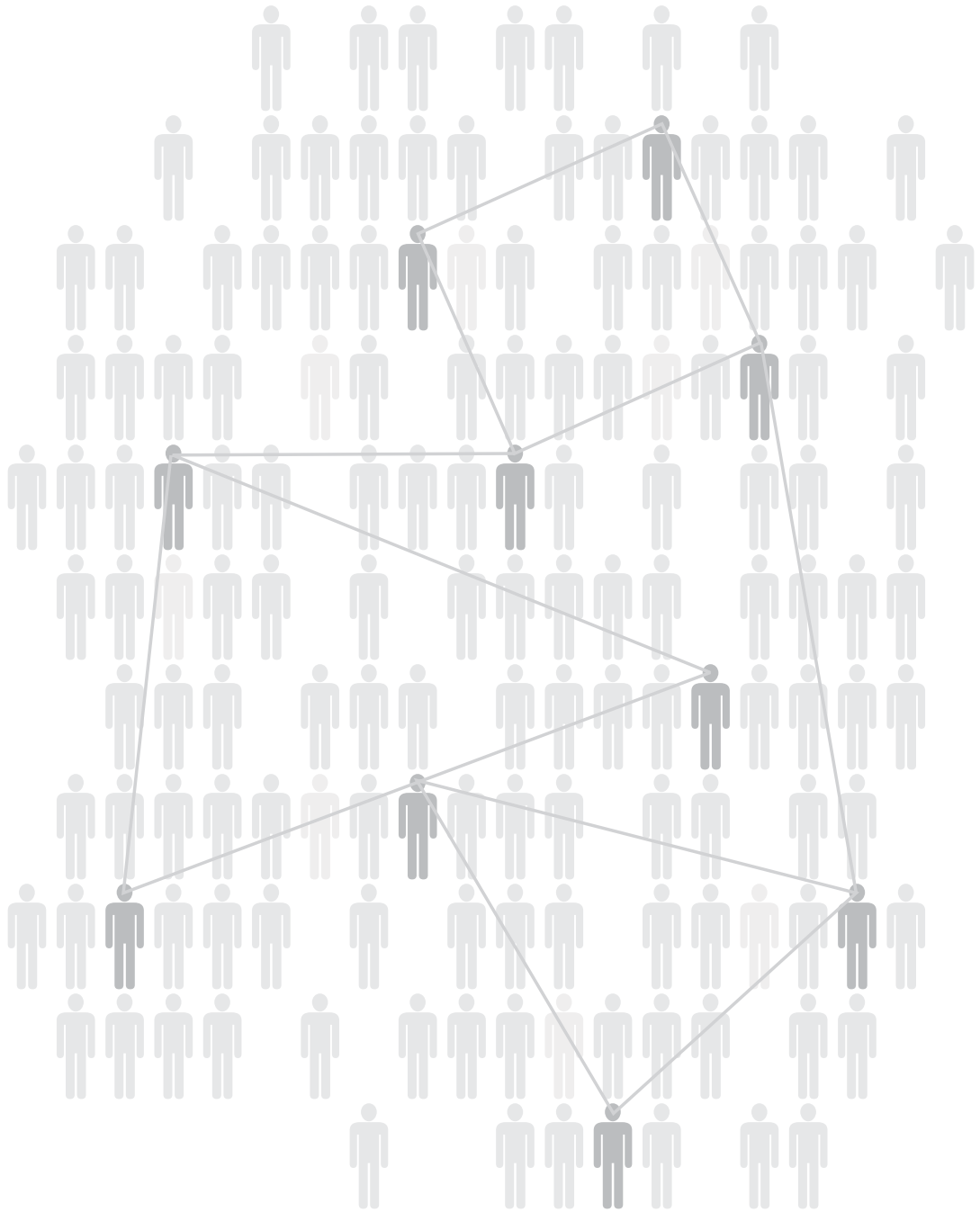


Waste Management in Mexico: key variables in play

The case of the Autonomous University of Baja California



Carolina Armijo de Vega

**Waste Management in Mexico: key variables in play
The case of the Autonomous University of Baja California**

**Afvalmanagement in Mexico: dominante variabelen
De Autonome Universiteit van Baja California als voorbeeld**

Thesis
to obtain the degree of Doctor from the
Erasmus University Rotterdam
by command of the
Rector Magnificus
Prof.dr. S.W.J. Lamberts
and in accordance with the decision of the Doctorate Board

The public defence shall be held on
Thursday October 19th, 2006 at 16.00 hrs

by

Carolina Armijo de Vega
born at Mexico City, Mexico

Doctoral Committee

Promotor: Prof.dr. J.M. Cramer

Other members: Prof.dr. J.J. Bouma
Prof.dr. A.L. Quintanilla-Montoya
Prof.dr. J.F.B.D. Wempe

Preface

My academic development as a researcher began in year 2000 when I joined the Environmental Research Group at the Engineering Institute of the Autonomous University of Baja California (UABC). Even though I had worked as an environmental consultant before, my involvement in waste management research began when I started working at UABC.

In spite of my basic knowledge about waste problems in Mexico, these were never as evident for me as they were the first time I participated in a waste characterization study. Separating, quantifying, weighting and finally analyzing and plotting the results of the study were activities that opened my eyes and made me realize that the problems of solid waste in Mexico are greater than I initially thought. The unpleasant nature (bad smell, insects' larvae, among other things) of working with waste far from inviting me to quit this line of research, made me more aware of the need to keep working on it and try to find solutions for the many problems involved.

During my participation as an associate researcher in two research projects I started to pay attention to the way UABC was managing its waste. My interest in this issue went beyond noticing the different types of trash bins. I started an inquiry to know who were the people in charge of waste, if there were any initiatives for waste recycling and reducing, how was UABC transporting its waste to the landfill, and so on. After doing this it was evident that at UABC there was not any formal initiative with the aim of improving waste management.

How could it be that an education institution did not manage its waste in an environmentally-friendly way? Why the institution was letting pass the opportunity to teach the students and the community in general through the example? What is more, how was it possible that no data existed about the quantity and quality of the waste produced at campus? Before these facts I proposed a characterization study for the waste produced at the Mexicali Campus of UABC. The results of the study were impressive. UABC's Mexicali Campus was producing great quantities of waste (one ton of solid waste per day). This waste contained high proportions of recyclables (more than 60% of the waste was recyclable). Based on these results I proposed the implementation of an integral solid waste management program for UABC. The proposal was approved and the waste management program was launched.

Soon after the launching of the waste program problems started to appear. Diverse adverse events prevented the program from functioning adequately. Some of these adverse events were originated inside the institution and were related to the way the actors of the program interacted with each other and participated. Other problems originated outside the institution.

In the middle of a bunch of problems and under the responsibility of the coordination of the waste program my will to continue began to erode. During those days, I received an invitation to attend to the conference “Cleaner Production and Pollution Prevention at Universities 2002: Inside Stories, Mexico”. Of course I attended to the conference to see if somebody else involved in environmental initiatives in universities was going through similar problems as I did. Dr. Don Huisingh was one of the key speakers on that conference. It was during this conference when for the first time made sense all the struggles to coordinate the activities of the waste program. Dr. Huisingh words encouraged everyone present in the room to start programs like the one I had been working on for the last months. He also invited the people working on environmental initiatives at universities to be patient and to persevere in their pathway to green their campuses. He mentioned these were important elements to the success of environmental initiatives. I understood that the same kind of trouble I was going through was being suffered by many environmental advocates in higher education institutions all around the world.

It was in that very conference that someone gave me a pamphlet with information about the Ph. D. Program Cleaner Production, Cleaner Products, Industrial Ecology and Sustainability at Erasmus University, Rotterdam. One month later I sent all the required documents to get enrolled in the program.

Once I was accepted in the doctorate program I decided that my thesis research would be about the waste management program at UABC. This way I would continue my work and at the same time I would have the opportunity to analyze the program under a formal theoretical perspective. The objective of my thesis work was not only to understand why the program wasn't successful but to find explanations with theoretical support to the problems encountered during the coordination of the program. Finally the aim of this work was also to generate recommendations to help other environmental program's champions in higher education institutions to have more possibilities for success. The lessons learned in this work can be applied to other universities.

My reflection during the elaboration of my thesis made me realize that:

Sustainability is not a goal to be reached but a journey that shapes a better future.

