rotterdam Authority"*, 2nd HAQCC Conference, Rotterdam, 2008.

The Rijnmond Regional Air Quality Action Programme incorporated all the measures introduced on the 8th of November 2005 in the "Plan of Approach to Air" by the Rotterdam Port Authority. The coordination between the two programmes was assured with the participation of the project manager of the PA's proposal plan in the Rijnmond Regional Air Quality Action Programme project group.

○ *Air quality – What was the challenge about **"shipping"**?*

Elaborating the results for the **"shipping"** strategies introduced by the Rijnmond Regional Air Quality Action Programme some considerations should be highlighted:

The measures for shipping were subdivided into two sectors operating internationally: seagoing shipping, and inland shipping. It was suggested that they were adopted in regulations and/or supported by subsidy instruments - for example, the ratification of international treaties on seagoing shipping (IMO/MARPOL) and, in addition, EU policy/legislation on inland shipping.

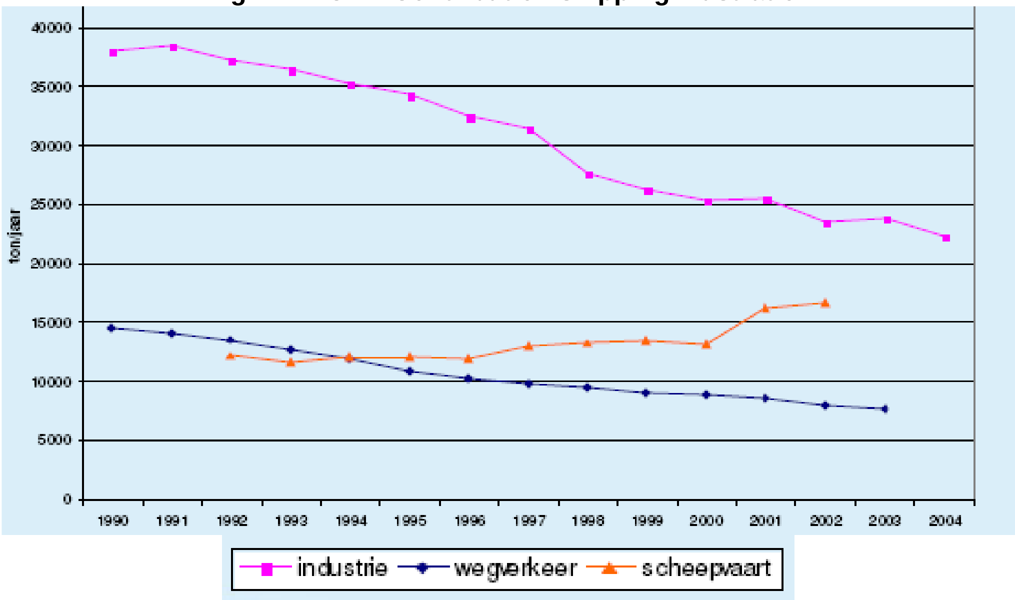
A second consideration was the timeframe for achieving effective measures, as most measures could not be implemented in short term and, moreover, they had the greatest impact on NOx emissions and less on the emissions of PM10.

Based on the fact that it was not possible to give an unequivocal picture of the most promising measures for air-quality improvement, a list to be used as a rough guide was introduced according to the Rijjnmond Regional Air Quality Action Programme:

- existing and future policy and legislation
- shore-side electricity for specific categories of ships in the port with high cost-effectiveness (€/prevented kg NOx of particulate matter)
- developing (end of pipe) techniques
- applying existing (end of pipe) techniques.
- Another important remark was the suggested combination of incentives from the region and those from the central government. The provided budget by the Ministry of Housing, Spatial Planning and the Environment, for the installation of NOx catalytic converters and soot filters in inland ships, was considered of vital importance for reducing emissions from inland shipping, but it was only sufficient for emission-reducing measures in a part of the Dutch fleet. Air quality

improvement could be provided by a scheme with sufficient financial scope to equip the entire Dutch fleet.

Fig 2.7: NOx – Contribution shipping illustration



industry traffic shipping

Source: Port of Rotterdam

2.3 Noise pollution

Noise management of seaport areas can be seen as part of the integrated noise management efforts in urban (cities, municipalities) and industrial areas. Noise environmental impact in a port area can be produced from a wide variety of sources, such as industry, shipping, cargo handling, hinterland transport, maintenance, etc. Noise emissions have been found to negatively affect the PoR's surrounding, having a serious negative impact on health (DCMR, 2004). As the port of Rotterdam is situated in the vicinity of residential areas, noise has had continuous attention. High noise levels exist in the port area, particularly close to the road- and rail-based hinterland connections, while industry noise is also prominently present in the port area.

2.4 Water & Soil contamination

The presence of industrial activities led to soil contamination in many areas in the port and thus, in the early 1990s the port paid particular attention to this environmental issue and pursued a specialized policy which aimed to maintain the soil quality of industrial sites. The policy was based on a case-by-case approach of soil pollution for each industrial location, while the port's leases ensured that after their use, the sites would be delivered in their original condition.
The improvement of the soil quality has been an important point of attention in the port's daily practice. In 2002 within the framework of the Existing Rotterdam Area project, the PA initiated a study into the possibilities for the accelerated clean-up of soil contaminations, (RMPM, Annual Report 2002). In 2003, discussions were ongoing with public authorities and the business communities regarding an integral approach to the existing soil contamination in the port and the industrial complex, (RMPM, Annual Report 2003). In 2004, as a result of the introduction of the so-called 'Bedrijvenregeling' (Company Arrangement) a subsidy -of up to 35% of the decontamination costs- was obtained. PoR initiated studies of an integral approach to the problem, which formed the basis of decision-making for the next years. (RMPM, Annual Report 2004).
In 2006, the PA developed a soil policy approach, that combines area-focused management of groundwater with site-focused management of the upper soil layers. Organizational, legal and financial preconditions were explored in a project implemented in Botlek testing the feasibility of the policy, (PoR, Annual Report 2006). Groundwater monitoring took place in the entire port area and in 2007 a pilot project was started to test the natural capacity of the soil and groundwater to break down contamination. Since 2009, PoR has reassessed its 1992 soil policy due to the introduction of

the European Groundwater regulation, which placed requirements on the spread of polluted groundwater. Following the normative requirements, the PA has focused on an area-specific approach towards soil pollution and groundwater policy, thus area-directed groundwater management has been introduced for the cleaning of pollution.
In 2010, the municipality of Rotterdam formulated administrative arrangements (Bestuurlijk Arrangement). This laid down the vision for area-directed groundwater management in the city and port. The PA gave greater substance to groundwater management and implemented a policy for area-directed groundwater management, starting to monitor and tackle deep groundwater pollution (from depth of four metres below ground level) in the part of the port area that is the most polluted, with the aim to prevent deep pollution from spreading beyond the boundaries of the port area. The control of the groundwater pollution on an area basis, started in the Botlek area, supported by the Ministry of Infrastructure and Environment, which granted EUR 5 million. External consultants (Deltares and Royal Haskoning) carried out three surveys which finally produced an adequate monitoring programme.
Compared to the rise in the number of shipping movements, Rotterdam was and remains an extremely safe port. With the **Safety Environment Index** (SEI) the PoR measures to what extent the safety and *environmental rules* are complied, in accordance with the Harbour Master's Covenant, Central Government and the Municipality standards. Environmental inspections are divided into: MARPOL inspections (seagoing shipping); and under the Environmental Management Act (WM) into bunker inspections (inland shipping). By structurally monitoring the compliance behaviour of ships and companies, PoR is able carry out more targeted inspections, which secure that safety and environmental standards can be maintained at the desired level and improved where necessary while reducing the number of inspections (PoR, Annual Report, 2006).

- **Bunkering and oil pollution**

Oil or chemicals may end up in the water when bunkering oil, transferring or for other reasons. In the Port of Rotterdam, spills regularly occur. However, the number, of spills by seagoing and inland vessels, has been notably decreased over the years. Compared to the number of spills in 1993 (600 spills) the occurrence has dropped at almost two third. PoR evaluates its performance compared to the standard of 250 instances of water pollution and works both preventatively (inspections) as well as correctively (prosecution) (Den Boer & Verbraak, 2010).

Table 2.6: Number of Oil Spills per year in the Port of Rotterdam

2005	***2006***	***2007***	***2008***
334	284	289	193

Source: PoR, Annual Reports 2006, 2009

The Netherlands government has a national contingency plan for oil spill which was adopted in 2006. In the Netherlands, oil spill response is the responsibility of the ministry of Infrastructure and Environment, however PAs are responsible for spills within their port limits. The Schermenpool ('Screen pool') for the Rotterdam Port Area was founded together with the companies which are joined in Deltalinqs and the Fire Department. The goal is an optimal availability of materials to barrier off spills (PoR, Annual Report 2006).
The PoR activities are directed to prevention and control of oil spills. In case oil spill occurrences, they will try to keep the environmental damage (water and sediment) to a minimum. An example of how PoR tries to prevent spills is through the Bunker checklist. Ships engaged in tanking procedures have to adhere to a number of precautionary measures to reduce the risk to a minimum, controlled by the port master. This Bunker checklist describes the necessary precautionary actions to be taken prior to bunkering, (Den Boer & Verbraak, 2010).

2.5 Port Waste

In 2002, the European Directive no. 2000/59/EC, on port reception facilities for ship waste and cargo residues (OJ L 332), came into effect. Under the Directive it was obligatory for ships to discard their waste products at port designated waste reception facilities. The purpose was the further reduction in discharges of ship waste and cargo residues into the sea, constituting a further tightening of the MARPOL Convention. **Waste reception facilities** have been installed by the PoR, and ships are obliged to pay a fee for waste disposal, whether they do or do not make use of the

waste reception facilities, depending on their engine size. A limited garbage disposal (small chemical, household garbage, plastic) of 3-6m^2 also depending on the engine size is free of charge. Ship oil waste products are handled by indirect financing. A ship pays a fee for every port call and receives a subsidy upon the disposal of oil. All ships have to notify PoR about their wastes (substance, quantity) and their capacity for waste storage. In both cases, garbage and oil disposal is frequently promoted for further processing. PoR is in charge of the waste disposal appointment and of the redistribution of financial means. The waste is collected and processed by commercial parties (Den Boer & Verbraak, 2010). The PA performs a number of supervisory tasks and, with its capacity as manager of the indirect financing system, is able to carry out checks on the correctness of the statements and the correctness of the quantities and types of ship waste, cargo residues and harmful substances actually delivered. The Housing, Spatial Planning and the Environment Inspectorate (VROM-I) supervises compliance with the environmental legislation, regarding the collectors with mobile collection facilities (lorries and barges). The provinces are responsible for the supervision of waste processing installations and stationary collection facilities. For the Rijnmond region, this has been delegated to the DCMR Environmental Protection Agency Rijnmond.
In 2006, PoR modified twice the indirect financing system for ships' waste. At the beginning of the year, a basic tariff was introduced for ships that had disposed their oily waste in another European port before arriving at Rotterdam, while halfway through the year, the amount paid to firms for collecting oily waste was increased. These measures were successfully giving an additional impetus to ship waste disposal, (PoR, Annual Report, 2006).
The problem of invasive species in ships' **ballast water** is largely due to the expanded trade and traffic volume over the last few decades and, since the volumes of seaborne trade continue to increase, the problem may not have yet reached its peak, (www.imo.org). In 2004, the IMO International Convention for the Control and Management of Ships' Ballast Water and Sediments, describes, where and when ballast water discharging is allowed to take place. The Netherlands signed this convention in 2005. PoR has not set any additional measures to control ballast water discharges in the port area, (den Boer & Verbraak, 2010).
Regarding **hazardous substances**, PoR has reception facilities for oily and chemical waste. Spills of hazardous materials must be reported immediately and equipment is available to allow for speedy clean-up. These emergence situations are dealt, based on the 'polluter pays' principle which requires that those engaged in disposal or incineration at sea bear the cost of meeting the pollution prevention and control requirements for the authorised activities (Salomons & Gandrass, 2001).
Under the Basel Convention, exports of hazardous waste from the EU to non-OECD countries are prohibited. To detect hazardous waste as mandated by law, in 1999, a powerful scanner was introduced to detect the contents of containers travelling through PoR. More than 5 million containers pass through PoR annually and about 80 per day are X-rayed. Images obtained are compared with the description of the product on the consignment note. However, it is impossible to check every container. Dutch Environment Enforcement Agency observed that exporting waste through European ports has become common. There is no accurate database on waste shipments, unless such containers are detected and enforcement procedures are launched.

Recycling campaigns in the port of Rotterdam were initiated in the form of recycling clusters since 2000. Rotterdam is the largest scrap iron European port. The port's scrap iron companies are clustered in the Botlek area for reasons of infrastructural and operationally efficiency. The port has also attracted companies that recycle car tires and household as well as industrial waste which can be reprocessed to form reusable materials and new products
The first of them, the Europort, was a local recycling cluster initiated in 2000 and various companies were engaged in composting, shredding car tires and converting plastic foil into granulate. Since that time, in the Waalhaven area, a private company (Terlouw Recycling) has opened a Regional Environmental Technical Center and there have also been various companies activated in recycling and ship waste management. Various recycling initiatives have been studied and realized within the port and industrial complex, and continue to increase in scale and professionalization.

2.6 Port development – MAASVLAKTE 2

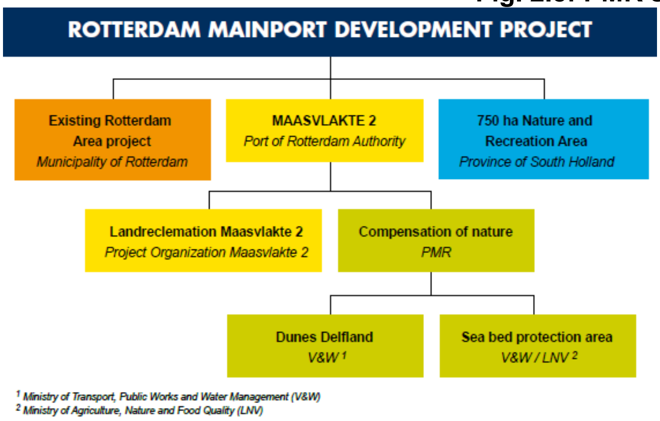
"This is an extremely important agreement. The expansion will give businesses the opportunity to grow in Rotterdam. Maasvlakte 2 will be an excellent location. Right on the sea, with good hinterland connection and in time –in conjunction with the current increase in capacity on Maasvlakte 1– to accommodate the ongoing growth in Rotterdam.", (Willem Scholten, PoR CEO, 2004) (*).

(*) Port of Rotterdam website, http://www.portofrotterdam.com/en/news/index.asp, 25 June 2004

Maasvlakte 2 is part of *Mainport Development Rotterdam Project* (PMR). PMR was started in 1997. The project explored the alternatives for expansion and the influences on the quality in the surrounding living environment, and it was a joint venture between various ministries of the Dutch Government, involving three components, which developed in conjunction with one another:

1) The construction of Maasvlakte 2 - the Maasvlakte 2 was a necessity primarily based on economic grounds, to support the future growth and competitiveness of the port itself and the wider Dutch economy, (Gibs, et.al., 2008). Port of Rotterdam Maasvlakte 2 is a key port expansion, enlarging the Rotterdam port area by 20%. In 2009, half of the total port area of 10.500ha that can be used for businesses, about 5.272ha was leased by the PA to private operators, (Merk & Notteboom, 2013). The Maasvlakte 2 extension consists another 1000ha leasable land immediately to the west of the current Rotterdam port area, with the first terminal expected to be open for business by 2013-14.
2) A number of projects geared- to make more intensive use of the existing space in Rotterdam's port area- the sub-project Existing Rotterdam Area (BRG). BRG has been focused on both a more intensive use of the space in the existing port and industrial area (to gain 200ha of space by 2021 through redevelopment, land reclamation and intensified use of port-related functions); and on an improvement of the living environment in the area (e.g. reducing noise, creating small recreational areas etc) (RMPM, Annual Report 2003).
3) The creation of a new 750ha nature and recreation area consisting of three sites located in the north and south of Rotterdam.

Fig. 2.8: PMR's sub-projects



Source: Hommes, 2006

The original plan for the Maasvlakte 2 was conceived in the early 1990's. Since the end of the decade, the importance of port development has been underlined by different public actors (Edelenbos et al, 2005). In 1998, the PA's draft plans and documents with an environmental impact statement, including the plans for the PMR, were consulted extensively and were open to public participation. The PMR project followed the decisions made within a planning procedure called Key Planning Decisions (PKB).

Size of port development (ha)	Cost	Size of Mitigation / Compensation (ha)	Cost of mitigation/ compensation	Designated site status	Tiers of governance	Legal body
1000ha	€3bn	25,000ha sea bed protection area; 58ha of land-based compensation	€45m	SPA SAC	EU National Regional Municipal/ Provincial	National Council of State

Although the construction of the Maasvlakte 2 received early political approval, in 2003, the final draft of the planning application, appealed from a range of stakeholders (NGO's companies, people living near the areas of the proposed site), objecting to various elements of the application. In addition, as effects on a priority habitat (grey dunes) were expected, in 2003, the European Commission (EC) was asked for advice on this matter with respect to Article 6.4 of the EU Birds and Habitat Directive. The EC issued a positive opinion and supported the Maasvlakte 2 project on the basis of overriding public interest, stating that no viable alternatives to the expansion existed. *"As not much was known about the requirements for this procedure, informal meetings with the EC helped to ensure that, within the development of the plan, steps were taken and studies made in accordance with the requirements of the Directive"* and *"in principle it was a go-ahead for the project, taking into account required monitoring and the timely implementation of the mitigation and compensation promised"*, (de Wit, 2005).