Acknowledgements

I want thank the Autonomous University of Baja California and the *Programa de Mejoramiento al Profesorado* (PROMEP) for supporting me to continue my professional education. I also want to thank the personnel of the Center for Environmental Studies of Erasmus University, specially Dr. Leo Baas and Trude DeGroot for their support during the four years that I've been enrolled in the program. Dr. Jacqueline Cramer deserves special thanks for her patience, and for guiding me in my research during these four years; with her help the contents as well as the quality of my work were improved.

I also want to thank Lewis for his help and support and my kids Luis Damián and Alejandro who tolerated my temper, lack of patience and stress during the writing of my thesis.

Finally I thank Antonio López who helped me to check the English writing of the six chapters included in this thesis and Dr. Ana Luz Quintanilla for reviewing my thesis drafts and for her support during the research.

Abstract

Soil pollution, water pollution, excessive levels of noise and air pollution are phenomena present wherever human have congregated in appreciable numbers. This has been taking place for centuries. As the human population increases and its activities diversify the impact on the environment reaches new proportions and complexity. Fortunately the same human greatness for creating new forms of production and human comfort that lead to pollution is also used to try to prevent and heal the damage done to the environment or at least to slower the pace of destruction.

The industrial sector has been the pioneer and the leader in implementing environmental remediation and pollution prevention measures with very good results. This trend has been taking place during the last three decades and permeates throughout other sectors that through the copying of the industrial sector scheme are taking initiatives to prevent and diminish the impacts to the environment.

The education sector, specially the higher education sector, has been very active in proposing and setting-off environmental protection initiatives. The publications about diverse initiatives indicate that good results have been obtained. However, these results haven't been obtained without hard work and troubles. Reported experiences about environmental programs at higher education institutions indicate that amongst the most common barriers for successful environmental problem-solving are the lack of environmental policies, the lack of a coordinator, and lack of financial resources. These reports however informative, lack the level of analysis that would allow suggesting deeper changes that might result in more efficient environmental programs. Other characteristic of the reported experiences of environmental initiatives in higher education is their focus on one or two variables of the internal environment of the organization.

The lack of a systemic approach of previous studies for getting to understand environmental initiatives in higher education institutions was the incentive to conduct this research under a systemic focus. Under this systemic approach external and internal variables of the organization were considered. The purpose of this research was to detect the key variables that affected an environmental program, namely the waste management program of the Autonomous University of Baja California, Mexico. Another objective of this work was to detect how those variables interacted to produce the results showed by the waste management program.

The external variables considered in this study were a) the sustainability trends in higher education and b) the waste management system in Mexico. The internal variables analyzed were: a) leadership, b) structure and c) culture focused on pro-environmental behavior. Based on the results

of these variables and their interactions it was possible to suggest some guidelines for environmental initiatives in higher education institutions.

In order to achieve the objectives of the study diverse theoretical perspectives were used. For the analysis of the external variables the concepts of task and general environments, organizational fields, networks and historical elements were used. For the analysis of the internal variables Fiedler's Contingency Model and transformational leadership theories were used to analyze leadership; Mintzberg's division of organizational forms and Lam's interpretation for linking organizational forms with the dynamics of learning and innovation were used to analyze structure; Azjen's Theory of Planned Behavior and other factors such as policies, location of recycle bins, habits, etc., were used to analyze some aspects of pro-environmental behavior.

In relation to the external variables analyzed the study concludes that in order to promote successful environmental care initiatives in the Mexican higher education sector a national strategy must be in place. This strategy should close the gaps between the governmental agencies involved in environmental protection and the education agency –in particular its interest on promoting environmental issues in higher education institutions. It is also concluded that for this to succeed incentives and performance standards should be set and applied to higher education institutions. Another conclusion derived from this study is that boundary spanning roles should be present to help in the processes of relationship building and communication between the external environment and the people within the organization.

For the special case of the variable "Mexican waste system" it is concluded that the local recycling market had a negative result on the UABC's waste management program. Regional and local recycling markets must be developed in order to decrease the uncertainty created by the dependency of the Mexican bordering states on the USA recycling market. It is also concluded that the lack of support and incentives from the Mexican waste system for the initiation and implementation of appropriate waste management alternatives leaves the organizations on their own making it difficult to allocate the financial resources and skills needed towards this end.

For the special case of the variable "sustainability trends in higher education" it is found that this variable didn't pose any effect on the institution. This allows concluding that UABC had a diffuse influence on the existence of national and international networks working on sustainability in higher education. In this sense it is also concluded that the knowledge networks COMPLEXUS (Mexican Consortium of Universities' Environmental Programs for Sustainable Development) and REMEXMAR (Mexican Network for the Environmental Management of Waste) did not play an important role for producing a paradigm change that could help the creation of successful

environmental initiatives at UABC. It is concluded that this situation was mainly due to the lack of a process of diffusion, assimilation and finally institutionalization of the new ideas proposed in those networks.

Concerning the internal variables of the institution analyzed in this work, it is found that leadership directly affected the waste management program. It is concluded that positive results for the program came to the fore when at least one of the characteristics of a transformational leader (vision sharing, moral purpose, relationship building, knowledge creation and sharing, coherence making) was present combined with a good leadership situation (According to Fiedler's Model). The good leadership situations were mainly present at the higher power positions.

In this work it is found that the organizational structure of UABC did not facilitate the success of the waste management program. The waste management program required the collaboration among administrative and academic sectors. It is concluded that the different approaches to work among these sectors generated difficulties between them. On the one hand the academic sector behaved like Mintzberg's professional bureaucracy –the creative-innovative side of the university- while on the other hand the administrative sector behaved like Mintzberg's machine-bureaucracy –rooted in an internal labor market organized around narrowly defined jobs. It is also concluded that the difficulty of adapting to changing circumstances faced by the administration staff made it difficult for them to meet the innovation and flexibility requirements demanded by the waste management program. Another conclusion of this work is that the bureaucracy's superficial approach to learning and its little capacity to innovate made it hard to mobilize the administrative sector to learn new ways of dealing with waste and make them participate in the waste program.

It was also learned that even when structural changes took place at UABC no positive results for the waste program were gained. It is concluded that the structural change produced an even more complicated and vertical organizational structure which is exactly the opposite requirement for sustainability initiatives. These need horizontal relationships as well as seamless integration of all units and functions in planning and decision-making. It was deduced that the UABC maintained the power/control-based structure that created separation between organizational functions, perpetuating this way the barriers that limit the ability to work together across departmental lines.

The results of this work show that the coordinator of the waste program lacked the authority and power derived from individual's structural position in the hierarchy. This result along with the structure type of UABC allowed concluding that a formal position within the organizational structure would help the coordinator of the waste program to successfully perform its activities.

Concerning the internal variable “pro-environmental behavior” the results show that in spite of the recognition that the strategies used by the waste program (reduce, reuse and recycle) were necessary people didn’t demonstrate the will to participate in the program, being the group of the administrative staff the one which had the lowest willingness to participate. It was learned that it was hard to relate this aspect to a single and specific causing variable. Four conclusions are derived from these results: 1) the bureaucratic mechanistic behavior of the administrative staff limits flexibility and openness to perform and experience new behaviors, attitudes and activities. The willingness of the administrative staff to participate in the waste program was low as a consequence of the lack of written rules and the lack of an established chain of command to shape and direct behavior. 2) UABC’s community did not see personal gains in the proposed behavior. If individuals don’t see any personal advantage of the recycling, reusing and reducing strategies for behaving according to them they might not consider it worth to make an extra effort towards the proposed activities. 3) People at UABC do not perceive that what others think about their waste practices is important. These subjective norms could have worked against the waste program. 4) People at UABC don’t feel that they can control the performance of the new behavior. This perception hinders their participation in the program. Furthermore it is suggested that other variables such as incentives, the location of the recycling bins and the lack of a waste policy could have also worked against the willingness to participate in the waste management program.

The main contribution of this work is the finding that the events of the waste program weren’t the result of a single variable. Instead the integrated framework used in this thesis allowed detecting that it was the interplay of several variables what produced the results showed by the waste program. In other words, it was shown that a single phenomenon can have more than one origin and various sets of players. The main theoretical finding was that, despite of the interplay of the various factors analyzed, the variable that played a more important role influencing the results of the environmental initiative was organizational structure.

This study proposes that for UABC to have a successful waste management program the initiative must be formally supported by top-management through written statements and commitments in the development institutional plan. Also the creation of the requisite policies and allocation of financial resources should be in place. It was also proposed that different levels of leadership are required, being the director of the maintenance department a key position for the whole system to align according to the plans of the waste management program. A waste program coordinator position should be created only if it is formally integrated into the organizational chart. Different mechanisms must be used to promote a more environmentally conscious culture in the university.