In 2005, the Council of State held a number of objections which concerned insufficient research conducted into various areas, especially the potential environmental impacts. One particular appeal which was upheld, was that of the National Fishers Product Organisation (Produktschap Vis) who argued that, the impact of Maasvlakte 2 on fish larvae transport to the Wadden Sea (Waddenzee) had not been sufficiently investigated (Paralia Nature, 2005). The main uncertainty in this research case, concerned the extent (in distance and time) of the required 'appropriate' assessment and the project's realization has been further delayed, (Mink & Hoenders, 2007).

In 2006, a Strategic Environmental Assessment was implemented estimating the impacts of the land reclamation on the European designated sites. The environmental effects were assessed and habitat baseline studies were also commissioned to assist in monitoring future impacts on protected species within the specific designated ecosystems (Hommes, et.al.,2009). Exactly where and according to which conditions the three subprojects can be finally executed has been set down in the KPlD, which came into effect in 2006 (approved by the Dutch parliament).

In 2007, two Environmental Impact Assessment (EIA) reports were also completed for two major elements of the Maasvlakte 2 project: 1) construction and 2) zoning and land-use

Maasvlakte 2 project - Environmental Impact Assessment

Maasvlakte II project – EIA reports	
EIA for construction	**EIA for zoning**
assessments of the effects of sand extraction and the possible impacts of the development on North Sea	possible effects on the surrounding area, e.g. traffic volumes

Source: PoR and Maasvlakte 2 Organization, 2008

After a last round of consultation on the possible side effects of the Maasvlakte 2 construction, the Government, the Municipality of Rotterdam, the Province of South-Holland, Rotterdam Metropolitan Area and PoR concluded to an agreement on how all three PMR projects will be financed. Construction was scheduled to start in 2008. According to the agreement, the State will take a 33.3% interest in the Port of Rotterdam. The municipality of Rotterdam will retain the remaining 66.7%. *"This participation by the State is a sign of the port's national importance",* (Willem Scholten, PoR CEO, 2004). PMR aimed to improve both the economy and the quality of life in the Rotterdam region, but the most important task was the timely creation of sufficient space in the port to enable the growth of the container, distribution and petrochemical sectors in Rotterdam and to meet future industrial housing requirements. The PoR was responsible for the construction of the new harbour area and the national government for the associated mandatory nature compensation. The province of South Holland has responsibility for the 750ha of nature and recreation area, while the Municipality for the sub-project Existing Rotterdam Area (BRG).

<table>
<tr><td colspan="6">Mainport Development Rotterdam Project (PMR)</td></tr>
<tr><td colspan="2">Existing Rotterdam Area project
Municipality of Rotterdam</td><td colspan="2">MAASVLAKTE 2
Port of Rotterdam Authority</td><td colspan="2">750ha Nature and Recreation Area
Province of South Holland</td></tr>
<tr><td></td><td colspan="2">Land reclamation Maasvlakte 2
Project Organization Maasvlakte 2</td><td colspan="2">Compensation of nature
PMR</td><td></td></tr>
<tr><td colspan="2"></td><td colspan="2">Dunes Delfland
PMR / Public works and water management</td><td colspan="2">Marine protection area
PMR / Public works and water management</td></tr>
</table>

The Effects of the Maasvlakte 2 project

The expansion of the Maasvlakte, by means of land reclamation, was known to have possible consequences for the natural environment in the North Sea. The project was planned in a Natura 2000 designated area and had implications for three sites designated as Special Areas of Conservations (SACs) and Special Protected Areas (SPAs) (Voordelta, Voornes Dunes and Kop of Goeree). The areas were designated in the framework of the European Birds and Habitats Directives and they were also part of the national 'Ecological Main Structure' of the Netherlands, as set forth in the Green Space Structural Plan. The project's environmental reports described the consequences of various sub-projects for protected nature, recreation and the environment, and, apart from these, have stated how any negative consequences could be mitigated or compensated.

Table 2.7: The cause and effects of the PoR Masvlakte 2 port intervention

cause	effect	cause	effect
construction of port land at sea	**damage of protected natural resources**	**land reclamation**	**loss of marine life reduction of the quality of the Voorne and Goeree dunes**
MITIGATION MEASURES		**COMPENSATION MEASURES**	
• Losses of shallow coastal sea must be limited by constructing a minimum corresponding length of soft sea wall, including underwater shore, at the reclaimed land. • The ultimate design of the reclaimed land should not have any additional negative effects on natural resources and not cause any additional damage to the Voorne and Goeree dunes. • For the operational design of the reclaimed land, effort must be made to take mitigating measures, which would not affect other preconditions such as coastal safety, marine aspects and the environment.		• Compensating the loss of marine life, a marine conservation reserve of 31,250ha in the Voordelta has to be established. • Compensating the damage to the dune landscape of Voorne and Goeree, a 100-hectare dune area on the seaside of the coast between Hoek van Holland and Ter Heijde, has to be constructed, with the construction of a 15-hectare strip of sea at Brouwersdam and an 8- hectare strip of sea on the land reclamation.	

Source: Paralia Nature Report - Phase II, 2005

Maasvlakte 2 is constructed in the Voordelta.
A large seabed protection area (25,000 ha) will be created at a site in the North Sea to the southwest of the reclaimed land, to compensate for the loss of a portion of the existing seabed.
The seabed protection area will offer a resting place for various species. In addition, fishing that disturbs the sea bed will be banned in this area.
A new dune area will be realised to the north of Maasvlakte 2, between Hoek van Holland and Ter Heijde. This area will be developed in compensation for the changes afflicting the local flora in the Voornse Duinen. The new dune area near Hoek van Holland will be about 35 ha.

The nature compensation projects for the sea and the dune landscape are separate from the development of the three new recreation areas on the edge of Rotterdam, which together cover a surface of some 750ha. The latter were part of the PMR umbrella project, which also included the Maasvlakte 2 project.

2.7 Biodiversity & Conservation

The area of the protected Natura 2000 sites designated on the Dutch coast, exceeds three times the ones located inland (EU Maritime Policy: "*Facts and Figures-The Netherlands*"). The port of Rotterdam is situated in an urban area and only a limited part of this area is bounded by nature. Since the late 1990s, mostly based on the experience gained by the Maasvlakte II planning and triggered by the evolved legislation on natural conservation, PoR has been committed to sustain its narrow natural environment.

Legislation on Nature in the Netherlands	
Nature Conservation Act (1998)	**Flora and Fauna Act** (2002)
• The Act centres on an area protection regime, containing rules to protect nature and the landscape. The Act also lays down a duty of care for everyone in or dealing with nature areas. • It contains a coordination regulation for Natura 2000 areas.	The Act regulates protection regimes for certain plant and animal species. About 500 species are protected under this Act. The aim of the Flora and Fauna Act is to preserve these plant and animal species which still occur in the wild.

The PA has kept a close watch on the consequences of the Nature Conservation Act 1998, with the construction and intended use of Maasvlakte 2, and initiated various projects in the existing port area, aiming to enhance the quality of the local and regional living environment (PoR Annual Report, 2005). The port's location along the Rhine and Maas rivers' estuaries, subtends an exceptionally high range and number of species. The developments related to the Birds and Habitats Directives and legislation linked to the Natura 2000 designated areas were of significance for the PA, within the scope *to "identify the opportunities and threats for the development of the port and to act accordingly"*, (PoR Annual Report, 2006:34).
Since the mid-2000s, the PA has been working with the concept of *'temporary natural environments'*. The aim was the latter to interfere with the port function without disturbing it and for this reason, in close cooperation with the Ministry of Agriculture, Nature Management and Food Quality, new policy strategies were developed in this area during the course of 2006 (PoR, Annual Report 2006). For any port activities affecting natural features, the PA has been committed towards a code of conduct which was drawn up in consultation with the Ministry of Agriculture, Nature and Food Quality. By the end of the 2000s' decade, PoR *"was aware of the unique and often protected natural features of the Rotterdam port area"*, (PoR, Annual Report 2009:46) and undertook management actions protecting plants and animals within the frameworks of the Flora and Fauna Act.

3.0 COPING WITH ENVIRONMENTAL ISSUES IN THE PORT AREA

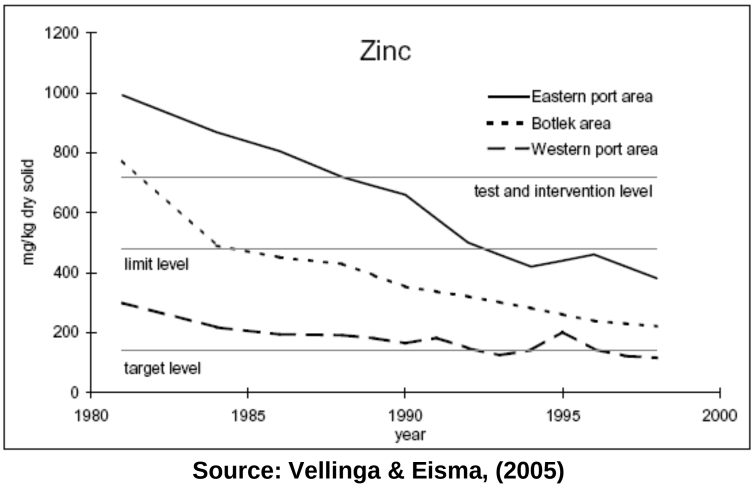
3.1 Managing dredging and disposal of dredged material

Since the mid-1980s, the RMPM's policy has aimed at solving the problem of contaminated dredged material at the source, by preventing contamination.

o ***Rhine Research Project** (**POR**) of the Rotterdam Municipal Port Management (1984-1999)*

The Rotterdam Municipal Port Management (RMPM) launched the '**Rhine Research Project**' (**POR**) in 1984. This project was especially aimed at identifying direct discharges along the Rhine and reducing them.Agreements with major discharging companies were successfully reached in the following years, resulting in significant reductions in point discharges and in a significant improvement, with regard to the quality of the Rhine water and, consequently, to the quality of the dredged material in the port of Rotterdam (Figure 3.1). The volume reduction of sediments deposited every year in the Slufter (from 10 million m^3 to 3-4 million m^3 per year) proves part of the project's efficiency, (Zanetto, et.al., 2002). However, for a number of contaminants, the target values have not been met, the Rhine river management interests tended to shift to other issues.

Fig 3.1: An example of the reduction of contamination in the different areas of the port



Source: Vellinga & Eisma, (2005)

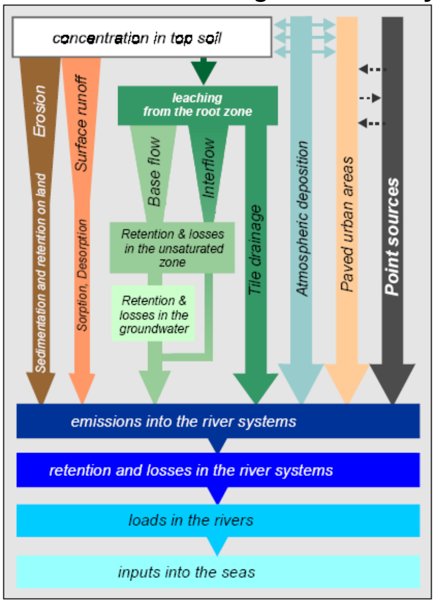
In the late 1990s, the concentrations in the eastern and middle part of the port of Rotterdam approached the values found in the Wadden Sea in the previous time period, showing the drastic decrease of inputs from the Rhine. In fact, the concentrations in the Europort were at the background level and the concentrations along the coast showed a tendency to a slight increase, for which admixture of older (still contaminated) sediments can be an explanation. In the Wadden Sea itself, there was no difference anymore between the eastern and the western part, concentrations were at background levels.

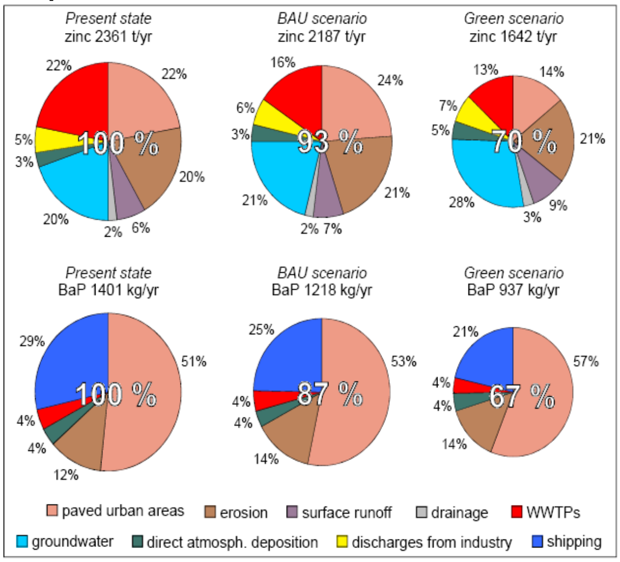
o ***Rhine research project II*** *(**POR II**) of the Rotterdam Municipal Port Management (1999-2015)*
By the end of the 90's, the majority of dredged material from the eastern port areas and partly from the Botlek area still had to be disposed in the Slufter. In order to also eliminate contaminants coming from diffuse sources, the '**Rhine Research Project II**' (**POR II**) started in 1999.
Further improvement of the dredged material quality in the port is worked on in this project, as the main objective of the 'POR II' is to ensure that all dredged material is sufficiently clean by 2015, in line with the concept of a sustainable port and region in which port activities take place. The final goal is to obtain dredged material that can be reused by 2015, (Zanetto, et.al., 2002); in other words, all dredged material should be clean enough, either to be relocated in the North Sea or to be beneficially used. Key concepts in this project are emission control, harmonisation of water and sediment policy and a shift *towards integrated sediment management*. (Vellinga & Eisma, 2005).

o Projects as parts of the on-going POR II – The PorII project
➢ *Sediments from the Rhine catchment area – Emission control, a shift to diffuse sources*
In 2001, a *supplementary project commissioned by the Rotterdam Municipal Port Management (*RMPM) as part of the on-going POR II, was carried out in a German-Dutch alliance of research institutes: *"Dredged Material in the Port of Rotterdam – Interface between Rhine Catchment Area and North Sea",* (GKSS Research Centre**,** published: 28 February 2001). The project raised the question: *how the contamination of dredged material will develop in future and whether it will reach levels that allow its relocation to the North Sea.*
The main objective of the study was to quantify inputs from point and diffuse sources in the Rhine catchment area and to analyse their current and future impact on sediments/dredged material quality using scenarios with a time horizon of 15 years, (GKSS Research Centre**,** 2001). The project has given an overview of the point and diffuse sources in the Rhine catchment and identified their past, present and future inputs and how sediment quality should been determined; the present and future regulatory bodies that are relevant for dredged material as well their proposals for "new priority chemicals; and finally focused on the issue of hazard assessment of contaminated sediments/dredged material through new methodologies and their relation to risk assessment at the disposal site. All the above described issues, have been evaluated as directly related to current and future policies and regulatory frameworks concerning: *water and sediment quality targets for rivers*, especially the Rhine, and the North Sea; *emission control*, which influences directly or indirectly the sediment quality of the Rhine; *dredged material management*.

For this purpose, a model of two types scenarios for the time period until 2015 that use a geographical information system (MONERIS, Fig:3.2), was developed, for quantifying nutrient emissions along the various pathways in river basins. MONERIS incorporates digital maps as well as data on land use, soil types, waste water treatment etc. Contaminant-specific information such as emissions from point sources, concentrations in top soils, atmospheric deposition were gathered and used as input data. The inputs for heavy metals, PolyChlorinated Biphenyls (PCBs) and Polycyclic Aromatic Hydrocarbons (PAHs) from different sources and their contribution to contaminant loads in the Rhine system, were quantified and linked to the *quality of sediments/ dredged material in the port of Rotterdam*. Subsequently, two types of scenarios were modelled, taking the late 1990s state as a starting point, until 2015 and thus, the changes in modelled future inputs in the Rhine basin were extrapolated on the development of the quality of sediments in the eastern parts of the Port of Rotterdam and were compared to the current Dutch quality criteria for relocation of dredged material to the North Sea. *The study elaborated the shift from point to diffuse sources* and the main results are presented in Box 3.1.

Fig 3.2: Pathways and processes in MONERIS





*Results of the scenario analysis for **zinc** and **benzo(a)pyrene** inputs in the Rhine basin upstream Bimmen/Lobith*

Source: GKSS Research Centre, *"Dredged Material in the Port of Rotterdam"*, 2001.

Box 3.1: The POR II project main results

- Pathways incorporating the highest reduction potentials for copper, zinc and cadmium are inputs from urban areas, from wastewater treatment plants and to a lesser extent erosion from agricultural areas. *PAHs*, are mainly released by combustion of fossil fuels and related processes resulting in elevated atmospheric deposition rates in urban areas. *PAH inputs by shipping* (releases by ship paints, spills) c*ould* not be quantified in satisfactory manner and cause a larger uncertainty in the modelling results for PAHs than compared to heavy metals.
- New PCB inputs are mainly driven by atmospheric deposition, re-emissions from soils becoming more important. Major pathways are paved urban areas and direct atmospheric deposition on surface waters.
- *An issue of special importance for PCBs* is the *'historic' contamination of sediments in the Rhine basin*. The study highlighted that, as new inputs of PCBs will continue to decrease, the relative contribution of 'historically' contaminated sediments to PCB loads in the Rhine basin will gain in importance. This process, is governed by re-erosion during high water discharges, by relocation of dredged material stemming from w*eirs and locks in the upper* Rhine o*r tributaries of the Rhine and related retention and los*s processes.
- *Average annual TBT concentrations in 19*96 of su*spended solids increased from 0.01 mg/kg in Lobith (Dutc*h/German border) to 0.104 mg/kg in Maassluis, situated a few kilometres downstream of Rotterdam. The majority of TBT emissions are caused by the larger ship classes (> 100 m); the relatively large number (46%) of small ships contribute only 6% to the estimated total TBT emissions.
- As part of the stud**y,** *TBT* emissions from *ships in the port of Rotte*rdam and *related concentrations in sediments were estimated by u*sing the MAM-PEC model (Marine Antifouling Model to Predict Environmental Concentrations) for different environmental scenarios. Predicted environmental concentrations (PECs) for TBT in sediments of different harbour sections were in the range 0.7 - 1.6 mg/kg, reaching maximum values of 2.2 to 2.8 mg/kg in poorly flushed regions. These concentrations are not exceptional compared to other sea ports.