These mechanisms must be aimed to create common understanding, beliefs, and assumptions and shared values of the need to take care of the environment and to act accordingly.

The author also proposes the creation of an academic center in charge of environmental research, teaching, outreach, and audit as an alternative way to avoid many of the problems encountered by the waste management program.

The systemic approach used here sets the framework upon which future work can be based. Finally, the research raises questions and leaves space for alternative interpretations and the generation of future hypotheses.

Table of Contents

Preface.....	iii
Acknowledgements.....	v
Abstract.....	vi
Table of Contents.....	xi
List of Figures.....	xv
List of Tables.....	xvi
Chapter I. Introduction and Methodological approach.....	1
1.1 The call for sustainable development.....	1
1.1.1 Role of higher education.....	3
1.1.2 Environmental care as a part of the sustainability challenge.....	8
1.1.3 Focus on waste management.....	12
1.2 Methodological approach.....	16
1.3 Structure of the thesis.....	21
Chapter II. Literature review and theoretical framework.....	24
2.1 External environment level.....	27
2.1.1. Approach to change.....	31
2.1.2 Aspects of the external environment related to the waste management program at UABC.....	33
2.2 Internal environment level.....	35
2.2.1 Leaders and leadership.....	36
2.2.2 Structure.....	47
2.2.3 Culture.....	57
2.2.4 Other variables.....	64
2.2.5 Conclusion.....	68
Chapter III. Results of the external environment elements.....	71

3.1 Waste management system in Mexico.....	73
3.1.1 The state of solid waste in Mexico.....	74
3.1.2 Current urban cleaning system.....	76
3.1.3 Municipal solid waste generation and composition	81
3.1.4 Options for waste management in Mexico.....	84
3.1.5 Solid waste legal framework.....	92
3.1.6 Importance of community participation.....	94
3.2 Sustainability trends in the higher education system.....	97
3.2.1 International trend.....	97
3.2.2. Different focuses of sustainability initiatives in higher education.....	101
3.2.3 Waste management at universities	103
3.2.4 Major barriers to change	106
3.2.5 How to overcome the barriers	108
3.2.6 The context of sustainability in Mexican Higher Education.....	110
3.2.7 National efforts towards sustainability.....	111
3.2.8 Environmental activities in Mexican Universities	114
3.3 Impact of external environment on the waste management program of the University of Baja California	116
3.3.1 Relationship between UABC’s waste management program and the Mexican waste management system.....	117
3.3.2 Relationship between UABC’s waste management program and the sustainability trends in higher education	122
3.4 UABC’s approach to change in response to external influences	125
3.5 Conclusion	126

Chapter IV. The case study of UABC’s waste management program.....	129
4.1 Methodology used for analyzing the internal variables of the case.....	129
4.2 The case: Waste management program at UABC.....	130
4.2.1 Institutional Background.....	132
4.2.2. Environmental awareness at UABC.....	134
4.2.3 History of previous efforts for waste recovery.....	138
4.2.4 State of the art of waste management at UABC before the introduction of the waste management program.....	140
4.2.5 Waste management program at UABC.....	141
4.2.6 Summary of the case.....	166
Chapter V. Results of the internal environment.....	171
5.1 Introduction.....	171
5.2 Leadership.....	172
5.2.1 Before the reform:.....	175
5.2.2 Transition stage.....	178
5.2.3 After the reform stage.....	179
5.3 Structure.....	183
5.4 Culture (Pro-Environmental Behavior).....	187
5.4.1 Attitude towards waste by different groups.....	188
5.4.2 Information about the waste management program.....	197
5.4.3. Location of the recycling bins.....	199
5.5 Summary.....	200
5.5.1 Leadership.....	200
5.5.2 Structure.....	203
5.5.3 Culture (pro-environmental behavior).....	204
5.5.4 Other variables used to explain pro-environmental behavior.....	204

Chapter VI. Conclusion and recommendations.....	205
6.1 Impact of the external environment.....	206
6.1.1. Reflections on the Mexican waste system and UABC’s waste program	211
6.1.2 Reflections about sustainability trends in higher education and UABC’s waste program.....	213
6.2 Variables of the internal environment	215
6.2.1 Leadership.....	215
6.2.2. Structure.....	219
6.2.3 Culture (Pro-Environmental behavior).....	224
6.3. General lessons learned	228
6.4 Similarities of the findings of this study and other studies.....	231
6.4.1 Additional theoretical insights	233
6.5 Recommendations.....	236
6.5.1 Leadership.....	236
6.5.2 Structure	237
6.5.3 Pro-Environmental behavior	238
6.6 An integrated approach.....	240
Literature References.....	242
Annex I.....	261
Research Report.....	261
Annex II.....	277
ANNEX III.....	280
Samenvatting.....	284
Resumen	289
Curriculum Vitae.....	294

List of Figures

Figure 1. Variables that will be used to answer the main research question.....	22
Figure 2. Overview of the components of this research.....	23
Figure 3. Organizational levels considered in this study.	26
Figure 4. A framework for Leadership (Fullan, 2001 P.4)	44
Figure 5. Innovation feasibility and organizational forms (modified from Lam, 2000).	55
Figure 6. Summary of the theoretical approaches used to answer the main research question.	69
Figure 7. Elements of the external environment of the university that will be analyzed	72
Figure 8. Municipal Solid Waste treatment in various countries.....	80
Figure 9. Waste management hierarchy. Source: Phillips (2001).	85
Figure 10. Attributions regarding the services for solid waste collection, storage, transportation, reuse, recycling, treatment and final disposal.	93
Figure 11. Relationships between the different elements of the external environment and the waste management program of UABC.....	117
Figure 12. Diagram of the relationships found between the sustainability trends in higher education and the waste management program of UABC.	124
Figure 13. UABC's organizational chart before the institutional restructuring process	159
Figure 14. UABC's organizational chart after the institutional restructuring process.	160
Figure 15. Internal elements of UABC considered for explaining the results of the waste management program.....	171
Figure 16. Percentages of the five possible answers for question 20.....	194
Figure 17. Variables analyzed in this study.	206
Figure 18. Disconnecting among the Mexican waste system, the promoters of sustainability in higher education and the Mexican education system.	212

List of Tables

Table 1. Sampling parameters and sampling choices used in this study.....	20
Table 2. Traits associated with efficiency in leadership.....	37
Table 3. Summary of four models for situational leadership theory.....	39
Table 4. Summary of Fiedler’s situational variables and the preferred leadership styles. (Modified from Fiedler and Chemers. 1982).	40
Table 5. Per capita MSW generation rate in different countries during 1998.....	82
Table 6. Percentage composition of municipal solid waste in Mexico.	84
Table 7. Percentage (%) of waste recycled by type of waste generated in the period 1992 – 1998.	88
Table 8. Chronology of some declarations related to sustainability in higher education.	99
Table 9. Position in the organizational hierarchy of the people considered for constructing the story of the waste program.....	131
Table 10. UABC development stages.	133
Table 11. Summary of the main events in each of the phases of the waste management program.	167
Table 12. Situations and leadership styles according to Fiedler’s Model encountered for the waste management program at UABC during the different institutional stages.....	174
Table 13. Situations and leadership styles according to Fiedler’s Model encountered for the waste management program coordinator.	177
Table 14. Characteristics of a transformational leadership showed by the leaders involved in the program.	181
Table 15. Number and percentages of subjects in each stratum that answered the questionnaire	190
Table 16. Percentages of the attitude of the four strata together towards recycle, reduce and reuse strategies.	191
Table 17. Percentages of the attitude of each stratum towards waste reduction.	192

Table 18. Percentages of the attitude of each stratum towards waste reuse.....	192
Table 19. Percentages of the attitude of each stratum towards waste recycling.	193
Table 20. Percentages by each stratum of the results to question 20 (I would like to participate in the UABC’s waste management program).....	194
Table 21. Results of the ANOVA test applied to the answers of Q 20 “Willingness to participate in the waste program”	195
Table 22. Multiple comparisons of the mean for the variable “willingness to participate in the waste program” among the different groups.	196
Table 23. Tukey HSD and Duncan tests for homogenous groups	197
Table 24. Results of the Spearman rho correlation analysis.....	198
Table 25. Percentages and frequencies for the most preferred forms of information distribution	199
Table 26. Percentages and frequencies of the answers to the statement “The location (situation) of the recycling bins is adequate	200
Table 27. Summary of the results of the three variables during three institutional stages.....	201

Chapter I. Introduction and Methodological approach

1.1 The call for sustainable development

Historically, the relationship of humans with the environment has evolved, albeit often falteringly, from modification, to controlling, exploiting, managing and restoring. This involvement has a long timescale. It was the industrial revolution sustained by the agricultural revolution and the steep rise in population that provided the catalyst for societal concerns for human health, resources and the environment in general (Petts, 1999).