Source: GKSS Research Centre, *"Dredged Material in the Port of Rotterdam"*, 2001.

The outcome of the POR II project was presented on the 4th International Rhine Conference in Rotterdam (22-24 November 2000), organised by the International Commission for the Protection of Rhine (ICPR) and the Rotterdam Municipal Port Management. The conference was attended by experts from national and international organisations, e.g. the OSPAR Commission, the EU-Commission, environmental agencies, research institutes, PAs, industry and non-governmental organisations. It was acknowledged that in the past years, much had been achieved concerning the reduction of inputs from point sources, but inputs from diffuse sources were still of concern. To ensure feedback from both the science and the policy community, as part of the POR II project, two international workshops were organized with the main theme 'River Sediments and Related Dredged Material in Europe' (Table 3.1).

Table 3.1: International workshops as parts of the POR II project – POR II

Science-Oriented Workshop:	Date
Scientific Background from the Viewpoints of Chemistry, Ecotoxicology and Regulations;	31 August 2000
Policy-oriented workshop:	
River Sediments and Dredged Material as Part of the System Catchment-Coastal Sea: Policy and Regulatory Aspects.	17-19 April 2000

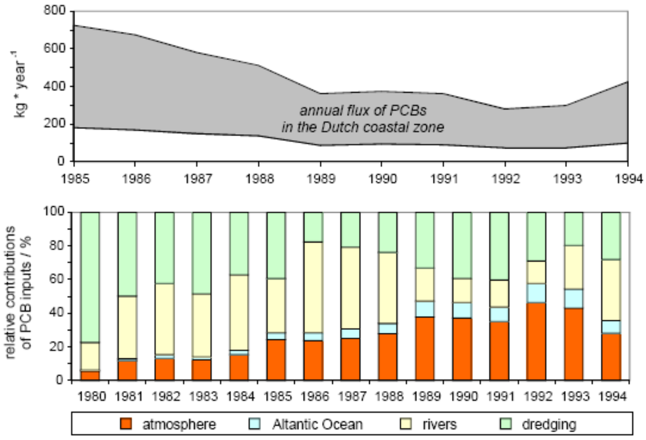
- The Sediment Network '**SedNet**'

A spin-off of these Por II project workshops is an initiative for a European, stakeholder demand driven, **Sediment Network** '**SedNet**', a European network aimed at incorporating sediment issues and knowledge into European strategies to support the achievement of a good environmental status and to develop new tools for sediment management. The Dutch TNO and the Port of Rotterdam were between the founding members. The Network SedNet was promoted by the EU, and in its initial phases questions related to handling contaminated sediments were discussed over a period of 3 years. In 2004, a guidance document and comprehensive status reports were in place.

- **Management of historic contaminated sediments** (in the river basin scale)

The port of Rotterdam fully supports the Dutch policy of reducing the amount of contaminated dredged material that has to be stored. In this perspective, the PA's activities are mainly focused on source control, (Vellinga & Eisma, 2005). Notable improvements have already been achieved in the Rhine basin, the port of Rotterdam, as well as in the North Sea, since the 80s. For the Dutch coastal zone, this is exemplarily depicted for particulate PCB concentrations (Fig 3.3).

Fig 3.3: Decreasing contribution of PCB inputs from dredged material in the Dutch coastal zone



Source: Laane et al., (199)

Several organisations were involved in identifying 'chemicals of concern' in the North Sea (Oslo and Paris Convention) and in European river basins (European Water Framework Directive), among the most important being, that the relocation of *dredged material in the North Sea needs to be considered in the whole framework of sediment movement combined with the inputs of contaminants from various sources*. This complex system, comprises the national, European and international level of policies and regulations.

The current Dutch criteria, concerning the relocation of dredged material, both on land and in the sea, were formulated under the 2002-2004 revision, based on ecological and chemical criteria, including the tributyltin (TBT, an antifouling agent) that received a lot of retention; these issues are expected to influence dredged material management in the future (Hakstege & Heineke, 2008).

According to Vellinga and Eisma (2005), - both policy advisors for the Port of Rotterdam-, "efforts to improve sediment/dredged material quality should include the assessment of biological, physical, chemical and economic factors, which implies the need for integration of stakeholders in the decision-making process. The port of Rotterdam has adopted this shift in thinking, mainly because the port had to deal with enormous amounts of contaminated sediment that came along with the river Rhine that links the port to its hinterland, (Vellinga, 2004). Knowledge was developed on the contaminant sources and the pathways, under the Por II project - POR II and based on that knowledge:

- agreements on the reduction of the input of contaminants up to 90% were made with parties that discharged polluted effluents into the river and its tributaries, upstream;
- awareness campaigns were organised to involve other stakeholders -to make them understand the relation between their behaviour in the Rhine catchment with regard to diffuse sources of pollution and the ecological status of the river, the North Sea.

The new way of thinking in the Port of Rotterdam, respects the fact that the elements in the system are connected, and that efforts to maintain and improve the ecological status of water bodies need to be co-ordinated on that scale (Vellinga, 2004).

- **Disposal and beneficial use of dredged material**

Although there is a distinct reduction of contaminants in dredged material, disposal of contaminated dredged material is, even today, necessary. The Slufter, this enormous permanent disposal site for dredged material, is still in use. Due to the efforts put into source control, there is still available space in the Slufter for contaminated dredged material (according to the present norms) up to 2025. As far as disposal is concerned, the policy of PoR has always been based on the economical use of space in the Slufter that could assure the continuing process of dredging and disposal of dredged material and thus, the port's function, although, the measures for disposal can have large consequences for the economical position of the port (Vellinga & Eisma, 2005).
Port of Rotterdam activities for the beneficial use of dredged material: In the Netherlands, the relocation of dredged material is governed by the concept of beneficial use, which is laid down in the Dutch Soil Quality Decree. Following the Dutch environmental policy, the order of preference of destinations for dredged material is: relocation, direct reuse, and treatment for beneficial use and, in the end, disposal (Hakstege & Heineke 2008). There are two options for the dredged material that is too contaminated for relocation: treatment for beneficial use or disposal. Only a small part of the contaminated dredged material is treated, mainly by sand separation at locations near confined disposal facilities (CDF's). In 1992, the RMPM started with the extraction of the clean sand out of the material that was brought into the Slufter. Since 1993 *sand separation* has been common practice at the Slufter disposal site (Fig 3.4).

Fig. 3.4: Sandy dredged material

Source: Vellinga, & Eisma, (2005).

Also, since the late 90's, *clay-fields* have been constructed at the Slufter site. In 2005, a study was carried out into the use of alternating layers of sand and clay (out of dredged material) in a construction (road embankment or raise). The civil-engineering aspects were investigated. The future scenario investigated was the possible use of the so-called "*sandwich constructions*" in the future extension of the port. Another investigation carried out by the RMPM, (some private companies and a company from the UK), was an innovative *thermal immobilisation of dredged material*. For the RMPM, the focus was mainly on a recycling factory in the Port. Besides dredged material, other additional substances were necessary for the process. "Because of the treatment and disposal cost of these additional substances otherwise and because of the economical heat consumption, this method can be relatively cost-effective for dredged material and the additional substances and is still in the test stage" (Vellinga T. & Eisma M. 2005).

3.2 Air quality

- **Air quality and climate change**: *Port of Rotterdam (PoR) involvement*

The “Plan of Approach to Air by the Rotterdam Port Authority” (2005), was the first comprehensive effort of the PoR to confront the air quality issue. This initial effort was pursued by the port’s participation in the: Regional Analysis and information centre Airquality (RAIL); Rotterdam-Regional Action Program Airquality (RAL/RAP); and Rotterdam Climate Change program (RCI).

The issue of air quality demanded a great deal of attention, partly because of European legislation, but mainly because of the way it was implemented in the Netherlands, linking the thresholds for traffic emissions and particulates to the spatial planning tools, thus (this link) manifests itself directly in the assessment of concrete projects in the area of infrastructure, housing and business accommodation, and limits the development options open to the port and industrial complex, (Houben, 2008). The Port Authority has set up an internal Task Force for Air in order to analyse opportunities and threats, develop policy and harmonize activities, both internally and externally. The targets were compliance with air quality regulations; drastically reduce CO_2 emissions; create further room for sustainable growth, (Houben, 2008).

The **Port of Rotterdam approach,** coping with air quality, was organized based on the following target areas: improvement of air quality information; lobby for stricter emission criteria (mainly reduction at the source); and offset emissions from port expansion (Masvlakte II). The PA was involved in various related **projects** (Table 3.2) aiming to reduce emissions, serve as an example and stimulate R&D under three different directions:

Port of Rotterdam Authority
Influence: ++
Effect: - -

Port and industrial complex
Influence: +
Effect: +

Supply chain
Influence: +/-
Effect: ++

Source: Port of Rotterdam

Table 3.2: Port of Rotterdam approach coping with air quality – projects formation

Projects
Port of Rotterdam Authority: Some projects 2006-2010
• TNO emission measurements on PoR-vessels • All our vessels on clean truck diesel fuel (EN590) • New vessels equipped with sooth filters and post combustion treatment • Use of shore side power • Reducing fuel consumption (“saving while sailing”) • “Clean” cars + incentives for clean leasing (now 10% of lease-fleet bi-fuel) • Carbon footprint calculation (ISO 14064-1/GHG)
Port area
• All nautical service providers on clean truck fuel • Shore power for inland vessels (now 25%, rest in 2008 and following years) • Shore side power feasibility studies for seagoing vessels • Clean inland vessel program (CCR 2) • Co-siting to minimise energy consumption • Sustainability in tenders and lease contracts • Carbon footprint monitoring and management • Carbon Capture and storage (CCS) • Development container transferium (inland container terminal)
Supply chain
• Smart logistics (sustainable mobility program) • Modal shift from truck to barge and train (incorporated in lease contracts) • Barge (engine) replacement program • Barge speed reduction program (if needed) • Environmental zoning for trucks *(in discussion)* • Environmental indexing for seagoing vessels *(in discussion)*

Source: Houben, (2008) *“Air Quality and climate change: involvement of Port of Rotterdam Authority”*, 2nd HAQCC Conference, Rotterdam, 2008.

In its first Corporate Social Responsibility (CSR) Annual report - "*Balanced growth*"- in 2007 the PA presented its key focus on the air quality issue and related R&D projects for the coming two years. The main future goals involved CO_2 reduction for the PA's own operations, as well as CO_2 reduction based on the port's obligations by its engagement in the World Ports Climate Declaration and the Rotterdam Climate Initiative (RCI).

- **Rotterdam Climate Initiative** (RCI) - **Rotterdam: CO_2 hub of Europe**

During the 2000s the city and the port of Rotterdam accounted for approximately 25% of all CO_2 emissions in the Netherlands (EU Maritime Policy: "*Facts and Figures-The Netherlands*"). PoR together with the Municipality of Rotterdam, the Rijnmond Environmental Protection Agency (DCMR) and Deltalinqs -companies in the industrial port district "working together"-, started the **Rotterdam Climate Initiative** (RCI) formulating the ambition for Rotterdam to develop into a CO_2-free city and a first-rate energy port: "the world capital of CO_2-free energy", (RCI, 2007). The ambitious objective aims at 50% reduction of CO_2 emissions by 2025, compared to the level in 1990, and has offered a platform for the business community, the authorities, and anyone interested to be involved, to work for a better climate in the area.

To C' or not to C', that's the question:

- A future with economic growth needs sustainability:

without –C's of carbon: 50% reduction in 2025
target Dutch government: 20% reduction in 2020

Source: Rotterdam *Climate Initiative (RCI)*

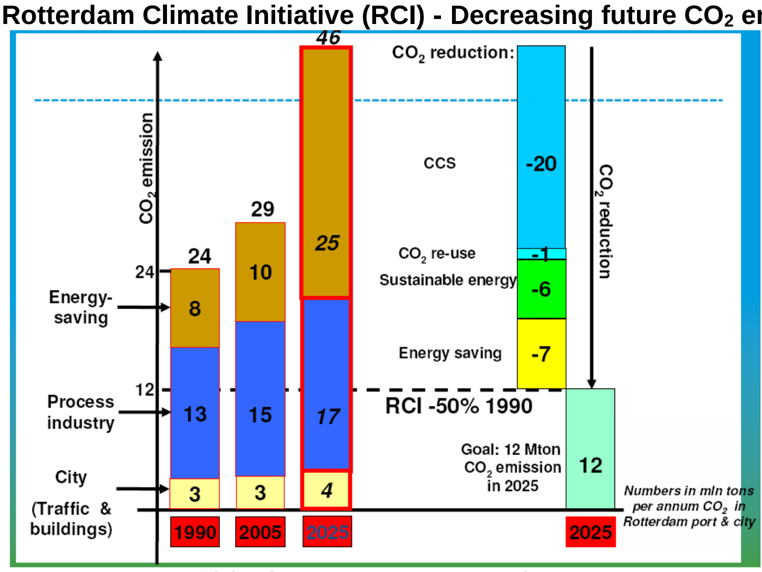
Halving the CO_2 emissions in the city from 24 million tonnes in 1990 to 12 million tonnes in 2025, Rotterdam goes one step further than the national reduction target for 2020 of 30% compared to 1990. The ambitions are of crucial importance and the possibility to become feasible is based on five pillars for action that RCI introduced (Table 3.3):

Table 3.3: Rotterdam Climate Initiative - 5 Pillars

SUSTAINABLE CITY	▪ District heating: 50.000 houses and office buildings
	▪ Energy-efficient buildings municipalities & private houses
	▪ 'Better good copied than badly designed'
ENERGIZING CITY	▪ 3% energy savings yearly (e.g. streetlighting)
	▪ Model role and initiator
SUSTAINABLE MOBILITY	▪ More clean vehicles
	▪ Including shipping, inland and sea
INNOVATION LAB	▪ Energy and sustainable innovation funding: incubators
	▪ One industrial area for close cooperation
SUSTAINABLE ENERGY PORT	▪ CO_2 capture, re-usage and storage
	▪ Biomass and LNG

Source: Jordan, (2007), "The Rotterdam climate case", presentation in the 13th Ph.D. Intensive of the Erasmus International Ph.D. Program on Cleaner Production-Products, Industrial Ecology & Sustainability, at Erasmus University Rotterdam, 24 October 2007

Fig 3.5: Rotterdam Climate Initiative (RCI) - Decreasing future CO_2 emissions



Source: De Hoog, (2008), *"CO2 Capture, Transport and Storage in Rotterdam Rijnmond"*, C40 World Ports Climate Conference, Rotterdam 2008

The reduction of over 30 megaton CO_2 is expected to be realised by energy savings, sustainable forms of energy and for two thirds by Carbon Capture and Storage (CCS). The planned measures (Fig 3.5) are expected to enable the partners to achieve the following quantified targets:

- energy efficiency measures – annual reduction of 2 megatons;
- use of low-temperature industrial heat – annual reduction of 1-2 megaton;
- large-scale use of sustainable energy – annual reduction of 5 megatons;
- CO_2 capture, transport, reuse and storage (CCS) – annual reduction of 20 megatons.

The Rotterdam Climate Initiative combines all the initiatives taken by Rotterdam-the city as well as the port-to develop a low- CO_2 city and energy port and become the world capital of CO_2-free energy. Two of the five RCI's pillars (Table 3.3) involve actions in the port area: *sustainable mobility* and *sustainable energy port*.
The third pillar introduced actions for international agreements on shipping industry emissions which was further promoted by the PA through national and international collaboration. PoR is a partner in **Dutch Ship Emissions Platform** (www.scheepsemissies.nl) which elaborates incentives for clean ships (2009/2010) and seeks cooperation not only with the Regional Expertise Centre for Air and the **Rotterdam Climate Initiative** but also with other European or world ports.
Therefore, PoR as a highly active member of the **C40 Climate Leadership Group** of 12 port cities worldwide, hosted the **C40 World's Ports Climate Conference** in 2008. It was an important initiative for world's ports to agree on actions to reduce GHG emissions. The main scope was:

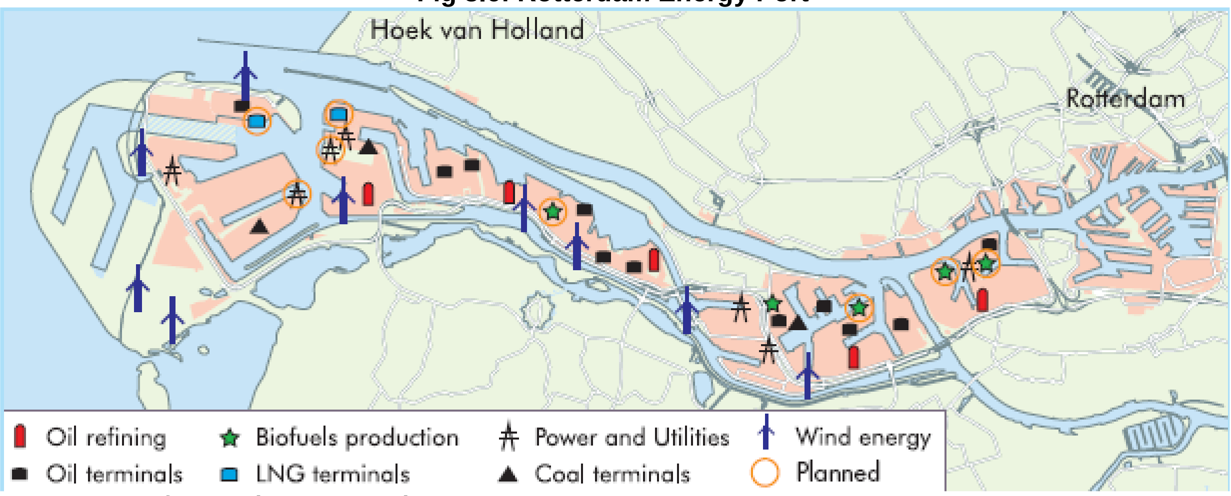
"To agree on joint measures, regulations and standards that reduce air pollution in general and greenhouse gas emissions in particular in the area of shipping, port activities, energy supply and heavy industries. In such a way that fair competition will be secured in a level playing field".