In recent years there has been a remarkable growth of interest in environmental issues especially in improving management of development that is in harmony with the environment. As a result of this growth of interest, new legislation has been introduced emanating from national and international sources that seek to influence the relationship between development and the environment (Glasson *et al.* 1998).

The direct impact on human health of the water, air and soil pollution has primarily dominated the debate since the rise of the environmental concern in the late 1960's. In the developed economies, environmental management was primarily an issue of reacting to environmental problems and controlling pollution via end-of-pipe solutions (Petts, 1999). In the course of time the approach has increasingly focused on anticipating the occurrence of environmental problems through preventive measures. Eventually, the spatial and temporal aspirational horizons shifted from the local to the global and from the immediate and short term to the needs of the next generation (Nadakavukaren, 2000; Leis, 2001).

The Earth Summit in Rio de Janeiro in 1992 (officially known as United Nations Conference on Environment and Development) is widely recognized as the landmark for international environmental issues. It represented the culmination of many years of debates on environmental degradation worldwide (Fiskel, 1997). Hundreds of thousands of people, from all walks of life, were drawn into the Rio process to join other nations in making the difficult decisions needed to ensure a healthy planet for generations to come.

The Summit's message reflected the complexity of the problems facing us: that poverty as well as excessive consumption by affluent populations place damaging stress on the environment. Governments recognized the need to redirect international and national plans and policies to ensure that all economic decisions fully took into account any environmental impact (UN, 2000).

The document resulting from the Earth Summit was called Agenda 21. This document contains a wide-ranging blueprint for action. Under the terms of Agenda 21, the central agreement of the Earth Summit was the need to pursue a path that achieves the goals of sustainable development.

The concept of *sustainable development* was first introduced in the late 1970s and popularized in 1987 by the World Commission on Environment and Development, also known as the Brundtland Commission, which defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987).

According to Leal-Filho (2000) *sustainable development* could be broken down, for instance, into the following meanings:

- The systematic, long-term use of natural resources
- The modality of development that enable countries to progress, economically and socially without destroying their environmental resources;
- The type of development which is socially just, ethically acceptable, morally fair and economically sound;
- The type of development where environmental indicators are as important as economic indicators.

It is unlikely that a consensus will be reached -at least a total one- on the meaning of sustainable development. The reason for this is rather simple: one's own definition will be influenced by one's training; one's working experience and one's political and economic setting (Leal-Filho, 2000); although most people would generally agree on what it is all about,

The industrial sector, amazingly, was one of the first to respond to the ambitious goals of Agenda 21. Significantly in this respect was the establishment of the World Business Council on Sustainable Development WBCSD in 1990 (Fiskel, 1997). This influential group of industrialists triggered initiatives to promote sustainable development within industry. They issued a book called *Changing Course* which describes the challenges and beneficial opportunities related to sustainable development (Schmidheiny and BCSD, 1992). They admitted that important changes in production systems were necessary in order to meet the needs and aspirations of a growing world population while using environmental resources in a sustainable manner.

After 1992 many countries in the world took up the issue of sustainable development and implemented national policies. The call for SD also reached Mexico. Although no specific national policies were formulated to promote SD, different environmental protection initiatives were launched such as fiscal and tax incentives, conditional operating licenses for industries, support for research and development centers, among others. For example, the Tax Law (Ley del Impuesto Sobre la Renta) established the possibility of applying the fast deduction to antipollution equipment. Additionally some production sectors were given the opportunity to get “zero-tax-tariff” for the import of anti-contaminant equipment that was not produced in Mexico. Shortly afterward, Mexican environmental regulations also began to demand environmental management systems and environmental certification in different industrial sectors in order to develop and strengthen the capabilities for environmental care (UN, 1999).

Furthermore, the Mexican Round Table on Pollution Prevention was set up. Thirteen governmental, academic, civic and financial organizations participate on its governing board, along with approximately 100 representatives of Mexican society in its five working groups: policy, education and training, tools for pollution prevention, financing, and diffusion of information. These working groups have ongoing activities on different topics relating to pollution prevention. The round tables on pollution prevention in Canada, Mexico and the United States are currently working together to develop a regional stance on pollution prevention policy in North America (CEC, 2002).

Despite the efforts made so far Mexico is still a long way from sustainability. Systems’ thinking tells us that environmental, social and economic concerns are not limited to the industry realm; the active participation of all sectors of society is needed. To raise the awareness for SD education and particularly higher education plays a crucial role.

1.1.1 Role of higher education

Universities have a key role to play in leading society towards a sustainable future, both in the education of the world's future managers, decision makers and in their own practices. A new vision for higher education is required to address profound challenges that face our society in responding to the unsustainable and environmentally destructive practices of our time (HENSE, 2000).

Incidentally Agenda 21 also recognized that "education is critical for promoting sustainable development and improving the capacity of all people to address environment and development issues" (Sitarz, 1994). Similarly, UNESCO argued that the power of universities to educate provides humanity’s best hope and most effective means to achieve sustainable development (UNESCO, 1997).

Thirty years ago the first sustainability declaration relevant to higher education was signed. To date, there are more than ten declarations signed by the representatives of diverse universities from different countries. A significant attempt to define the sustainable university was made in 1990 with the Talloires Declaration. Twenty-two university leaders met in Talloires, France, to voice their concerns about the state of the world. They created a document that spelled out key actions universities must take to create a sustainable future. Recognizing the shortage of specialists in environmental management and related fields, as well as the need of professionals in all fields who recognize the effect of their professional decisions on the environment and public health, this gathering defined the role of the university in the following way: "Universities educate most of the people who develop and manage society's institutions; for this reason, universities bear profound responsibilities to increase the awareness, knowledge, technologies, and tools to create an environmentally sustainable future" (UNESCO, 1990).

Another important initiative from the universities was the Association of University Leaders for a Sustainable Future (ULSF), which was created with the mission to make sustainability a major focus of teaching, research, operations and outreach at colleges and universities worldwide. ULSF is the higher education program of the Center for Respect of Life and Environment (CRLE). The Center, founded in 1986, promotes the greening of higher education, explores the implications of eco-justice for religion, and supports the Earth Charter Initiative (ULSF, 2001a). ULSF's on-going Sustainability Indicators Project has revealed a set of orientations and activities found in colleges and universities fully committed to sustainability. Though approaches to SD in higher education vary considerably, these institutions must be implementing practices in the seven areas explained below in order to be along the path to sustainability:

1. The written statements of the vision and mission of the institution and its various units should express their philosophies and commitments. In this way the descriptions of the learning objectives and public relations materials of the various schools, departments, programs or offices would express prominent and explicit concern for sustainability.
2. The college or university should incorporate the concepts of sustainability into all academic disciplines and in liberal arts and professional education requirements, as well as into faculty and student research. For example, some institutions committed to sustainability prominently feature certain topics in their course offerings, e.g. Globalization and Sustainable Development; Environmental Philosophy; Nature Writing; Land Ethics and Sustainable Agriculture; Urban Ecology and Social Justice;

Population, Women and Development; Sustainable Production and Consumption; and many others.

3. A major shift from the current academic paradigm lies in a conscious reflection of the role of the institution in its social and ecological systems. This would help the students to learn about the institutional values and practices in this context. For example, all students would understand:
 - a) How the campus functions in the ecosystem (e.g. its sources of food, water, energy, endpoint of waste and garbage) and its contribution to a sustainable economy.
 - b) How the institution views and treats its employees (such as student, staff, faculty involvement in decision-making, their status and benefits, etc.).
 - c) The basic values and core assumptions present in the content and methods of the academic disciplines.
4. Since research and teaching are the fundamental purposes of academic institutions, knowledge of sustainability is a critical concern in the hiring, tenure and promotion systems. In this sense we would expect the institution to:
 - a) Reward faculty members' contributions to sustainability in scholarship, teaching, or campus and community activities.
 - b) Provide significant staff and faculty development opportunities to enhance understanding, teaching and research in sustainability.
5. The institution has an "ecological footprint", thus in its production and consumption the institution should follow sustainable policies and practices: for example, CO₂ reduction practices and the use of emission control devices; sustainable building construction and renovation; energy conservation practices; local food purchasing program; purchasing and investment in environmentally and socially responsible products; and many others. Furthermore, these operational practices should be integrated into the educational and scholarly activities of the school.