C40 Climate Leadership Group - Port of Rotterdam

On the 11th July 2008, the involved - in the C40 initiative- ports endorsed the World Ports Climate Declaration, *"realizing that they need to make the change" and without "waiting for governmental and international regulation"*, and agreed to *"start collaboration directly with their own competence*", (Conclusions World Ports Climate Conference, 2008).The undertaken actions were also decided to be guided and coordinated by the International Association of Ports and Harbours (IAPH) and regional organizations like ESPO (Europe) and AAPH (America).

Among the 5 pillars, the most innovative was the one under the title **Rotterdam Energy Port**. In 2007, a long-term energy vision was presented for the development of the port as "*a future-oriented world class Energy Port"*, (PoR, "Balanced growth" Annual Report 2007, p:5). Under the RCI umbrella what is aimed, is *"an energy efficient port and industry cluster of global proportions"* to be realized. Rotterdam is determined to become the CO_2 hub of Northwest Europe, and the energy port for low-CO_2 energy sources and products (RCI, 2007).

Fig 3.6: Rotterdam Energy Port



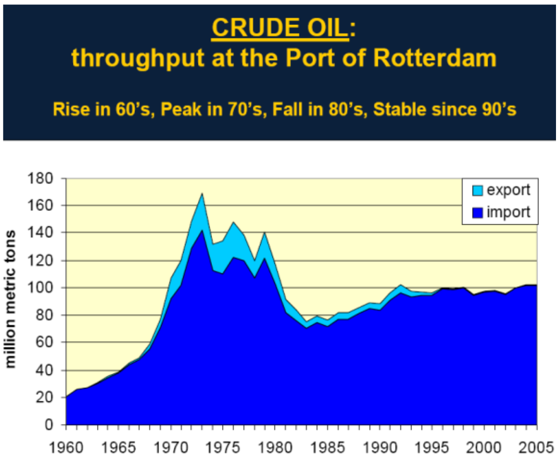
Source: Port of Rotterdam – Rotterdam Energy Port

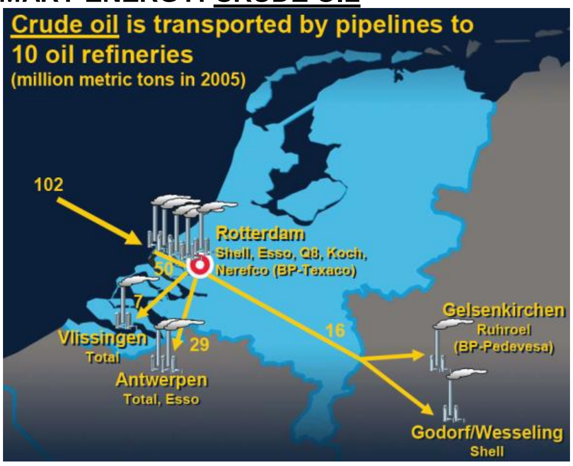
Table 3.4: ENERGY AT THE PORT OF ROTTERDAM

IMPORT PRIMARY ENERGY AT THE PORT OF ROTTERDAM			
		2007	**%NL**
OIL	**6 oil terminals**	**102 mln tons**	**99%**
COAL	**3 bulk terminals**	**26 mln tons**	**60%**
GAS	**2 LNG terminals planned**	**2010-2020**	
	> LNG import:	**9-18 mln tons**	**100%**
	> regassification:	**12-24 bcm**	**15-30%**
		2005	
BIOMASS – WIND		**0,6 mln tons**	

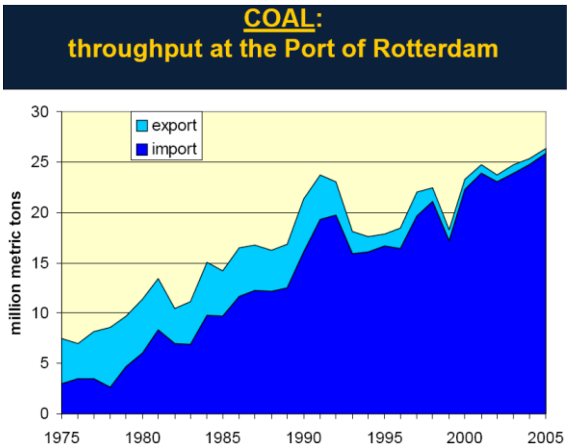
Source: Jordan, (2007)"The Rotterdam climate case", presentation in the 13th Ph.D. Intensive of the Erasmus International Ph.D. Program on Cleaner Production-Products, Industrial Ecology & Sustainability, at Erasmus University Rotterdam, 24 October 2007

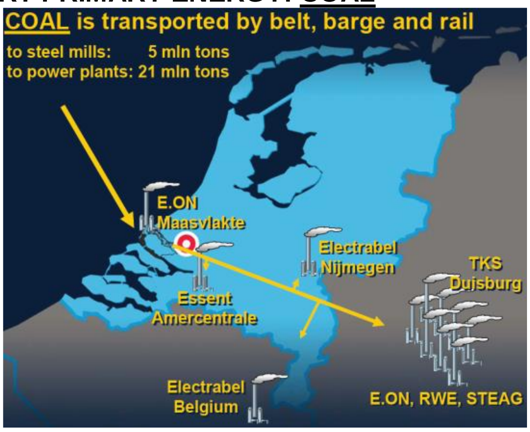
IMPORT PRIMARY ENERGY: CRUDE OIL





IMPORT PRIMARY ENERGY: COAL





Source: Melieste (2006) ***"Rotterdam Energy Port*****".**

Oil and coal form the basis of Rotterdam's worldwide unparalleled port cluster, and because there were still plans for the construction of three new power stations: two coal-fired (pulverized combustion) stations and one natural gas-fired station, which aim to improve the stability in supply with respect to the power supply in the Netherlands and in Europe, the PoR's Energy port visions is of utmost importance. The port management planned efforts to develop the *"most efficient energy and industrial cluster in the world"* (PoR, "Balanced growth" Annual Report 2007, pp.5) involve:

- plans for the construction of two LNG (Liquid Natural Gas) terminals (decided in 2007);
- bio-fuels and wind energy production;
- industry produced CO_2 increased use to greenhouses to stimulate plant growth;
- industry produced residential heat used on a large scale to heat homes;
- projects promoting co-sitting;
- research and pilots for the underground storage of CO2 (CCS).

o **Rotterdam and Carbon Capture & Storage** (CCS)

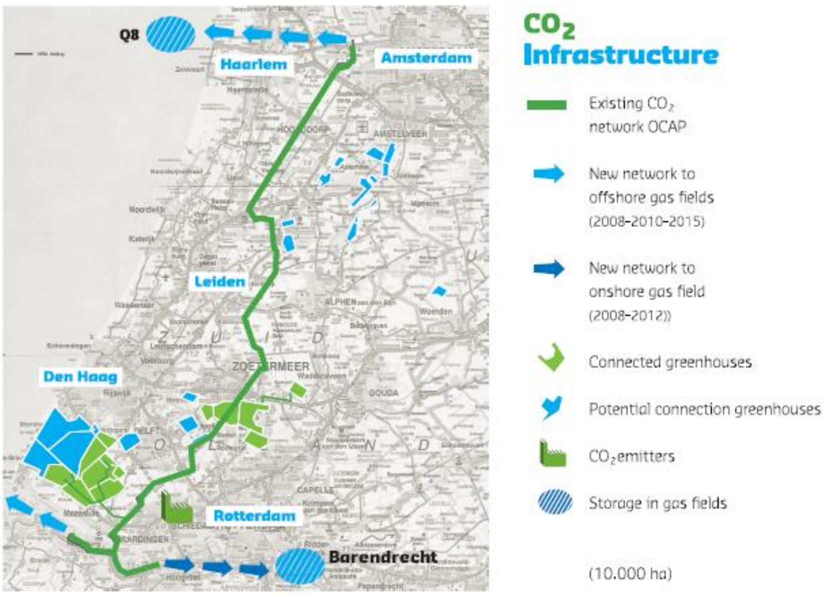
Carbon dioxide capture and storage (CCS) is an approach to mitigate global warming by capturing CO_2 from point sources such as fossil fuel power plants, refineries and petrochemical plants, and storing it in underground gas and oil fields instead of releasing it to the atmosphere.

The first Dutch trial to capture carbon dioxide (CO_2) from a power plant's waste gas emissions, was launched in the port of Rotterdam. While the Netherlands prepared to embark on CCS projects, including two carbon storage demonstrations, the Dutch government's ambition, was matched in Europe only with Norway and the UK. Apart from Rotterdam, the northern part of the country was also active in the area of CCS. To support these two regional initiatives and to back up the national policy, the Dutch Government set up a national Taskforce for CCS.

- *<u>CCS is one of the key focus areas of the Rotterdam Climate Initiative</u>* (RCI).

Until 2010, already 400.000 tonnes of pure CO_2 were sold to greenhouses to stimulate plant growth. This was expected to be increased to 1 megaton per year. The 4-megaton excess capacity of the pipeline network, was expected to be used for CCS in one of the offshore empty gas fields and to be sufficient for the capture pilots of two new coal-fired power stations. After CCS are fully deployed (around 2020-2025), some 20 megatons of CO_2 are expected to be stored annually. The location of Rotterdam (compared to other high-CO_2 emission areas, like Antwerp and the Ruhr region), the size and the high concentration of energy intensive industry of the port area offer excellent opportunities for CCS, mainly because there is:

- an existing pipeline infrastructure (used commercially) for transport of CO_2 to green-houses;
- a relatively short distance to both onshore-offshore fields with sufficient CO_2 storage capacity;
- a possibility of further gas and oil recovery through CO_2 injection into onshore-offshore fields;
- availability of residual heat, (capture costs can be significantly reduced when the energy to remove CO_2 from the capture solvent and thereby regeneration of the solvent is based on industrial-residual heat);
- availability of streams of highly concentrated CO_2. Production of biofuels, like bioethanol through fermentation and biodiesel through gasification, provides concentrated CO_2 that can be captured at a low cost. Pure CO_2 is also available as a by-product of gasification activities.



Source: ROTTERDAM CLIMATE INITIATIVE (RCI)

A phased approach: For the capture and storage of CO_2, RCI intends to use a three-phase growth model: phase 1: pilots for infrastructure and large-scale storage of CO_2; phase 2: large-scale pilots of CO_2 capture; and phase 3: full deployment of CCS. Phase 1 is an expansion of an existing and commercially viable business, that already operates independently from the EU emission trading scheme. This approach, is making possible to properly and expeditiously link up with the current situation and the immediate opportunities in the Rotterdam port and vicinity, while it limits the technical and financial risks.

Table 3.5: RCI phased approach for capture and storage of CO_2

Phase 1	Phase 2	Phase 3
Involves two pilot projects for underground storage of CO2 in empty gas fields and the expansion of the existing infrastructure. ▪ CO_2 is captured from sources that have emissions of more than 50kton/year, which is emitted in a concentration above 75%, while the capture and delivery of 1.5 megaton CO_2/year is to be realized by increasing the flow of CO_2 to greenhouses to 1 megaton/year; this will comprise around 2.5% of the total industrial CO_2 emissions in the Rotterdam region. ▪ The injection of 1megaton CO_2 per year into empty gas fields (one onshore, in an empty gas field of NAM in Barendrecht, and one offshore in a Q8 field of Wintershall) was expected in 2010. The capture pilots of two new coal-fired power stations, part of phase 2, will be connected to this system. The decision on phase 1 investments was taken in 2008.	Large-scale pilots of CO_2 capture This phase consists of encouraging large-scale CO_2 capture and the connection of this capture to the existing infrastructure. • CO_2 will be captured from both existing and new sources that emit more than 50 kton/year CO_2 with a CO_2 concentration of more than 10%. This regards companies with furnaces and boilers (not gas turbines) and coal-fired power stations. The capture costs will be higher for companies in phase 2, than for those in phase 1. According to RCI, "it is realistic to aim for the capture and storage of a total of 3-5 megaton/year CO_2 in the coming years", while "the sale of emission rights (of the stored CO_2) and any extra oil and gas will proceed to generate revenue".	Full deployment of CCS and use of the CCS potential in the region and possible expansion of and into other regions (Antwerp, the Ruhr region, Groningen, Norway). This also requires new infrastructure. After the third phase (2020–2025) the CO2 capture from the Rotterdam harbour will amount to some 20 megaton/year. This will only be possible after commitments will be made to ensure that the total emission, from the two, new coal-fired power stations, is captured, thus this stage becomes relevant after 2011, when the new plants will be operational.

Source: ROTTERDAM CLIMATE INITIATIVE (RCI)

The RCI formed its own CCS platform to work out the agreements made with the Ministry of Housing, Spatial Planning and the Environment at a regional level. Participants in this platform include particularly companies that are part of the chain of source, capture, transport and underground storage of CO_2. The objective is to exchange knowledge, initiate projects, and organize a joint lobby group at national, governmental, and European Union level. Finally, the RCI is part of the Dutch delegation that has joined the North Sea Basin Taskforce. The objective of this Taskforce is to collaborate on matters in the area of transport and storage of CO_2 under the North Sea. Through the Dutch Government, the RCI is involved in the preparations of European policy in the area of CCS.

- **LNG** (Liquid Natural Gas) **terminals**

"This is the first time in 20 years that an LNG terminal is to be built for our part of the continent. Rotterdam will build further on its position as Europe's most important energy port. With more LNG capacity, the modernisation of refineries, new plants for biofuels, cleaner coal-fired power stations and a sharp reduction in CO_2 emissions."

Port of Rotterdam Authority CEO, Hans Smits - Rotterdam 12-18-2007.

According to Mr Ruud Melieste (2006), manager of Energy and Process Industry in PoR, in response to the fast-increasing European demand for natural gas, and because "the National Energy Council insisted upon diversification of import of natural gas in order to improve security of supply", **two LNG terminals** (LNG= Liquid Natural Gas), will be opening in Rotterdam's port area; plans for a third terminal are on the drawing board, (PoR, 2008). The two terminals will store natural gas in a liquefied state, cooling it to 162 degrees Celsius below the freezing point - by liquefying natural gas-, its volume is reduced 600-fold. Rotterdam will be equipped to handle the largest LNG ships (of the Qatar Max type), measuring 350 m in length and having a draught of up to 12m, carrying 150 million m^3 of liquefied gas (exported in Qatar, Algeria, Libya, Nigeria or Malaysia), expected to dock in the port on a daily basis, (PoR, 2008).

Fig 3.7 The GATE terminal proposal

Source: Melieste (2006) *"Rotterdam Energy Port"*; PoR–Rotterdam Energy Port, 2008

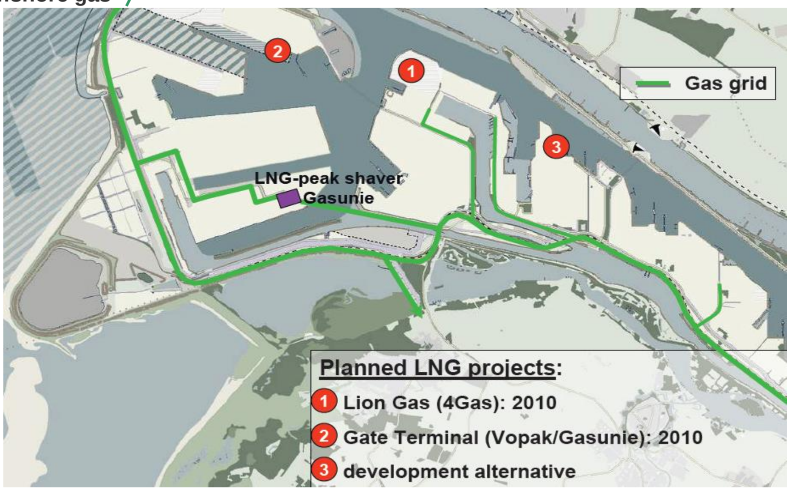
The terminals are to be constructed just off the main waterway leading to the Maasvlakte along the Beerkanaal. This main access terminal for liquid gas, situated on the Maasvlakte (at a location known as the Parrot Beak), has been dubbed **GATE** (Gas Access To Europe) and the (last) plans are, to have it fully operational in the second half of the 2011[4]. It is planned to have an initial throughput capacity of 12 billion m^3 (bcm) per annum and will consist of three storage tanks and two jetties. Annual throughput capacity can be increased to 16 bcm in the future. This would be a considerable fraction of the total Dutch natural gas market, which amounts to 90 bcm on an annual basis, half of which is consumed locally and the other half exported, (PoR, 2008).