6. The institution must support campus student life services that emphasize certain practices, such as:
 - a) new student orientation, scholarships, internships and job placement counseling related to community service, sustainability and/or justice issues;
 - b) an Environmental or Sustainability Council or Task Force, an Environmental Coordinator or Curriculum Greening Officer;
 - c) regularly conducted environmental audits;
7. Public, student and staff celebrations of sustainability on campus (for example, lectures, conferences, Earth Day celebrations, etc). The engagement of the institution in outreach activities and in the formation of partnerships both locally and globally to enhance sustainability. This way the college or university would support sustainable communities in the surrounding region and relationships with local businesses that foster sustainable practices. Finally the institution must seek international cooperation in solving global environmental justice and sustainability problems through conferences, and student/faculty exchanges, among others (see Clugston and Calder, 1999 for the extended list).

Several conferences and meetings were organized to declare the conviction of higher education institutions towards sustainability. To date extensive commitment and actions have taken place in universities throughout the world. Progress is reflected in the development of national and international networks of university staff devoted to improvement in sustainability, and innovation in environmentally sustainable design and practice. Despite these achievements, neither sustainability can yet be considered a mainstream activity in the majority of universities nor can sustainability efforts in universities be considered homogeneous all over the world. In fact, different authors (Wright, 2002; Dahle and Neumayer; Leal-Filho, 1999; Clugston and Calder, 1999) agree that approaches to sustainability differ from campus to campus, country to country, policy to policy, and declaration to declaration. However, the general trend is that each year more universities are getting engaged in sustainability efforts. In the UK, for instance, 50 out of 132 institutions had an environmental policy in 1995, compared to only one in 1990 (Khan, 1996). Unfortunately, this does not mean that SD is anchored homogeneously within the institutions. Frequently particular

efforts are carried out in one part of a university, while other operational units of the same institution will lag behind (Dahle and Neumayer, 2001).

Besides sustainability policies another indicator to assess the universities' commitment is the growth of the number of signatories to declarations of sustainability. For instance the Talloires Declaration was signed by 104 US signatories, followed by Brazil with 52 signatories, Colombia with 29, Canada with 23 and only nine Mexican universities. In Europe 29 universities have signed this declaration (USLF, 2001b). Other declarations and strategies were adopted as well by specific regions. For example for Europe there is the CRE-Copernicus Charter that was developed by the conference of European Rectors (CRE), now called the Association of European Universities. The objective of the COPERNICUS programme is to stimulate the discussion on ways and means by which universities can contribute to sustainable development, in particular to the implementation of chapter 36 of Agenda 21 (Copernicus Campus, 2005). The Copernicus Charter was a direct result of discussions within the organization, culminating in a call for a higher education sustainability statement that would be relevant to over 500 universities within 36 countries that CRE represented (Wright, 2002). To date over 321 universities have joined the initiatives of the charter (Copernicus-Campus, 2005).

Unfortunately very little is known regarding the implementation of the sustainability principles stated in the different declarations. Once universities have become signatories, there is no system for information exchange currently in place (Wals & Jickling, 2002; Wright, 2002). Some institutions are voluntarily reporting their sustainability advancements, while others make the reports for their own communities or choose to broadly disseminate their results. To date only two universities –the University of Hong Kong and the Florida University- are reporting according to the Global Reporting Initiative guidelines (GRI, 2005). The Global Reporting Initiative (GRI) is an independent institution whose mission is to develop and disseminate globally applicable Sustainability Reporting Guidelines (GRI, 2005).

According to different authors (Clugston and Calder, 1999; Wright, 2002; Creighton, 1998) the following conditions are critical for initiating and implementing sustainability initiatives in higher education institutions:

1. University commitment should be explicit and supported by key administrative leaders at the institution. The president, provost, vice presidents, and dean must make visible and meaningful commitment to sustainability action.

2. A clear understanding should be developed of how declarations can be implemented effectively at institutions. As a guideline the following measures were proposed:

- The development and the implementation of a sustainability policy statement. A policy statement is a public declaration of university commitment to sustainability and serves as a framework for decision making and goals.
- The organization of sustainability committees. A university-wide committee can help institutionalize sustainability stewardship efforts and bring stakeholders to the table.
- The putting in place measures of accountability and efficiency to verify progress towards sustainability goals. For example the performance of regular sustainability audits. Audits are valuable for raising awareness of university environmental impacts.
- The institution must acknowledge failures and lessons learned from the initiatives.
- The leading of sustainability initiatives should be preferably carried out by leaders with credibility and the personality needed to promote them, persistence in the face of resistance, with adaptability and grace.
- The benefits from the initiative should be clear.
- The identification of how well the initiative conforms to its institutional identity.
- The initiative should elicit the engagement of the university community. It should also have sufficient publicity and regular disclosure of progress, successes and failures.
- The initiative must be academically legitimate and economically feasible.

1.1.2 Environmental care as a part of the sustainability challenge

Environmental concerns are part of the sustainability challenge. The higher education sector has been active in sustainability initiatives especially those related to environmental care.

Environmental care implies the implementation of practices to diminish the environmental impacts generated by the normal operations of the institutions. In this way, environmental care programs can create environmental improvements on the university campus. A variety of environmental care initiatives has been implemented at universities, comprehending a broad spectrum of activities such as energy efficiency, water saving, waste management and recycling, green purchasing, green transportation systems, water treatment, hazardous waste minimization, and landscaping, among others. These initiatives, however well intended, often encountered problems, particularly due to the structure of universities. The reason for this is that the business of running a university's physical plant is complex and rooted in systems (technology and processes) that may have evolved over many years. In spite of this complexity, the usual way of facing problems at campus is through a punctual and very local perspective that attacks only the immediate consequences instead of the causes that originated the problem. By punctual the author refers to a momentary action considered as having no temporal duration. By local it is understood an action that affects a particular place rather than a larger area. Thus, when applying a punctual and very local perspective to solve a problem that has been developing for years with consequences in a large area, the intended solution would have a limited scope in time and space, with limited results as well. Besides the temporal and spatial variables, by a punctual and local it is also understood a perspective that considers a small number of variables amongst the total involved in a given problem. A variable could be any element affecting the situation under study such as actors, financial, social and cultural elements, etc. The punctual and very local perspective is called "*reductionist thinking*" which is the opposite of systems thinking. Under a systems thinking perspective the organization is seen as a holistic pattern of interconnected parts because its character depends on the whole (Mintzberg, *et al.*, 1995). In other words, the reductionist thinking emphasizes analysis of parts of the environmental problem as opposed to the systems-oriented perspective of sustainability (Shriberg, 2002a). Thus when trying to make a change towards a "green operation" of the campus the reductionist thinking encouraged by universities (Orr, 1996; Clugston and Calder, 1999) blurs the possibility to detect the links between the related parts involved to solve the problem.

Aside of the reductionist thinking which is sadly predominant in universities, advocates of environmental change in higher education institutions face other problems as well. Many of these problems are similar to the problems faced by advocates of sustainable development in industry and in universities. Frequently mentioned are:

- Lack of economical resources (Allen, 1999; Bowers, 1997; Schriberg, 2002a; Dahle and Neumayer, 2001). Fiscal pressures on colleges and universities have been increasing in recent years which are forcing campuses to operate more like corporations, focusing on economic performance (Schriberg, 2002a).
- Lack of an institutionalized leader dedicated to coordinate environmental issues (Allen, 1999; Shriberg, 2002a; Ching and Gogan, 1992). The lack of coordination hampers the communication between academics, staff and students which results in misunderstandings, unnecessary duplication of work and bad relations between key stakeholders in campus environmental issues.
- Absence of continuous administrative support and commitment (Allen, 1999; Creighton, 1998; Bowers, 1997). If a continuous support is lacking the environmental initiatives may fade away and eventually disappear.
- Lack of policies to guide and support the environmental initiatives (Allen, 1999; Bowers, 1997; Hamburg and Ask, 1992).
- Lack of incentives for the people who participate in the environmental initiatives (Allen, 1999).
- Difficulty of coordinating two or more university units (Armijo, et al, 2003; Schriberg, 2002a).
- Lack of clear performance measures for environmental activities (Schriberg, 2002a).
- Resistance to change behavior. An organization's culture will not alter quickly. What is often the most resistant to changing directions is that what lies below the surface level of awareness –the culture (Dale and Neumayer, 2001; Bowers, 1997).
- Competing priorities (Dahle and Neumayer, 2001). Without clear signals that environmental issues are an institutional priority, advocates find it difficult to command the time and attention of key stakeholders.