PoR is investing around € 60 million in the construction of the basic infrastructure for Gate terminal, for the sheltered port basin created on the Maasvlakte for the LNG vessels. In digging the 1.5km long basin, 6.5 million m^3 of sand will become available. The aim is to use the construction which began in 2008.

LNG helps towards the "sustainable port vision" of Rotterdam, basically as a "clean product" and because the terminals in Rotterdam are to be connected to power plants, and 'residual heat' will be used to return the extremely cold (-160 degrees Celsius) LNG to gas form, promoting a "clean synergy". Simulation, in cooperation with the maritime research institute Marin and the Rotterdam Rijnmond Pilotage Service, has revealed that LNG can be shipped into the port well and safely; this does not involve any noticeable delays for other shipping traffic. It should be noted that, important factors for the projects implementation are the quality of the PoR's traffic guidance system and its experience with ships carrying dangerous substances.

Fig 3.8: Rotterdam Energy Port - <u>LNG</u>

BP offshore gas



Source: Melieste (2006) *"Rotterdam Energy Port"*.

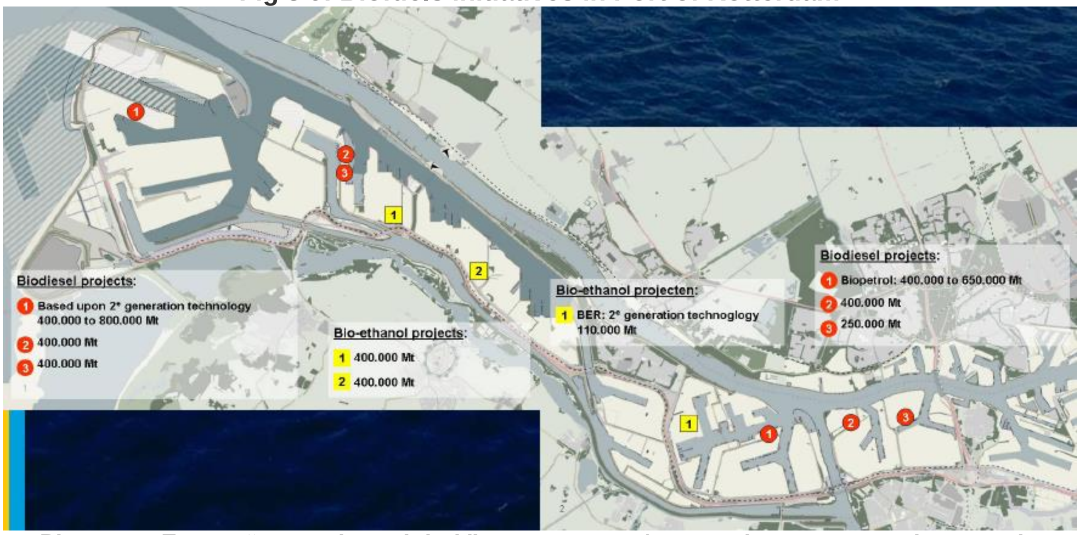
- **Biofuels**

Until 2010, there were not any criteria established at a European level for the sustainable production of the bio-fuels. In terms of the sustainability production criteria, the EC has just proposed not to use raw materials for biofuels coming from any of the following: forest undisturbed by human activity; area designated by nature protection; wetlands; and the permanent grasslands. Certification for the bio-fuels was expected but was still not in place. However, according to the related EU strategy, the share of the bio-fuels compared to the traditional fuels must reach 5.75% in 2010 and 10% in 2020.

[4] Port of Rotterdam website, http://www.portofrotterdam.com/en/pressreleases/2007/index.asp, 18 December 2007

PoR was aware of the enormous potential for bio-fuels initiatives in the port area (Fig. 3.9). Biomass trade may turn the port into a logistic place for the future bio-energy supply in Europe. Until 2010, the port had already handled 10Mt of agri-bulk, 0.3Mt vegetable oils, 0.5Mt woody biomass, 1Mt ethanol and 0.17Mt biodiesel. It is therefore, not astonishing that 9 projects for liquid bio-fuels production for diesel and ethanol, including second generation technologies, were under study for a total capacity of roughly 2 and 1 Mt respectively.

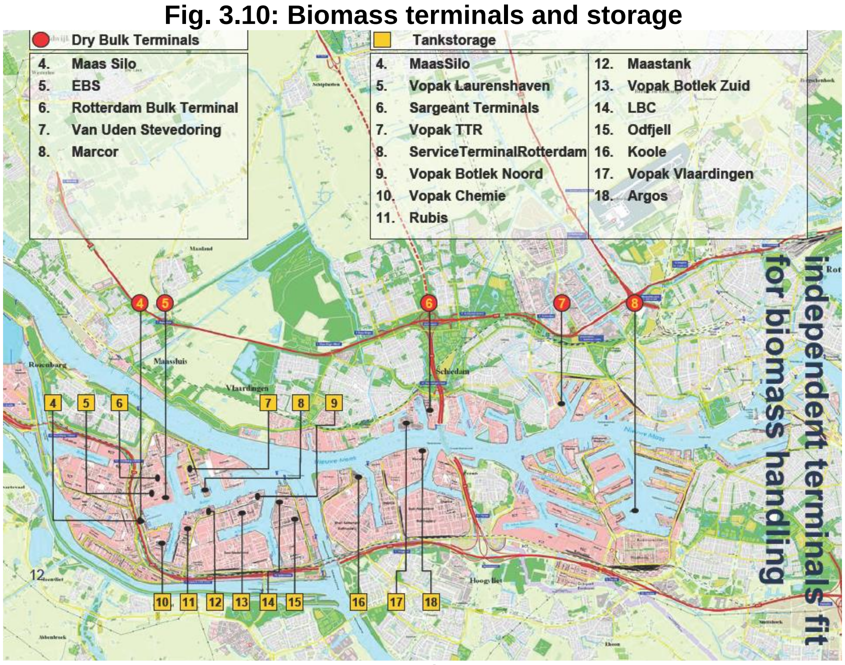
Fig 3.9: Biofuels initiatives in Port of Rotterdam



Source: Pieter van Essen, "*Rotterdam Biohub*", EUBIONET II / IEA Task-40, presentation 19 February 2007.

The fact that Rotterdam played and will continue to play a leading role in the production of bio-ethanol is not the only reason why Rotterdam will remain Europe's main energy hub. The construction of two bio-ethanol terminals in Europort will attract other industries to the area as well. In addition, environmental interests were served by further facilitation for the bio-ethanol and bio-diesel industries. In addition to natural gas, the PA wanted to attract other, new, clean sources of energy to the port. Biomass has been the main exponent, following European mandates that made it obligatory for petrol and diesel products to be mixed with bio-fuels such as bio-ethanol and bio-diesel (Fig3.10). Other forms of biomass (wood chippings and the like) are an attractive supplementary fuel for coal-fired power plants. A substantial number of companies in the port are already investing in trans-shipment and production capacity for bio-fuels. This, often took the form of co-siting, linking up with existing cargo terminals.

Fig. 3.10: Biomass terminals and storage



Source: Pieter van Essen, "*Rotterdam Biohub*", EUBIONET II / IEA Task-40, presentation 19 February 2007

Projects like the UNECE/PoR Sustainable Biomass Trade Project are taking place in the port area. This particular, aims to be client oriented, innovative, and have a practical use of energy. Biomass in this collaborative UNECE/PoR project includes woody biomass, energy crops, and crop residues and has also introduced a big opportunity in terms of palm oil production in Indonesia.

- **Actions under the RCI sustainable mobility pillar**

Although the PA is working on the use of 100% sustainable energy for its own buildings, most of the actions undertaken to improve air quality, are related to **sustainable mobility** under the RCI pillar.

Box 3.2: PoR's sustainable mobility actions

- All vessels on clean truck diesel fuel (EN590)
- New vessels equipped with sooth filters and post combustion treatment
- Reducing fuel consumption ("saving while sailing")
- "Clean" cars + incentives for clean leasing (now 10% of lease-fleet bi-fuel)
- TNO emission measurements on PoR-vessels
- Carbon footprint calculation (ISO 14064-1/GHG)
- Use of shore side power

New company vehicles already comply with the European Standard (euro V) and old vehicles, where possible, have been fitted with a soot filter. In 2006-2007 the fleet was expanded with two clean hydrographic measuring vessels and an oil spillage clean up vessel (reduction of 75-80 NOx emissions and 95% fine dust). The whole of the PA fleet also changed over to sulphur-free fuel in 2007. On an annual basis, these actions saved approximately 4.800kg of sulphur emissions, (PoR, "Balanced growth" Annual Report 2007, p:5).

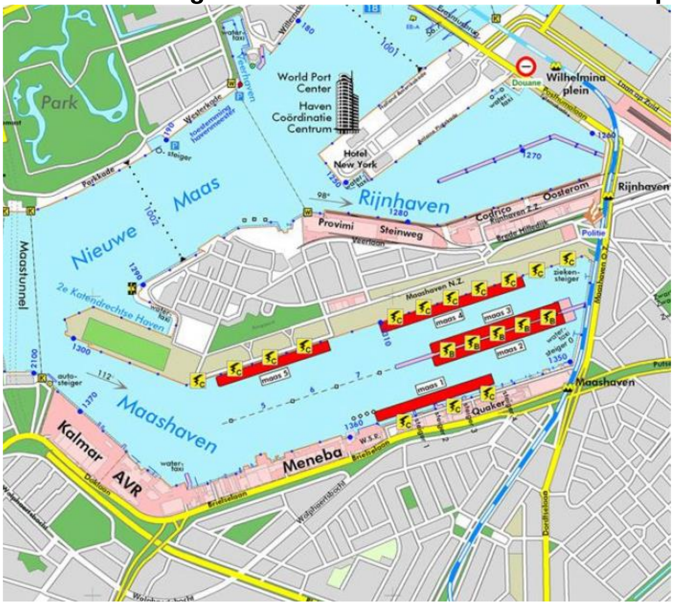
- **PoR's own Footprint**

2006: PoR is working on improving its own footprint. The PA besides working together with other parties into dynamic traffic management in order to minimize traffic jams and the emissions caused by these, is also working on making its own vehicles and vessels eco-friendlier. PoR has been committed to reducing its own CO_2 emissions from its own activities and to informing of the actual results by reporting on a yearly basis with respect to the CO2 footprint of the PA. The footprint is based on the ISO 14064 standards from the Greenhouse Gas (GHG) protocol and addresses CO_2-emissions derived from the energy use of buildings and transportation needed for daily activities and operations. The port has applied this method and, on this basis, made a choice of the most relevant CO_2 producing activities. In 2008, the PA expressed the ambition for its own business operations to be CO_2 neutral with effect from 1 January 2012 and set the additional target: a 35% reduction in our own CO_2 footprint in comparison to the base year 2007. It is also expected that, in 2025 all containers and vessels with dirty engines will be prohibited to enter the port complex.
In 2007, PoR initiated its yearly footprint report regarding CO2 emissions from its own operational activities. Until 2010, three reports were available. The report of the 2009 operations is the third report in the series. The data gathering for the report concerning 2009 and the reliability of the figures were improved. The CO_2 footprint for the year 2009 totals was referred 28 kTon CO_2, thus, a reduction of 15% compared to 2007(PoR Annual Report, 2010).
In 2010, the port authority published a business plan for the period 2011-2015 with the following objectives regarding the port's carbon footprint: a further CO2-emission reduction of 10% targeted for the business plan period 2011-2015, as well as CO2 emission reductions to become part of the sustainable procurement criteria used in respect of investment projects, such as maintenance dredging, construction quay walls and other port development projects.

- **Shore side power for inland barges** (pilot Maashaven) - Port of Rotterdam Authority

In this respect, there has been initiated a study into the feasibility of a shore-based power supply for ocean and inland shipping, so that ships along the quays can use electricity from the national grid rather than running their generators. The Port of Rotterdam Authority, after consulting major stakeholders and using an innovative and user-friendly concept - old and new ships (low / high power demand)-, developed the feasibility study and constructed the necessary engineering infrastructure for the shore side power for inland barges in 2006/ 2007, (Fig 3.11).

Fig 3.11: Pilot Maashaven - shore side power for inland barges

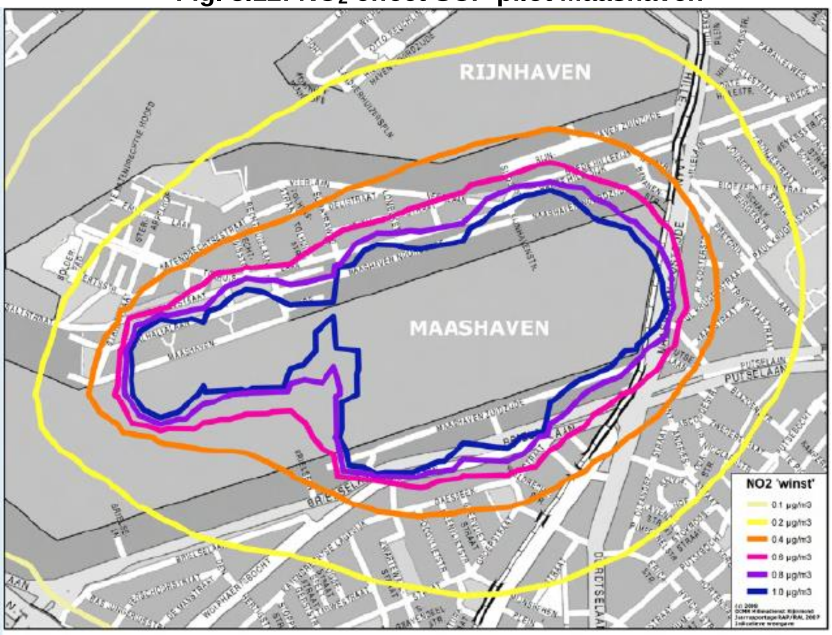


Source: Port of Rotterdam

A contract signed with ENECO Energy, one of the leading energy companies in the Netherlands formed the project to a shared responsibility, regarding investments and finance and set the project's duration for two years (April 2007- April 2009). The construction and opening of the pilot, was implemented in November 2007, establishing the project that was designed to serve as an (inter)national standard. The Air quality calculations (by DCMR) which inspired the project application involved positive effects to the NO_2 emissions (Fig. 3.12)

The pilot characteristics involves: 22 units with 132 connections (400V, 63A, 50 Hz); registration by mobile phone or via internet; internet-site in 4 languages (www.walstroom.nl); and during the pilot timeframe low costs (24c€/kWh) for inland vessels. The full implementation in Port regulations is expected no later than the end of 2009.

Fig. 3.12: NO_2 effect SCP pilot Maashaven



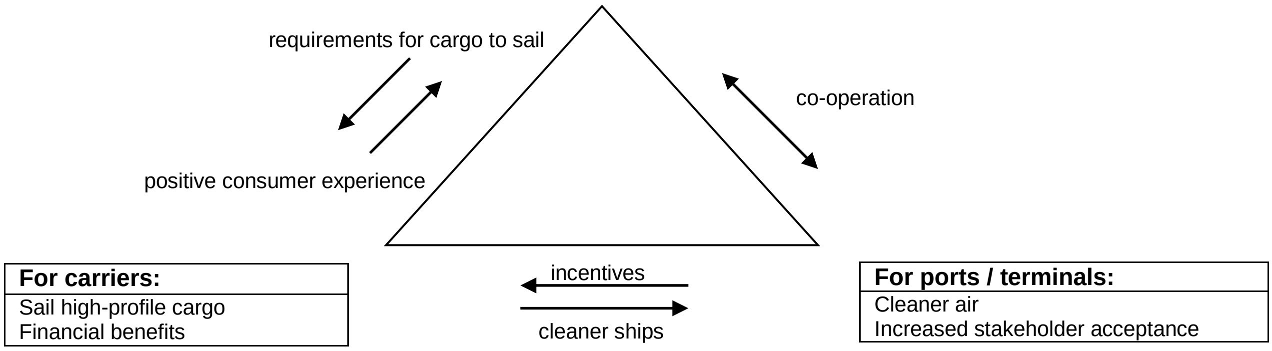
Source: Port of Rotterdam

Moreover, during the coming years, the PA wants to increase the number of shore-based power locations for inland shipping and Rhine cruise vessels; besides, feasibility studies have been also completed for the application of shore-based power in ocean shipping (including ferries and cruise ships). A great deal of effort is also being put into the introduction of an international ISO standard for the application of shore based power in ports, (PoR CSR Annual Report 2007, p:5)

○ **Environmental indexing seagoing vessels –** Project in the supply chain

Since 1990, the emission of environmental pollutants produced by shipping in Rotterdam has increased by 40%. *"The focus on clean shipping could in the opinion of the Port of Rotterdam Authority (also) be used to reduce the emissions from ships and improve the air quality within ports"*, (statement from PoR for the Green paper Maritime policy, 2006) and with own competence it promotes "clean shipping".

Why indexing a clean ship? The following diagram visualizes the arguments about the environmental indexing of seagoing vessels. In general, clean ships should be indexed promoting the ideas behind the concept of clean shipping, as a true evidence of corporate responsibility for carriers, shippers and ports/ terminals and making financial incentives possible to be applied (higher port/fairway dues for not clean ships, discounts for clean ships).

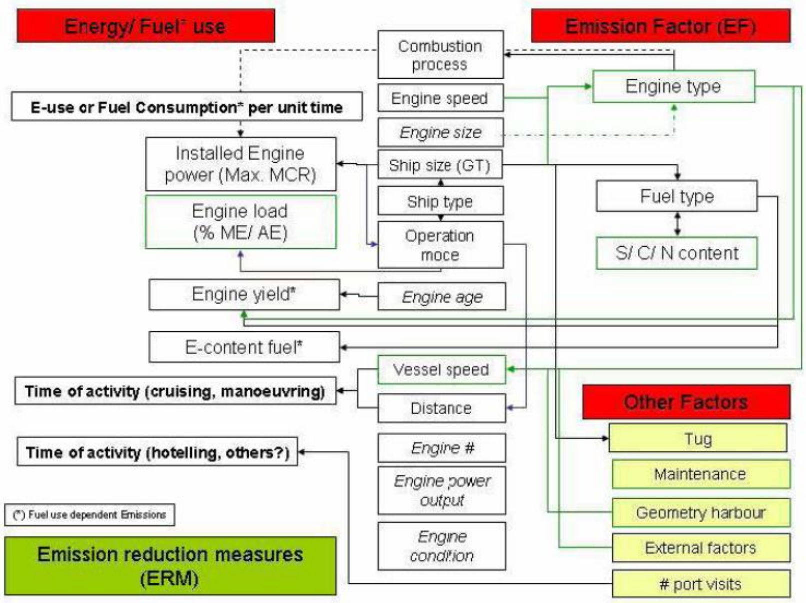


Source: Houben, (2008)

The PoR has introduced an: *Assessment instrument for air emission performance* - based on current ship emissions (NOx, PM, CO_2, SOx) and the principle involved for the selection criteria (energy/fuel use, emission factor, other factors etc) as well as the assessment process itself.

It is an inspection method easily applied by any port organization and to all calling ships in EU ports, whose centres of attention is to level playing field and the related issue of incentives.

Fig 3.13: Assessment instrument for air emission performance



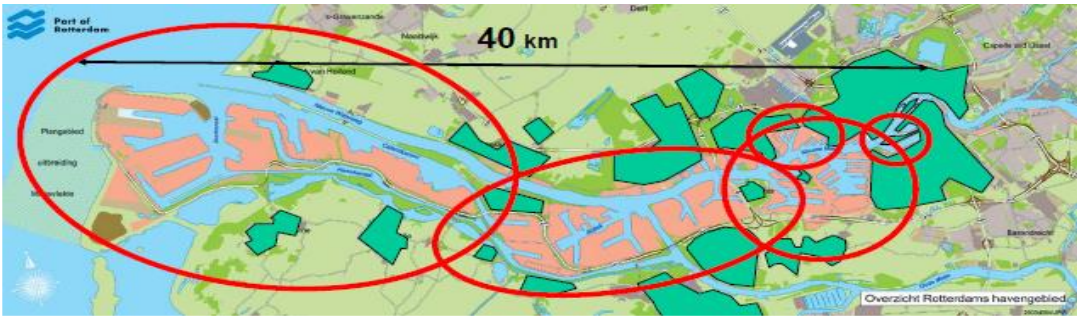
Source: Prinssen, 2008.

The *Environmental Ship Index* (ESI) project was further promoted and formed part of the World Port Climate Initiative (WPCI). The final form of ESI was developed, within the framework of the WPCI, by a project team consisting of the ports of Hamburg, Bremen, Amsterdam, Rotterdam, Antwerp and Le Havre. The ESI standard is fixed, but the individual ports, or other potential incentive providers need to decide for themselves what kind of incentives they will offer to the ships that go beyond compliance with the present rules. The database and the ESI website will be fully administrated by the International Association of Ports and Harbors (IAPH). By identifying seagoing ships that go beyond the current standards in reducing air emissions, is an example of incentive pricing at the port level, in view of improving environmental port standards in the port area. The index is intended to be used by ports to promote clean ships, but it can also be used by shippers and ship-owners as a promotional instrument. Finally, all stakeholders in maritime transport can use the ESI as a means to improve their environmental performance and as an instrument to reach their sustainability goals.

3.3 Noise Management

Since 1979, the Dutch law on noise pollution enforces: a) zoning of industrial areas, b) cumulation of the industrial noise, and c) introduction of limit values for each zone. *"Zoning has implied strict restrictions to port development and has put into effect the need of a noise management instrument in the port area"*, (Wolkenfelt, 2007).

Fig 3.14: PoR- (5) different zones for port area



Source: Wolkenfelt, 2007

The PoR's noise management scheme is based on two acoustic models. *<u>Model 1</u>: Budget model* and *<u>model 2</u>: Actual Monitoring* that are forming the principles of the scheme (Table 3.6).

Table 3.6: PoR Noise Management

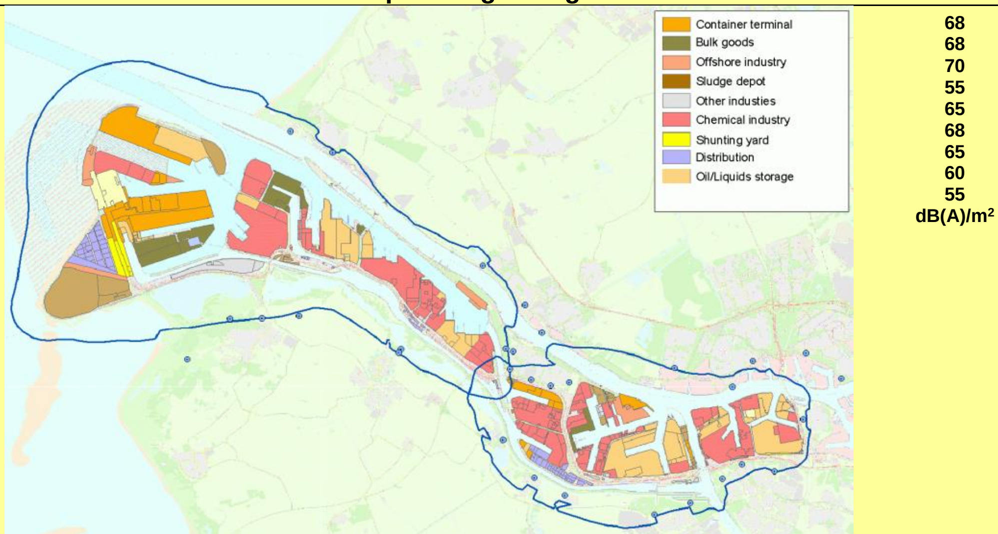
Model 1: Budget model	Model 2: Actual Monitoring
▪ **Acoustic model for area planning (B-model)** - each plot a specific noise budget - PoR in charge of (acoustic) planning - maximum noise level in the future < legal zone limits	▪ **Acoustic model for monitoring (A-model):** - each company modelled with specific noise sources - environmental department in charge (DCMR) - is actual permitted noise level
▪ **Noise budget based on:** - studies of noise production of different activities - existing acoustic models of port activities - economic port planning - prognoses of existing companies	▪ ***Total noise emission of all companies must be within legal zone limits***

Source: Wolkenfelt, 2007

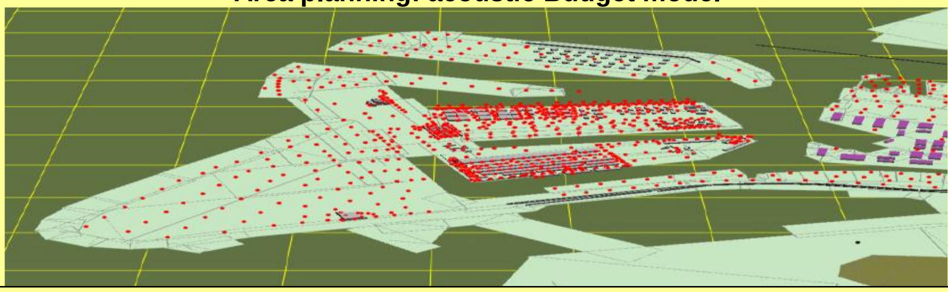
It is an interesting management scheme which creates a 'budget', "*like managing money*" (Wolkenfelt, 2007) with the use of an acoustic model for future/maximum noise nuisance. The 'budget' is divided into different types of expenses labelling plots with noise budget and it is based on: studies of noise production of different activities (dB(A)/m2); existing acoustic models of port activities; economic port planning; and prognoses of the existing companies. The PA is in charge of the area planning (Fig 3.15). The Actual model is the acoustic model applied to the actual situation monitoring expenses. Each company in the port area is modelled with specific noise sources. The acoustic model of a company is part of its application process of environmental permit (DCMR). DCMR tests each application and the noise 'budget' from PoR and, if both are acceptable, the company receives an environmental permit. At the operational level emissions are calculated and tested based on: Best Available Techniques (BAT), noise budget of plot, and realistic operation. The total noise production of all companies must be within legal zone limits. The PA is the manager of the 'noise space' for industrial noise. For each potential site letting, the PA assesses whether the enterprise fits within the 'noise space' of the area. When letting out the land, the PA assigns a 'noise budget' and the environmental license specifies how much noise the enterprise is allowed to make. This system of 'noise bookkeeping' has reduced the problem to a manageable level and it is integrated in the PA's letting process (PoR, Annual Report, 2006). Until 2010, PoR had been experienced in noise management for more than a decade. Data of actual industrial sites of 95% were available. Acoustical area planning has been part of any port development or in other words, it has been used to *"no (unexpected) problems with port development"*, as PoR is *"in charge of* *planning"*, (Wolkenfelt, 2007). In addition, the obtainable data promoted a smoothening process of obtaining permits, counterweight to spatial planning of residential areas and transparency to port industries and citizens, (Wolkenfelt, 2007).

Fig 3.15: Port of Rotterdam - Noise Management

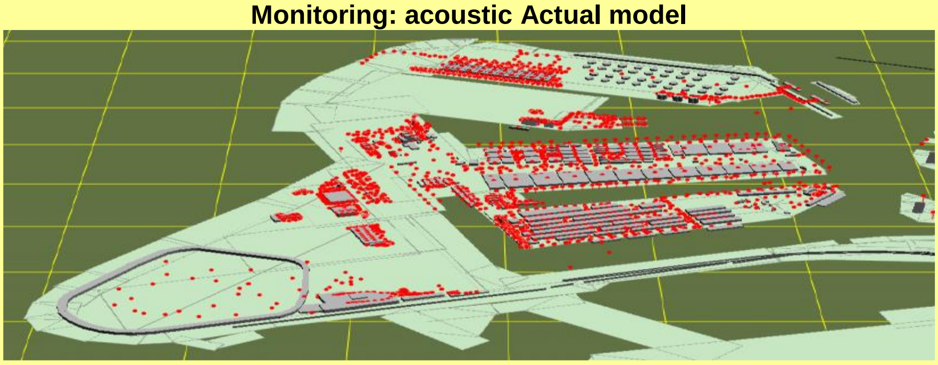
Area planning: Budget model



Area planning: acoustic Budget model



Monitoring: acoustic Actual model

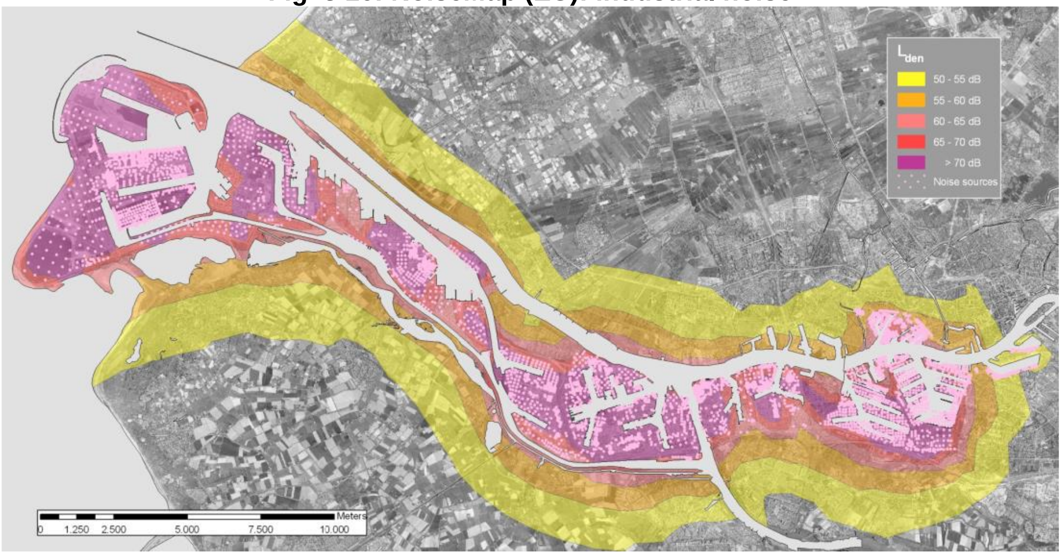


Source: Wolkenfelt, 2007

Back in 2002, RMPM identified noise impact as a point of attention in its daily practice, with a constant policy plan of "*maintaining sufficient 'room for noise' for port and industry*", (RMPM Annual Report, 2002). At that time, the Environmental Noise Directive (END) came into force requiring that, industrial port areas near large agglomerations are included in noise maps. The Directive had to be implemented in the national legislation until 2004, whereas the noise maps had to be drawn up by competent authorities until 2007. As a consequence of the EU legislation, a noise map of the Rijnmond area had to be completed by the summer of 2007, and for this purpose the PA made the information from the 'noise bookkeeping' data available (Fig 3.16). Among the benefits of noise management was *"the up to date data and the quick production of noise maps",* (Wolkenfelt, 2007).
In 2005, PoR participated as an observer port in the EcoPORTS - **NoMEPORTS project** (2005-2008). The project was funded by the European Commission LIFE-Environment Programme. The main objective of the project was to develop a common good practice guide, from which ports and local authorities -through noise mapping and noise management- can be inspired to reduce

noise, noise-related annoyance and health problems of people living around port industrial areas. The *NoMEPORTS Good Practice Guide* was published in May 2008. The guide involved six issues taken into consideration among which: geographical situation and port information; noise sources; noise data; noise modelling; identification of mitigating measures; and noise management. It also provided a technical annex focused on the use of software, gathering information and interpreting calculation results, with additional technical details.

Fig. 3.16: NoiseMap (EU): industrial noise



Source: Wolkenfelt, 2007

An important aspect emerged in the NoMePorts project (during field studies conducted to characterize the different noise sources present in a port); of particular interest in the Rotterdam case, was the ships' contribution to environmental noise primarily coming from the operation of internal combustion engines. It was noticed that noise emission during berthing periods, is generally dominating over the noise emission during navigation, and that sailing ships have little influence on the overall noise situation. Thus, the noise produced by ships can be indirectly traced at the different types of sources in the port. The project also revealed the *cold-ironing* system as an effective measure that reduces the noise levels from the engines of ships at the quay. This system allows emergency equipment, refrigeration, cooling, heating, lighting and other equipment to receive continuous electrical power while the ship is loading or unloading its cargo, and consequently an important reduction in fuel consumption, GHG emissions and noise nuisance occurs.

Apart from the noise of vessels in the Rotterdam port area, other potential noise-related issues identified through the years were: 1) lower frequency noise; 2) peak levels; and 3) residential areas coming closer to the port area. The most important topics, which played a role in the relationship between the port and its surroundings, were the updated noise legislation as well as the possibilities and impossibilities for housing construction near the port, (RMPM, Annual Report 2003). In 2000, housing construction plans of the Zuid-Holland Province started an inventory of noise environmental bottlenecks on the right bank of the Meuse, (RMPM, Annual Report, 2000).

Since the 1990's, the PA has applied an effective set of tools for preventing noise standards from being exceeded. The pressures of housing construction plans on the right bank of the river, forced the PA to closely look into the developments related to new laws, engage with stakeholders, and communicate its noise management scheme. The PA confronted problems and constraints, citizens through local discussion groups have been approached and information on port planning has been introduced, mostly aiming for solutions to be found, (Wolkenfelt, 2007).

For a long time, the amount of noise that the port and industrial complex may produce was laid down in laws and agreements with the surrounding districts. Finally, in 2009 PoR came in agreement with the regional administration (the Provincial Executive for Zuid-Holland and Rotterdam Municipal Executive) about the required space in a statutory noise zone, for the port and industrial area development. As a result, the business sector in the port area, as well as the municipalities and sub-municipalities around the port area, know precisely how much 'space' is available, both now and in the future, (PoR, Annual Report, 2009).

3.4 Water and Soil contamination management

o *Soil Quality Management Scheme (SOQUMAS)*

The **WELCOME**-project (2002-2004) was funded by the EU and addressed groundwater, surface water and soil contamination on large industrial sites. The result was an *Integrated Management Strategy for Megasites* (IMS). 'Megasites' are large areas and regions with a high density of industry, such as the Rotterdam port area, where soil, surface water and groundwater are usually polluted with a mixture of a wide variety of pollutants. For Megasites, redevelopment- combined with a comprehensive remediation- is often impossible in short terms. Remediation costs are high; thus, they obstruct an economically balanced redevelopment program. On the other hand, severe contamination in soil, surface water and groundwater can be hazardous for humans and ecosystems and limit the free usage of resources like surface water, groundwater and land. Due to the complexity of Megasites -related to site conditions, contaminant characteristics, organizations involved, regulatory aspects and considerable costs- an integrated risk-based management approach was recommended by the project, in order to manage the risks for the defined receptors (soil, groundwater, surface water and land users at the surface).

As part of the EU 'WELCOME" project, an Integrated Management System (IMS) was developed for the 'Rotterdam Megasite' port area. The WELCOME-project aimed to produce an integrated management strategy for prevention and reduction of risks at contaminated industrial Megasites, by taking the present situation of port areas as a starting point. A risk assessment, that takes the soil-water system and the technical and economic feasibility of the remediation actions into account, forms the core of this methodology, helping site managers to define the most cost-effective set of mitigate measures, which satisfy the legislative, financial and social boundary conditions.