In spite of all the similarities shared among universities and business settings such as the types of problems faced during the implementation of green initiatives, there are huge differences between them making higher education institutions a particularly interesting case for study. The

main and most obvious difference resides in the very objective for the creation of these settings. While an industry was created with the particular objective of producing goods for producing revenues, a university has the priority of educating new generations. Despite this fundamental difference there is an existing trend to see and treat higher education institutions to be run as a business. In the words of Seymour (1992, p. 128) “*this kind of thinking supports new management techniques on the grounds that higher education has the same operating characteristics as a bank, an airline, or a restaurant. The fact is that we do have customers. We provide them with a service and an exchange takes place*”. It is possible to see universities as business –in fact many universities and colleges are part of private corporations with good revenues- but different experiences demonstrate that what is functional in a business is not always functional in an educational setting. Birnbaum (2001) explains that the difficulties for applying business procedures to educational settings arise when the differences between technical and social systems are ignored. Two examples of this are given by Birnbaum (2001): a) when the total quality management (TQM) trend hit the higher education sector many institutions engaged in it, but different studies done after its implementation showed that difficulty and failure took place in many of the educational institutions engaged in TQM. Reasons for failure are varied such as the difficulty to answer who is the customer of a university. In universities and colleges there is so much ambiguity about which customers should aim to please: students, professors, taxpayers, parents, or their graduates’ prospective employers. The picture becomes even more complex if students are considered not only customers but further divided into producers and products b) the second example the intent to apply business process reengineering (BPR) to universities, which took place in the 1990s. According to Birnbaum (2001) the difficulties began with trying to define what a process was in higher education. Hammer and Champy (1993, p. 117) stated that “*process are what companies do*”, to transform input into output. The reasons why BPR was not successful in universities were varied such as the lack of support, opposition by vested interests, limited demonstrated realizable benefits, and the lack of clear and measurable outcomes of instructional processes, among others (Birnbaum (2001). Moreover, the academic culture of higher education meant it would be necessary to dismantle higher education completely as we know it if BPR was adopted; the redesign would have to ignore the foundation of over four hundred years of tradition and start with a clean sheet of paper (Hammer and Champy, 1993, p. 49). Thus these two experiences exemplify that what is applicable to business is not always applicable to higher education institutions. Higher education institutions are not organized like business firms. The relatively tight coupling of business organizations permits control through hierarchical

directives. In contrast, colleges and universities are professional organizations in which managers with limited authority provide support for relatively autonomous specialists performing complex tasks within relatively stable structures (Birnbaum, 2001).

The same problems are explained by Barnes and Jerman (2002). These authors state that the implementation of environmental management systems in universities is more difficult than in companies. The explanation they give for this is that the traditional approach to development of an EMS—decision by a CEO to proceed, with the organizational hierarchy falling in line—will not work well in a university. In the first place the “product” of a university is intangible, consisting of knowledgeable students, sound faculty research and teaching, and so forth. In the words of Barnes and Jerman (2002) “while the environmental damage caused by a university is certainly related to its product, the relationship is far less clear than in the case of an industry producing widgets with an effluent of widget juice and air emissions related to the drying of widgets”. Thus operations manager that are responsible for decreasing the university’s environmental impact are less closely linked to the core functions of the organization than they would be in an industry.

Aside from the problems stated above another problem faced by environmental care initiatives is the negative attitude towards these programs. The most likely people to participate in environmental care programs are those who are motivated to do so (e.g., Katzev and others, 1993), while others are more hesitant.

The barriers to make changes towards SD found in the scholarly literature appear to be interrelated (Shriberg, 2002c). For example, it is difficult to look at the lack of financial resources for environmental programs without noticing that in the list of priorities the environmental issues are not present. Thus the former is a consequence of the latter.

1.1.3 Focus on waste management

The focus of this dissertation is closely related to the issues mentioned above. It addresses the environmental aspects of sustainability in higher education, especially in the problems of introducing waste management programs at universities. Specifically, the waste management program of the Autonomous University of Baja California is the case that will be analyzed in depth and will therefore serve as an example of the problems faced in higher education during the process of implementation of an environmental initiative.

The waste management program was selected by the author of this work because it lasted for two different administration periods thus it offered the opportunity to look at different variables playing a role under different institutional contexts. This is relevant because it would allow the researcher to

detect whether variables playing key roles were contextual or not. At the same time, the process of implementation, performance and the end results of this program were well documented offering a rich set of data. Other environmental care programs that have taken place at UABC have lasted less than a year and don't have written reports or documents to backup any of its phases. Finally, although any other environmental care initiatives at UABC would have its own particularities, they would face the same institutional context. Thus it was considered that the waste management program would serve as a useful and illustrative research case.

In this research the term "variable" is understood as any element that affected the waste management program of UABC. Because the systems approach was chosen for the analysis of the waste program, this analysis was performed considering elements (variables) from the outside of the institution -external variables- and elements from the inside of the institution -internal variables. These variables were analyzed over an extended period (temporal duration) and over diverse settings (broad scope). This way the analysis offered the basic requirements to perform a systemic approach.

The majority of the published articles that deal with the problems faced by advocates of environmental care programs at universities are focused on **what to do** to solve these problems. For example how to implement environmental management systems (EMS) (Herremans and Allwright, 2000; Noeke, 2000; Barnes and Jerman, 2002) and environmental management models in universities; (Viebahn, 2002; Allen, 1999); how to assess the ecological footprint of a university (Venetoulis, 2001); how to assess sustainability in higher education institutions (Kliucininkas, 2001); how to increase sustainability research, performance and curricular contents in universities (Fien, 2002; Shriberg, 2002c; Capdevila, *et al.* 2002); how to overcome barriers to campus greening (Dahle and Neumayer, 2001; Allen, 1999); and how to transform higher education through sustainability (Link, 2000) among others. Less attention has been paid to **why** these problems are present and why in some organizations it's difficult to change their internal processes of thinking, their assumptions and behavior to embrace new practices, techniques and tools (Doppelt, 2003; Shriberg, 2002c).

In confirming the above statements, plenty of written reports and papers are available about the efforts and advancements in different environmental care initiatives such as waste management programs. These publications are particularly focused on the results and achievements of the programs but not on **how** such results have been achieved. Among the publications that report success stories there is the paper by Clugston and Calder (1999) who reported that Santa Clara University (California, USA) SCU's recycling program compares with the best programs in the

USA in approaching a 50% recycled solid waste level. There are other publications that make emphasis on the problems faced during the launching and implementation of waste programs.

According to this set of publications the problems faced by the coordinators of waste management programs are much like the above mentioned problems for implementing any environmental change but there are also specific problematic issues related to waste, as an example is the case of Recycling at Tulane. The administration did not provide substantive support for this program, while the student involvement was excluded. As a result, recycling leadership became overextended and unfocused, leading to a collapse of policy enforcement, community education, communication and progress (Allen, 1999). Other authors (Armijo *et al.*, 2003; Keniry, 1995; Ching & Gogan, 1992) have reported that janitors might be reluctant to implement recycling if it means loss of income from scavenging. Ching and Gogan (1992) also mention that a recycling program would have more chances of success if a good understanding of local markets for recyclable commodities is present. The recycling market is composed of three stages —collecting recyclable materials, manufacturing recycled-content products, and selling those products. The knowledge of the recycling market will bring information about the type of materials that can be sold, the mechanisms for their collection, their prices and the amounts that can be delivered to the purchasing companies. Other problem present in waste management programs is that people throw all kinds of rubbish into the recycling boxes thus making the selling of the recycling wastes more difficult (Dahle & Neumayer, 2001). The above mentioned problems faced in waste management programs evidence the problems that could also be present in other environmental care programs.

The lack of success of the environmental care programs evidences the need of understanding their problems and the variables that are playing key roles. The issue relies on **how** to approach the required changes for the successful implementation of these programs. Nevertheless the absence of information and studies about how to make the change, explain many of the problems that organizations face when trying to operate environmental care programs. This lack of information is due to the limited number of studies focused on understanding the variables playing key roles in those types of programs. The studies done have limitations; some of them were focused on a particular sector like the industry, where waste management studies show that it is relatively simple to add or correct some stages of the industrial process to improve the overall waste management of a particular industrial sector. Said improvements can sometimes be achieved with state of the art equipment and sometimes it's just a matter of changing a stage of the process. In higher education institutions, waste management improvements are expected to be different because there are many different processes going on at the same time and all of them generate wastes. For example in a

university waste is produced by secretaries, faculty staff, administrative staff, janitors, students, etc. which work, study and eat in different institutes, faculties, laboratories, halls, gardens, etc. Thus it is expected that for the improvement of waste management all the departments of the university should be coordinated. This means that waste management in universities is not a linear process but a multi-player and multi-departmental issue.