The **SOQUMAS** data base contains information for all soil investigations that have been carried out for the port of Rotterdam. It contains contaminant data of soil and ground water analysis as well as samples for many types of contaminants. Also, data on location, depth, soil, groundwater level etc., can be found in the Soqumas database.

Measures, dealing with **water quality** in the Rhine river, have been among the most rigorous in the world. Under the European Water Framework Directive, the Netherlands was required to set new standards for water quality by assessing ecological risks and developing remediation measures. As a result, licenses for industry are being modified according to the new requirements of the Water Framework Directive, in which PoR was also involved.

o *The role of the **Harbour Masters' Division** and its core activities*

Over the last two decades, oily waste spills (MARPOL – Annex I) were the dominating source of maritime pollutant to PoR. However, the gap between oil waste and other pollution sources had been continuously shrinking throughout this period, especially since 2000 (Lems, 2009).

Since 2004, and the establishment of PoR's corporate management, the collection of data on maritime pollutants has been carried out by the Harbour Master's office under the newly-established corporation. The port of Rotterdam's Harbour Master Division (DHMR) is responsible for secure and smooth shipping traffic, as much as safe and environmentally responsible ship related operations in the port (area), including crisis management and incident fighting (Lems, 2009). The Harbour Master Division (DHMR) has applied, through the years, a strict observance policy to which should be ascribed the strong decrease of water pollutants. As a result, in 2009 the port's silt was of a much better quality: only five per cent of all dredged silt is polluted. In 1986 this was 75%[5].

3.5 PoR and the Maasvlakte 2 experience

Already in the beginning of 2000's, the development of the Maasvlakte 2 was introduced as *"an example of good port-city relation"* and a *"project of mixed attractive functions: economic, social and urban"*, (de Bruijn, 2002). Overall, what was expected from the project's implementation was not just a port expansion aimed to strengthen the PoR's business position but the improvement of the environmental situation in the region and the creation of new opportunities for the city. According to Mr de Bruijn (PoR, Corporate Development), the success of the Masvlakte2 project was primarily

[5]Source : http://www.portofrotterdam.com/nl/nieuws/persberichten/2009/03032009_01.

based on three main principles: better use of the existing Rotterdam port area, through intensification and optimisation of the use of space; an area-specific improvement of the living environment quality; and the compensation measures according to the Habitat and Bird Directive, (de Bruijn, 2002). Regarding *what* the PA learnt through the process, the *“port and the city live apart but together and if you separate the functions of both, you create distances, physically and mentally”*, (de Bruijn, ESPO Seminar-Genoa, 2002).
A key stipulation of the Maasvlakte 2 development is that it is designed and managed according to sustainability principles, (Gibs, et.al., 2008). This included plans for business clustering to encourage industrial symbiosis, utilising land efficiently and promoting sustainable transport infrastructure and business operations (DCMR and Port of Rotterdam, 2007). Air-emission targets and reducing CO_2 are also key priorities. Therefore, ‘re-scaling’ the port and city relationship and renewing environmental standards was essential (de Bruijn, 2002).

- *Stakeholder Engagement*

The decision-making process in the Mainport Development Rotterdam Project (PMR) size, was a complex process, mainly because of the expansion’s size and the impact of the project on many actors, that makes them complex (Van Gils & Klijn, 2007). Through the planning process the PMR management organisation and PoR vastly intended to manage formal negotiations involving all interested parties, with the scope to avoid lengthy administrative or appeal procedures. However, after years of formal negotiations between a broad range of local, regional, and national stakeholders, the planning was considered not feasible, as NGOs and PoR had not come to a mutual agreement.
In the 1990’s the Maasvlakte 2 expansion was purely a concern of public actors (ministries and PA), but through the years this shifted among several public bodies and non-public actors (Healey, 2006). Then, the PA initiated informal negotiations with NGOs and they finally agreed on the port expansion, as long as it created opportunities to improve the natural environment and provided the region with recreational opportunities. The outcome was the ‘**Vision and Courage**’ document. A stakeholder agreement was reached, which included the establishment of a marine reserve and the creation of dunes and wetlands as measures to compensate for the loss of habitat due to the land reclamation process. In this agreement, the City of Rotterdam is committed to a maximum level of mitigation and improvement of the city’s built environment including living conditions and nature development.

Box 3.3: Stakeholder agreements

- **Vision and Trust**
  - Parties: Industry/Recreation/Nature/Environment/Province/ City of Rotterdam/City Region / Port of Rotterdam.
  - To check and balance all the agreed sustainability concepts.
- **Sustainable Voordelta**
  - Parties: Nature/Fisheries/port of Rotterdam/State
  - To balance fisheries uses and nature in sustainable way.
- **Sustainable Maasvlakte**
  - Parties: Milieudefensie/Port of Rotterdam.
  - Joint research on further air quality improvement towards a lower 10% target for the emission ceiling
- **Sea birds Maasvlakte 2**
  - Parties: Fauna protection/Port of Rotterdam
  - Agreed management plans for black-backed gull and terns on Maasvlakte 1and 2.

Source: Vellinga, 2015

PoR was in the centre of decision-making throughout the entire process and PoR representatives took part in the coordinating organisations. Hommes, et.al., (2009) assert that, in the Maasvlakte 2 case, marine and coastal management was shifting from the classical decision-making to an interactive/ participatory decision-making, while van Gils and Klijn (2007) introduce the Maasvlakte 2 as *“a nice example of dealing with the complexity of stakeholders”*, since the decision-making process gradually evolved from a top-down steered process towards an interactive process in which many stakeholders were involved.

Besides the fact that the final agreement provided a clear framework for the different stages of the project, what was also interesting in this port expansion case, was that during the implementation phase (2008-2013) tailor made compensation schemes were further agreed, taking into account the different implementation phases. For this reason, and since 2008, the government and the port have been in the process of setting up a monitoring system, together with the main stakeholders. The monitoring system, should allow adaptive measures if the effects are different than expected.

3.6 The project R3 (Rotterdam-ROM-Rijnmond) for sustainable solutions

Environmental regulations in the Netherlands forced regional and local authorities to facilitate industry initiatives for strengthening them economic and environmental. In the port of Rotterdam industrial complex the INES program from 1994 to 2002 focused on initiating and supporting industrial symbiosis initiatives (Baas & Huisingh, 2008).

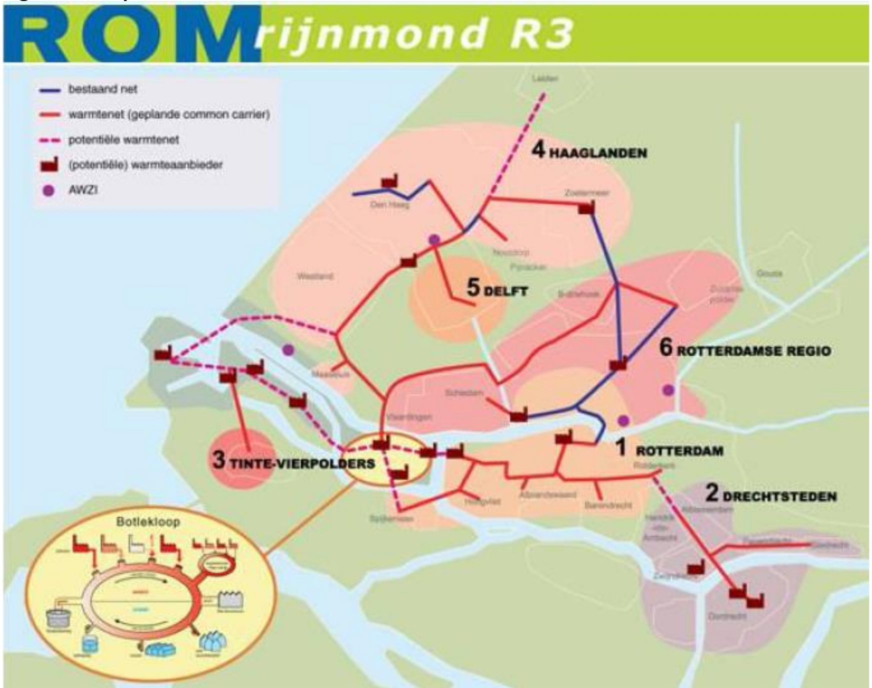
Table 3.7: Rotterdam industrial symbiosis – "To C or not to C" Sustainability Routes

INES project	**1994-1997**	• Category of sub-projects: • prevention • chain management • utility sharing waste heat compressed air • joint treatment bio sludge, waste water
INES Mainport project	**1999-2002**	• Feasibility studies on: • fuels and resources bio mass, syngaz, wind, hydrogen • rest heat use, warmth infrastructure,clean fossil (CO_2 removal)
R3: Sustainable Enterprises	**2002-2010**	• Strategy Platform R3: • industry • national and local government, academia

Source: own elaboration

Under the Sustainable Rijmond and Energy 2010 regional policy, the so called *Sustainable Enterprises in the Rotterdam harbour and industrial complex R3 program* was initiated following the results of the former INES program. The R3 was aprogram running under the ROM-Rijnmond umbrella from 2003 to 2020 with the scope to develop a strategic platform which fuctioned as stimulator and *sustainability conscience* of all the involved stakeholders in various developments of the Rotterdam Energy Port (Baas & Huisingh, 2008).

- Three related energy initiatives merged into the R3-initiative with the common goal that combined integrated space use and environment.



Energy saving has been of strategic importance for the Rotterdam PA because of the resulting reduction in CO_2 emissions and the improvements in air-quality. In 2005, PoR was closely involved in the preparations for setting up Warmtebedrijf N.V., a company which was established to supply industrial residual heat by pipeline to homes and facilities. For this purpose, Warmtebedrijf N.V. initially invested €100 million in an industrial heat system, 60% of which was for the transfer of heat from industries (particularly AVR and Shell) and 40% in the pipeline infrastructure between the industries and residential districts. PoR participated in Warmtebedrijf N.V. with a shareholding of € 9 million.

The initiative is based on four transition routes: sustainable fuels and raw materials; sustainable infrastructure and energy carriers; sustainable processing of residues and waste; sustainable production processes and chains. In order to realize sustainable ways of production and transportation in the Rotterdam port and in the industry complex area the main objectives of the R3 transition program were:

- Maximized use of residual heat in buildings and greenhouses and other applications;
- Maximized use of waste and residues as raw material;
- Energy production and use with minimum CO_2 emissions through energy efficient production methods using clean fossil and renewable fuels;
- Location of companies with optimized energy and raw material synergism.

In the long run, the use of Rotterdam's industrial residual heat was estimated to achieve savings of 1 billion m^3 of natural gas each year, a reduction of 1 million tonnes in CO_2 emissions, and 1 to 1.5 microgram/m^3 reduction in NOx emissions (Port of Rotterdam, Annual Report, 2005).

3.7 Species and habitat management schemes

- *PoR involvement in the Paralia Nature project*

The Paralia Nature project was initiated in 1999, when it turned out from a comparative study that in Belgium, France and the Netherlands, similar problems had arisen regarding the sustainability dimension of projects in the sector of maritime transport. It became apparent that many large infrastructure projects, particularly port projects, had problems with the implementation of the Habitats Directive. Its requirements were not always clear and in many cases, there was no societal consensus on the design and scope of compensation measures. After about a year, a number of government and industry stakeholders also supported the project financially or in human resources for a longer-term exploration. These included the port of Bremen, the port of Rotterdam, the port of Antwerp, the Dutch Ministry of Agriculture's Expertise Centre and the International Navigation Association (PIANC) represented by the UK Major Ports Group (UKMPG).

The Paralia Nature Phase II (2002 - 2004) objective was to find practical solutions to problems regarding the application of the EC Birds and Habitats Directive (and other relevant EC legislation) in relation to port and other infrastructure development in coastal zones and estuaries within or in proximity of designated areas. The starting point of Paralia Nature was the Birds and Habitats Directives. However, the intention of the project was not to change or reduce the requirements of the Directives but to establish more clarity in their interpretation, where the European requirements are not sufficiently clear. The wide spectrum of project partners, including representatives from government, industry and academia, helped to ensure that the project is neutral. The project's approach was further strengthened by co-operation between the project partners and NGOs.
More precisely Phase II of Paralia Nature sought to:

- Exchange information for solutions to problems pertaining to the implementation of articles 6.3 and 6.4 relating to port projects in estuaries in NWE.
- Explore the implications of the European framework of fishery (EU fisheries policy) and nature protection policy (Natura 2000, Birds and Habitats Directives) for large coastal zone infrastructure projects and their compensation.
- Establish more structured cooperation on Natura 2000 and estuaries.

- Explore the different approaches to management plans, their monitoring and evaluation.
- Explore and compare approaches to species protection issues in ports in NW Europe.

o *Activities for flora and fauna*

The Port Nature Plan 2004 is the Port Authority's policy strategy for ecology- related matters. This policy strategy has been translated into a concrete action plan. A few examples of the activities from the action plan are described below.

- In 2006, the landscaping of the **Landtong Rozenburg** was completed. This area became the green platform in the port and can now be better used for recreation. In addition to the Landtong, investment has been made in the riverside parks at Pernis and Charlois and the redevelopment of the area around Hoek van Holland. On behalf of the Municipality of Rotterdam, the Port Authority restored the brackish water environment in the lake 'Oostvoornse Meer' by creating a salt-water inlet. Brackish water environments are rare and support an often highly specific ecosystem with unique flora and fauna.
- A world-class port must look like one. For employees, visitors, holidaymakers and residents in the area, the port also provides an attractive environment. During the last few years, investment targeted the development of green spaces and recreation in and around the port. The **landscaping of the public areas** and the outdoor areas of industrial zones has been the central focus in the port. By improving the landscaping of these outdoor areas (image quality), the accessibility of the port for visitors is improved. For example, cycle routes are developed in the port area.
- Maasvlakte 2 is constructed in the Voordelta, a protected area of the North Sea. Other protected ecological areas in the immediate vicinity include the Voornes Duin, the dunes at Goeree and the Kwade Hoek, all of which are vulnerable areas. To compensate for the loss of the marine ecological environment, part of the Voordelta is to be designated a **soil protected area with quiet areas**, ten times the area of Maasvlakte 2. Thanks to this extra protection, the natural environment will be able to better develop there. The consequences for the dune landscape in the area are compensated by a **new dune area** of 35 hectares along the coast of Delfland. Between Hoek van Holland and Ter Heijde, the coastline is raised at the same time as the vital coastal defences are strengthened.

- *Eco-design of coastal structures - PORT RESEARCH CENTRE FLYER (2007)*

Since 2007, PoR has joined forces with TU Delft to increase biodiversity in the harbour and the port research centre Flyer has been established. For the first time, civil engineers applied biological knowledge to create harbour structures, which not only fulfil the required civil engineering objectives but also constitute an attractive habitat for valuable species. "We have designed eco-structures for different depths and currents. Design parameters are the shape and slope of the structure, the choice of materials, the size distribution and the porosity" (de Wit, 2007). Large scale implementation of eco-design is expected to improve water quality, and the enlargement of suitable habitat will be beneficial for various species such as migrating fish. Pim de Wit (2007) mentioned another important advantage: *"Eco–structures could help to obtain the ecosystem quality goals as required by European legislation, without hampering the economic function of the port of Rotterdam."*

4.0 APPLYING FOR PERS VERIFICATION – PERS CERTIFIED 2008

Care for the environment can really make a difference, especially in such a large port as Rotterdam. Among the PERS standards objectives is, to identify particular environmental aspects in a port area and make the port related efforts to address them effectively and transparently. Although the port of Rotterdam was highly involved in the EcoPorts, it was also confined within its own managerial procedures for enforcing mandatory requirements and controlling pollution and therefore, it had not used both the EPF/EcoPorts tools (SDM/PERS) until 2007.

- *Gaining environmental knowledge and building up environmental policy frameworks*

The main environmental performance aims of the port's municipal management were included in the port's 'clean port' policy. Environmental procedures were gradually incorporated into daily operational management activities and most of them were the result of knowledge gain through various -mostly aspect related and project based- environmental policy frameworks. RMPM was an active participant in a series of environmental research programs.
A clear example of the efforts involved, besides being the longest, were the efforts made by the RMPM to confront dredging environmental issues in the port area and beyond (Table 4.1). The amount of work done reflects the significance of dredging for the port, the mandatory demands and especially those of the Water framework Directive, as well as the ecological situation in the Rhine, the North Sea coastal zone which has significantly improved through the years. From 1984 to 2010, the overviewed picture reflects the importance of knowledge gained in directing policy objectives. In the beginning, the management efforts focused on reducing contamination at the source, while by the end of the time period the policy objectives shifted to the direction of reuse.

Table 4.1: The port efforts gaining knowledge and managing dredging

Tasks	Action	Responsible post	Timescale
	Dredging and dredged material disposal		
D1	**Rhine Research Project** (ROM)	initiated by RMPM	1984-1999
D2.0	**Rhine Research Project** II (ROM II)	initiated by RMPM	1999-2010
D2.1	PorTI project - supplementary project under the ROM II	commissioned by RMPM	2001
D2.2	Two International workshops as parts of the PorTI project		2000
D3	**Dutch-German Exchange** on Dredged Material (**DGE**)	national level Port of Rotterdam highly involved	1999-2010
	2005 and beyond		
D4	**MANAGEMENT OF HISTORIC CONTAMINATED SEDIMENTS** (IN THE RIVER BASIN SCALE)	the new thinking highly supported by PoR	
D5	**Activities for the beneficial use of dredged material**	implemented & investigated actions	

Source: own elaboration

Since 2004, the corporate management of the port has placed the PA in a more *"central role in ensuring that the port and the surrounding community can develop in harmony with each other"* (PoR Annual Report, 2006:33). Therefore, it was extremely important for the PA to achieve improvements in environmental protection while the main focus shifted onto air quality issues.
Until 2010, the PA was engaged in a number of environmental policy frameworks (Table 4.2). Under these policy frameworks, PoR embarked on a number of specific projects within its own area of responsibility and was involved in related projects within the port and industrial complex (Table 4.2).