Other studies are focused just on particular variables from inside the organization under study while others are focused on understanding more general trends on the implementation of sustainability initiatives in the educational sector. The majority of these studies have used analytical approaches rather than systemic ones. The analytic approach seeks to reduce a system to its elementary elements in order to study in detail and understand the types of interaction that exist between them. By modifying one variable at a time, it tries to infer general laws that will enable one to predict the properties of a system under very different conditions (de Rosnay, 1997). But, to make this prediction possible, the laws of the additivity of elementary properties must be invoked, definition which requires a homogeneous system, one composed of similar elements and having weak interactions among them. In the analytical approach the laws of statistics readily apply, enabling one to understand the behavior of the multitude-of disorganized complexity. The laws of the additivity of elementary properties do not apply in highly complex systems composed of a large diversity of elements linked together by strong interactions (de Rosnay, 1997). The case at hand is an environmental change attempt where different variables are interacting simultaneously making it a complex system, under these circumstances a systemic approach or holist approach is advisable. In this sense a systemic approach is likely to be most fruitful because every organization belongs to several social systems. The best way to understand the tangle of variables thrown up in a systemic approach is to identify and analyze the most salient variables, and to build complex models and explanations that interrelate those variables.

The research hereunder seeks to analyze which variables are crucial, how they relate to each other and finally how they influenced the results of the waste management program at UABC.

“Why?” and “how?” questions are important since they guide the researcher to find the reasons (variables) of the facts that lie behind the evident problems. Eventually proposing changes or modifications to those variables would ease the path towards the desired change. The understanding of the variables behind encountered problems would lead the researcher to propose **how** change should be implemented in an organization. The lack of a systemic approach of previous studies for getting to understand how environmental initiatives work in higher education institutions was the incentive to conduct this research under a systemic focus. The purpose of this research was to detect

the key variables that affected an environmental program, namely the waste management program of the Autonomous University of Baja California, Mexico. Another objective of this work was to detect how those variables interacted to produce the results showed by the waste management program.

The central question this study proposes to answer is: **how can we explain the difficulty of implementing waste management programs within a university from a systems oriented perspective?**

This question will be answered on the basis of a case study of the introduction of a waste management program in the Autonomous University of Baja California (UABC). The relevance of this case to UABC is that it would help the institution to learn from a failure. This would allow the institution to avoid committing the same mistakes as in the waste management program. The case would be also relevant to environmental care advocates in other universities where some of the circumstances of UABC might be also present. In both cases environmental advocates could benefit from the recommendations derived from the case.

1.2 Methodological approach

This research was carried out through a case study methodological approach. Case study is an ideal methodology when a holistic, in-depth investigation is needed (Feagin, Orum, & Sjoberg, 1991) and excels at bringing the researcher to an understanding of a complex issue. Case studies have been used in a variety of investigations, particularly in sociological studies but increasingly, in many other research areas.

There are many different definitions for case study. For Yin (2003) the case study research method is 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 - multiple sources of evidence are used. For Merriam (1998) case studies are intensive descriptions and analyses of a single unit or bounded system such as an individual, program, event, group, intervention or community (Merriam, 1998). Other authors have more simple definitions, for Miles and Huberman (1984) it is a phenomenon that occurs in a well defined context; for Smith (1994) is a bounded system while for Stake (1995) it is an integrated system. Since Yin's definition somehow includes the others, in this study Yin's (2003) definition of case study will be used.

In this work, as mentioned before, the specific phenomenon that is going to be analyzed is the waste management program of the Autonomous University of Baja California, Mexico. The real-life context is given by the external and internal environments of UABC. The time boundaries that will

be used to analyze the program will be from December 2000 to December 2004 and the space will be limited to the boundaries of the campus Mexicali of the Autonomous University of Baja California (UABC).

The research presented here focuses on one case study. The criteria for choosing only one case study are based on the design proposed by Yin (2003) for a single case study which should be under the following five circumstances:

1. When it represents the *critical case* in testing a well formulated theory. The theory has specified a clear set of propositions as well as the circumstances within which the propositions are believed to be true. To confirm, challenge, or extend the theory, a single case may meet all of the conditions for testing the theory.
2. When the case represents an *extreme case* or a *unique case*.
3. When the case is *representative* or *typical*. Here, the objective is to capture the circumstances and conditions of an everyday or commonplace situation. The case study may represent a typical “project” among many different projects.
4. When the case is *revelatory*. This situation exists when an investigator has an opportunity to observe and analyze a phenomenon previously inaccessible to scientific investigation.
5. When a single-case study is a *longitudinal case*, this is studying the same single case at two of more different points in time.

The research reported here meets two of the conditions described by Yin (2003) for doing single case studies.

1. The case is *representative* or *typical* because it shares many of its characteristics with other waste management initiatives, particularly in Mexican universities¹.

¹ Diverse waste management initiatives in Mexican public universities were initiated with the support of top management. After a short time they all have disappeared or are functioning with limited results. The majority of these waste management initiatives were proposed by the academic sector of the institutions. Although the results and experiences from these initiatives have not been published, their champions mentioned that several problems were present that hampered their efforts (Martínez-Gasca, Gutiérrez, Palacio, García, personal communication, October, 2004). Some of the problems mentioned were lack of support from top management, lack of commitment, lack of an environmental culture, janitors' reluctance to participate in the recycling efforts, etc. All of these characteristics resemble the ones that were present in the waste management program under analysis in this thesis.

2. In the research below a single environmental care initiative is analyzed over time (*longitudinally*) paying special attention to two different institutional stages.

The relevance of the case here under resides in the following:

1. It deals with different variables that other studies have not considered. The majority of the studies have focused only on the internal variables that exert any influence in the results of the change efforts towards environmental care at universities. The study reported here considers also external elements of the environment that, when combined with the internal variables of the organization, influence the results of the change efforts. In universities environmental issues are made up of an aggregate of factors that affect the whole institution (Hamburg and Ask, 1992). In dealing with environmental issues, therefore, it is important that proposed solutions to critical problems are based on the understanding of the triggers of the problems not only the immediate obvious related factors. According to Shriberg (2002c) holism, systemic changes and integrative efforts are the three important principles for any environmental change attempt.
2. Many of the problems faced by the waste management program at UABC are being faced by other Mexican public universities that are administrated and governed under similar circumstances. Thus the results derived from this research could be applied to universities with similar contexts.

The case under study is undertaken from different theoretical perspectives. The theoretical perspectives used are consistent with systems theory framework, this research conceives an organization as existing in a largely determinant relationship with its environment. The systems perspective was useful to explain how the waste management program was affected by elements of the external environment of the university. The two external factors considered in this study are: 1) the Mexican waste management system and 2) the sustainability trends in higher education. The former was chosen because the waste produced by the university, once it leaves the institution has to be absorbed by the waste system, creating an everyday relationship between the university and the external environment. The latter was chosen because UABC is familiar with the sustainability trends internationally and in Mexico, thus it was expected that this familiarity would exert any effect on the environmental care initiatives carried out in the institution.

Because the elements of the external environment alone don't provide sufficient information for answering the main research question, the organizational theory approach was also used to analyze the internal variables of the institution. It is not enough to have technologies, processes and well

defined activities to launch environmental programs. Different studies have proved that diverse forces from the inside of the organization shape the development and outcomes of new programs, strategies or technologies. This study will focus on three internal variables: 1) leadership, 2) structure and 3) culture (specially related to pro-environmental behavior). These variables were chosen because there exist sufficient evidence in the literature that supports the relationship between these variables and the outcomes of new initiatives, see for example Doppelt (2003), Fullan (2001), Ray (2001), Kegan and Lahey (2001), McKenzie-Mohr and Smith (1999), Wheatley (1999), Kotter (1996), Oakley and Krug (1991), Kotter (1990).

According to Tesch's (1990) classification of the qualitative research types, this study can be categorized as qualitative research. Based on his definition, the type of investigation hereunder falls into the category of research whose interest is in the comprehension of the meaning of actions. This comprehension can be done through interpretation of cases using mainly qualitative data. The advantage of qualitative data is that one can preserve a chronological flow, see precisely which events led to which consequences, and drive fruitful explanations. Another feature of qualitative data is their richness and holism, with a strong potential for revealing complexity (Miles & Huberman, 1994).