Table 4.2: PoR's involvement in environmental policy frameworks, until 2010.

time of involvement	policy framework
more 20 years	Rhine Research Project
10-15 years	• concerns for environment protection; • a port focused approach to soil, water quality, noise, and air quality.
10 years	area-focused environmental policy for the port
5 years	area-focused ecological policy for the port
3 years	Corporate Social Responsibility (CSR) by the PA

○ *Implementing an EMS as part of the Port Vision 2020*

The PA -under its *'clean port'* and after 2004 its *'quality port'* policies- was already highly committed to environmental protection and had systematically implemented a three-level approach: 1) improving the performance of the PA; 2) fostering sustainable activities and enterprises in the port area with various measures; and 3) calling for sustainable innovation in the entire supply chain (Table 4.3).

Table 4.3: PoR's environmental management approach before EMS adoption

Environmental performance at the PA level	Enforcing sustainable activities in the port area	Sustainable innovation in the supply chain
• energy savings in own operations; • sustainable mobility; • carbon footprint; • participation in various projects producing knowledge in specific port environmental aspects.	• managing sustainable dredging; • sustainable energy port: RCI CO_2 capture, re-usage, storage Biomass, LNG shore-based power (inland shipping) • sustainable accessibility • noise management • soil contamination management • water quality management • co-sitting towards energy saving; • species & habitat management • sustainable Maasvlakte 2	• modal split demands in terminal Maasvlakte 2; • the environmental zone Maasvlakte 2; • discount for clean ships with Environmental Ship Index (ESI); • encouragement of clean engines in inland shipping; • Green Award for inland shipping; • International cooperation with other ports: World Ports Climate Initiative.

Source: own elaboration

Based on its most updated green framework, until 2010 the PA aimed to develop the port into a 'quality port' by 2020. Both elements of the 'clean' and 'sustainable' port were incorporated within the 'quality port' policy. The Port Plan 2020 does not have a specific action plan. The activities which are already in progress are part of various projects and programmes of the Municipality of Rotterdam, the Port Authority (business plan) and the City Ports Office. The five (5) most important focuses for the 'quality port', that were introduced in the PoR's Port Vision 2020, are the following:

- *sustainable port*: constructing **Maasvlakte 2** and thus, developing a high standard and sustainable area with multimodal infrastructure;
- *knowledge port*: bringing together the port, housing and work in the **City Ports** (Waalhaven, Eemhaven, Merwehaven / Vierhavens); making the transformation of City Ports into a mixed port/urban area possible.
- *versatile port*: strengthening the existing business clusters in the port; by multi-using of space, innovative building, co-siting and sharing facilities and utilities;
- *fast and safe port*: improving the accessibility of the port with water, rail, road and pipelines; resolving bottlenecks in the capacity and quality of regional and national infrastructure, especially in the A15 highway;
- *attractive port*: devising creative solutions for uniting the port, industry, housing, natural amenities and recreational facilities on the right and left bank of the River Maas.

PoR's corporate management through its 2006-2010 Business Plan, as it was redefined at the end of 2007, has designated sustainability as its prime objective. With the Maasvlakte 2 expansion project entering its implementation phase as flagship for the sustainable port, PoR's management engaged in a greater effort to improve its own performance and that of the port and industrial complex in this field. The Business Plan (2006-2010) was named **corporate social responsibility** (CSR), as an essential part of business processes and corporate culture.

The PA interprets CSR as a working method that is sustainable, committed and transparent. The method is endorsed as a crucial precondition for a healthy development of the port in harmony with the surrounding area, and it is considered the key to a successful future in the port's own course of *"balanced growth"* (PoR CSR Annual report, 2007). The PoR's CSR program has three pillars: sustainability, commitment and transparency (PoR CSR Annual report, 2008). It addresses sustainability through six focus areas: clean and safe shipping; water quality and nature; outdoor space and the environment; energy and recycling; sustainable transport; and *environmental management*.

In terms of <u>*reporting*</u>, since 2004, the port's Annual Reports has made extensive information related to sustainability available, and a substantial part of critical performance indicators has been focused on this respect. The Annual Report has been considered a valuable tool in the stakeholder dialogue. The port's corporate management, besides making available information of sustainability considerations in the decision-making process of investments and other important issues, it also made related information throughout the entire report publicly available, reflecting the strong corporate belief that sustainability is part of the port's overall policy (PoR Annual Report, 2010). Recent empirical research on the port has outlined that, regarding the 'issues' treated and the stakeholder groups targeted in the PoR's annual reports, a growing number of environmental issues related to the local community has been mentioned in these reports since 2009 (Satta et al., 2014).

PoR is moving towards the creation of a comprehensive sustainability report, in line with other world ports (such as its main competitors, Antwerp and Hamburg). In order to increase transparency, the level of compliance with the G3 guidelines has been tested by Global Reporting Initiative, a non-governmental organization that develops worldwide standards for corporate social responsibility reporting. According to the GRI, the report of the Port of Rotterdam Authority fulfils the requirements of Application Level A+.

- *EMS implementation and certification according to PERS*

PoR went through implementing PERS (the only port sector specific environmental management standard) in 2007, and it was certified according to the standard in 2008. Responsible for the EMS implementation was the PoR's Environmental department, that falls under the responsibility of both the department of Infrastructure & Maritime matters and the department of Port Planning and Development. At the specific time that PERS standard was endorsed, the PA was already very active in implementing issue-based environmental management schemes and procedures. Most importantly, environmental management had been addressed at both the policy and the operational level. Also, in line with the port's ambition to become a sustainable port, the PERS standard was considered a useful tool that can further enhance the established environmental management procedures, especially through its structure inventory of the port's significant environmental aspects.

Voluntary self-regulation, through EMS standards implementation and certification, contributes to a port's image improvement especially when the industry -in this case the port industry- assists networking amongst its members to exchange good practices and experience. The PoR's notable contribution to the EcoPorts Solution Database (Table 4.4) was part of its successful PERS certification after the EMS implementation according to the standard.

Table 4.4: Port of Rotterdam contribution to the EcoPorts Solution Database

Solutions by *issue*	**No of Solutions**	**Referred Solutions**
Air Quality	**1**	Creation of underground storage
Dredging	**2**	Beneficial use of dredged material Management of historic contaminated sediments (in the river basin scale)
Energy use	**3**	Creation of underground storage The project R3 for sustainable solutions Realization of wind energy in Rotterdam Port Area
Environmental Management	**2**	The project R3 (Rotterdam-ROM-Rijnmond) PERS certified 2008
Habitat loss	**2**	Species and habitat management scheme Cases for port-city transformation
Noise Management	**3**	Research for the actual noise levels Noise Management system for industrial noise Cases for port-city transformation
Port Development	**3**	Research for the actual noise levels Species and habitat management scheme Cases for port-city transformation Realization of wind energy in Rotterdam Port Area
Soil Contamination	**2**	Soil Quality Management Scheme (SOQUMAS) Cases for port-city transformation
Traffic Volume	**7**	Cases for port-city transformation

Source: ECOPORTS-Ports sharing environmental experience – Solution Database/www.ecoports.com

5.0 CONCLUSIONS

The Port of Rotterdam (PoR) is a seaport cluster located in the heart of Europe, more specifically the Rijnmond region of the Netherlands close to the North Sea. The port is located at the end of the Rhine and the Maas rivers, the most important inland waterways in Europe. Rotterdam is more than a transit port. It is also a vast industrial complex.
In the 1990's, the two defining characteristics of Netherlands' environmental policy, of long range planning and achieving consensus between government and interested stakeholders, were already apparent. Early in the decade the Dutch Government's *mainport policy* targeted at the port of Rotterdam, although research in the country pointed out that the multipolar functioning of mainports and their increasing participation in activities outside their own area could not be strategically planned just only in line with the interests of the mainport itself (Kreukels & Wever, 1996; Van Klink, 1996; Van den Berg & Van Klink, 1996).

In the case of the port of Rotterdam and its mainport, development for the next two decades-what is sometimes referred to as the Dutch approach- (an integrated environmental planning system based on long-term analyses and implemented via negotiations with stakeholders) (De Jongh, 1996), was also apparent. In 1993, the municipal management of the port (RMPM) indicated that, the port would reach its limits to expand, and therefore, among the large amount of conditions to be met to keep Rotterdam as a successful port, the most important was to gain further space. The Maasvlakte 2 expansion project was therefore, extremely significant for the port. The project -as part of the Project Mainport Development Rotterdam (PMR)-, and after long and comprehensive planning procedures as well as involving extensive stakeholder dialogue, was finally agreed in 2004. Although, the ROM Plan for the Rotterdam region of Rijnmond (the umbrella policy covenant that supported the mainport development), has been considered traditional (Baas & Boons, 2007), it involved various actors in the decision process and in this respect, it was a "joint authorities approach" (Kreukels & Wever, 1996) that improved the environmental planning in the Maasvlakte 2 project. The changes in the institutional arrangements of the port were part of the positive final decision for the Maasvlakte 2 expansion, mainly because the central government had its share in the port of Rotterdam (Jacobs, 2004). The agreement included compensation for the loss of nature reserves as part of the project. One of the best guides in the *do's* and *don'ts* regarding the application of Natura 2000, is probably the Maasvlakte 2 in the Netherlands.This port expansion project was the only European case, where in fact a formal notification was asked by the Netherlands from the EC, as priority habitats were involved. This case was considered exemplary by the EC particularly in relation to stakeholder communication. At the same time, it showed that in addition to European requirements, national regulations, norms and procedures, it also remains very important that the stakeholder process in relation to Natura 2000 was included.

The Port Plan 2010 was a municipal plan on behalf of the municipality of Rotterdam which, as presented in 1992, was remarkable in respect of the changes it brought; firstly in the port's strategic vision from tonnage to value added (the preference for value added or quality was the most central element in the plan); secondly to planning methodology (a choice was made for a flexible plan that could adapt to new developments); and thirdly to its physical and environmental layout (the environmental aspect was also included in the port's investment policy) (Den Dunnen & Schut, 1994; Kreukels & Wever,1996;). The port investing program incorporated, for the first time, actions for improving the housing and living conditions in the surrounding area, while the environmental consequences of the Plan for the Rotterdam region were addressed in the 'Port Plan 2010 and the Environment' plan, in which 16 environmental actions were proposed. The Port Plan 2010 was RMPM's first attempt to internationalize environmental policy. The most important was that, the Maasvlakte boosted complex sustainability issues in the policy planning of the port, beyond those addressed as specific environmental aspects under the port's Port Plan 2010 'clean port' environmental policy. In parallel, in the beginning of the 2000s, the Dutch port strategy shifted to sustainability concerns and sustainability was emphasized as increasingly important to the competitiveness of the seaports (Kolk & van der Veen, 2002).
Perhaps the most prominent milestone that shifted the port's planning towards sustainability was the port's corporatization in 2004. Since then, the emphasis of the new structure of PoR was on a more

commercial role, in which the PA could operate within a market context more freely and transparently, but in a position to secure its important public character in terms of nautical management, safety, security and environment (Jacobs, 2004). The fact that investment in sustainability and the environment also delivers a return to the port is not a recent discovery. Building on sustainability has been an ongoing process from the beginning of the 1990s. Although effective licensing and permit procedures for different activities in the port area, as well as effective enforcement of legislation, were successful in producing pollution prevention outcomes, it was the active cooperation and coordination with DCMR, other authorities and the neighbouring municipalities that further enhanced the port's knowledge of environmental protection and environmental management.

Thanks to years of efforts by the Port Authority and the Municipality of Rotterdam, the quality of the water and the sediment in the port area has considerably improved. In the **Rhine Research Project**, discharges into the river have been successfully tackled at an international level. As a result, less and less dredged material is being transported to and stored at the Slufter. In 2030, innovation should ensure that, all dredged material is clean enough to relocate at the North Sea or to reuse on land. Besides monitoring the agreements with companies and government bodies as part of the **Rhine Research Project II**, innovative dredging techniques and the intensification of the reuse of dredged material are being investigated.
Reducing the environmental impact of Europe's main energy hub in a growing and rapidly globalizing economy is no easy task, but PoR is up to the challenge. In the 2000s, more emphasis was put on the environmental management and on how PoR will turn out to be the most '*sustainable port'* in 2020. The issue of **air quality** demanded a great deal of attention, partly because of European legislation, but mainly because of the way it was implemented in the Netherlands, linking the thresholds for traffic emissions and particulates to the spatial planning tools. This link manifests itself directly in the assessment of concrete projects in the area of infrastructure, housing and business accommodation, and limits the development options open to the port and industrial complex (PoR Annual Report, 2005).
In the mid-2000s, the port's management was engaged in a number of energy transition projects, with highly ambitious targets in the area of CO_2 emission reduction. The scope for the port has been to become the CO_2 hub of Europe and for the PA to be an attractive business partner for companies operating in Rotterdam Energy Port. Energy transition is an ongoing process, with no unique solution immediately available. The currently applied or under research available solutions of renewable, LNG, biomass plants and CCS, are highly innovative and are expected to play an important role in the regional sustainable energy system in the next decades. Rotterdam is an ideal place to build such an integrated 'plant', as both the existing and even more the port's expansion, offers chances for new techniques and smart combinations in terms of co-sitting (Jordan, 2007).
The port takes a strong position in this respect, as a result of intensive national and international collaboration. The introduction of the term 'Rotterdam Energy Port' as a marketing tool, marks a new leap forward for the promotion of Rotterdam in this role. The energy market is expected to change rapidly over the course of the following years, mainly based on the bio-fuels use, a trend driven by societal developments and new legislation (RCI, 2007) and hence, PoR as a PA, offering a wealth of specialised knowledge and an extensive network (PoR, 2008), will be at the forefront, as these new developments unfold.

With more than fifteen years of experience tackling specific environmental issues, the PA was able to form a comprehensive CSR program and use standardized tools to present actual environmental protection results, like reporting according to the Global Reporting Initiative guidelines, and producing its own Carbon Footprint. In 2008, PoR EMS was certified according to PERS and thus, obtained its first 'environmental quality mark'. Since this system was used by several ports, it was now possible to make comparisons and good examples could be quickly exchanged. PoR has substantially contributed to the EcoPorts Solution Database. By the end of the decade, various sustainable initiatives were already implemented among Dutch ports and until 2010 four Dutch ports had certified their EMS implementation according to PERS standards.

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- *Position of People interviewed or contacted via questionnaire*:

Tiedo Vellinga	PoR – TU Delft; Chairman of the SedNet Comittee
Marc Eisma	PoR - Strategy Port Infrastructure & Maritime Affairs; position: senior policy advisor
Rob Houben	PoR - Project manager; Port Planning & Development - Port of Rotterdam Authority
Maurits Prinssen	PoR - Project manager; Port Planning & Development, Shipping department
Steffart Buijs	Rotterdam Climate Initiative
Ruud Melieste	PoR - Manager Energy & Processing Industry
Resianne Dekker	PoR - Head of Environmental Department
Pim de Wit	PoR - Manager Natural Affairs for the Port of Rotterdam Authority.

Curriculum Vitae

Chrysanthi (Christina) Kourbeti was born on July 4th, 1964 in Thessaloniki, Greece.
In 1988, she graduated from the Department of Civil Engineering at the Aristotle University of Thessaloniki (AUTh), defending her dissertation on a mathematical model for the movement of carried materials in a coastal space at the Department of Hydraulics, Harbour Works.
In 1995, she obtained her degree in Architecture at the Aristotle University of Thessaloniki (AUTh). During the studies she participated for an academic year in the “ERASMUS” mobility program, attended the Department of Architecture at the RWTH of Aachen, Germany and specialized in Architectural Planning. Her thesis project “Fix-care on the waves”, presented an experimentation planning for an artificial island of a multipurpose cultural center on the occasion of Thessaloniki’s film festival.
From 1988 to 1996 she worked as construction manager and assistant project manager in Greece and Germany, and from 1995 to 1996 as junior project architect. She was a member of Task-Force of the Hellenic Institute of Metrology (EIM) (1996-1999), responsible for EIM’s Business Plan '95-'99 implementation. Her main task was the project management of the institute’s new building of high standards that housed the institute’s new laboratories. In 1997, she received an award participating at the International Union of Architects (UIA) Habitat II International Ideas Competition: “convivial spaces”, proposing refugees’ integration in the redesign of Vlali Market urban area, a bazaar market in the center of Thessaloniki.
The same year she decided to pursue environmental studies and enrolled into the European Association for Environmental Management Education (EAEME), and in 1998, she obtained MSc in environmental management with honors. In her thesis project, she explored metrology and the case of the Hellenic Institute of Metrology (EIM) as potential policy tool putting into practice accurately monitored environmental pollution in Greece.
In 1999, she co-founded *ereisma s.a.*, an engineering consultancy. The company is registered in Thessaloniki and it is specialized in project management, architecture and environmental consultancy. Until today she has been working as the company’s senior designer and project architect, as well as project management planning director. She has over 15 years’ experience working as coordinator of environmental studies and project development in renewable energy in Greece.
She strongly believes that environmental challenges require significant adjustments in the way we work, and that for those with an interest in sustainability, interdisciplinary research based project analysis is essential. Both were the main reasons she joined the Erasmus University of Rotterdam international off-campus PhD program on “Cleaner Production, Cleaner Products, Industrial Ecology & Sustainability”.