Case studies are designed to bring out the details from the viewpoint of the participants by using multiple sources of data (Yin, 2003). This research includes the use of multiple sources of data. According to Miles and Huberman (1994) the sampling parameters in qualitative research can be settings, actors, events and processes. In this study all of these parameters were considered. Table 1 shows some examples of the choices of sampling parameters used for this study.

The sampling parameters are approached through observations, interviews, analysis of published documents and written reports, and questionnaires. In each part of the study one or more of these sources were used.

Due to the amount of data obtained during the study data management was very important. Filed works were sorted into a structure of file type; each file included the names of specific persons, events or topics relevant to the study. Cross-referral information was used to link contacts and events. Recordings and transcripts of interviews were clearly tagged. For every person interviewed contact summary sheets were done. These sheets contained the most relevant information obtained from those contacts or key informants. Document summary forms were also used specially when documents like meeting agendas, reports, newspapers articles, and minutes of meetings were analyzed. When condensed summaries were used they were linked to the more extensive material analyzed.

Table 1. Sampling parameters and sampling choices used in this study.

<i>Sampling parameters</i>	<i>Choices for this study</i>
Settings	Corridors, offices, classrooms, halls and temporary disposal sites for waste within the university.
Actors	Actual rector, ex-rector, director of maintenance office, coordinators, janitors, social service students involved in the program, etc.
Events	Meetings of the people in charge of waste management at UABC, speeches, previous waste management initiatives, etc.
Processes	Delivering of recyclables, separating recyclables from non-recyclables, diffusion campaign, communication, setting up of the program.

The author of this dissertation was a participant-observer within the case under study. Participant-observation is a special mode of observation in which the researcher is not merely a passive observer. Instead, he or she may assume a variety of roles within a case study situation and may actually participate in the events being studied (Yin, 2003).

There are both advantages and disadvantages associated with participant observation. The advantages are associated with (1) giving the observer access to situations in which a formal, detached observation would not be welcomed and (2) through participation, giving the researcher a firsthand sense of the quality of the experience, what it feels like to be in that situation. However, there are important potential disadvantages as well: (1) the observer may, through his/her actions, change the situation in important ways and (2) through active participation; the observer may lose the capacity to be objective.

According to Merriam (1998), participant observing is a marginal position and personally difficult to sustain. This author says that there is always the concern about the extent to which the observer-investigator affects what is being observed. In traditional models of research, the ideal is to be as objective and detached as possible in order to avoid contamination of the research. However, in qualitative research where the researcher is the primary instrument of data collection, subjectivity and interaction are assumed. The interdependency between the observer and the observed may bring about changes in both parties' behaviors.

In the research reported here the investigator tried to stay sufficiently detached to objectively observe and analyze. The author of this work was the coordinator of the waste management program during its launching and its first two years, after that she was the advisor of the program. In this way she had access to the people, reports, meetings, etc, acting as a covert participant observer. During that time none of the stakeholders knew that the researcher was going to use the information for research purposes. This made it possible for the researcher to gain access to groups that would not normally allow them to be studied. In addition, since the groups under observation were not aware they were being researched; the problem of an observer effect was avoided.

An additional advantage was that by becoming a member of a group the researcher could personally experience incidents and events and, by doing so, arrived at a richer, **more detailed**, account of the factors that encouraged and motivated people's behavior.

In the results section (Chapters III and IV) a more detailed description of the methodological approach will be given.

1.3 Structure of the thesis

For single case studies the prime concern is with the conditions under which the theory operates, not with the generalization of the findings to other setting (Miles & Huberman, 1994; Yin, 2003). The theoretical framework that was used to analyze the case is presented in Chapter II. Chapter II is divided in two main sections, the first describes the theory used to analyze the external environment, and the second one describes the theory used to analyze the internal environment. The second part is divided into three sections each one corresponding to each of the internal variables under analysis: leadership, structure and culture (pro-environmental behavior). Each part of this chapter ends with a theoretical based research question. Each of these questions will help to answer the main research question. Figure 1 summarizes the variables that were used to answer the main research question.

The results of the external variables are presented in chapter III. In this chapter the two external elements of the environment under analysis are described: 1) the waste management system in Mexico and 2) the sustainability trends in higher education. The description of these variables was done through the reviewing of the relevant published literature, published reports and interviews.

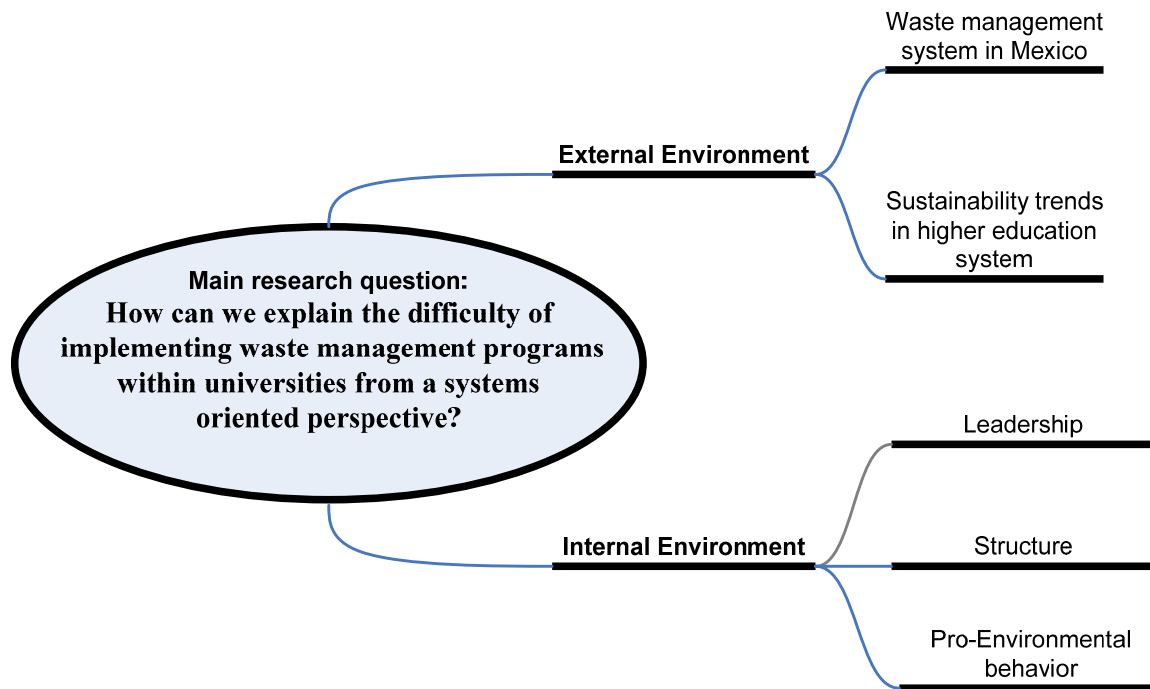


Figure 1. Variables that will be used to answer the main research question

The case is constructed in Chapter IV. In this chapter the descriptive story of the program was constructed. The story aims to build the understanding of the process of implementing the waste management program at UABC. This part of the chapter also helps the reader get acquainted with the facts of the program as perceived by the people who participated in it and through the description of the major events that took place. The construction of the story was also made of student's reports, limited circulation reports, and speeches, information obtained from some written documents about the program and through observations made throughout the first four years since the setting up of the program. To provide confidence in the findings the information from different sources were triangulated as suggested by Yin (2003) and by Miles & Huberman (1994).

The three variables of the internal environment are presented in Chapter V. This chapter includes the empirical data further analyzed in Chapter VI.

Chapter V focuses on the variables pertaining to leadership, structure and pro-environmental behavior. These variables were analyzed based on the research questions raised in Chapter II. For understanding the role that leadership and structure played in the waste management program two procedures were followed: 1) an in depth analysis of the history of the waste management program to detect the processes or activities where leadership, structure or culture could have played a role in the program; and 2) interviews with key respondents or main actors of the program to underpin the

anecdotes and events that were not clear enough through the analysis of the history of the waste program or additional events.

In the case of the aspects related to pro-environmental behavior the information was obtained from a questionnaire applied by the author of this work when she was the coordinator of the waste program under study (see Appendix XI for the questionnaire).

Chapter VI reflects on five variables analyzed and brings a systemic answer of the main research question. The reflection in this chapter is based on the theoretical aspects depicted in Chapter II. This chapter ends with a set of conclusions from this research.

In sum figure 2 shows the overall design of this thesis.

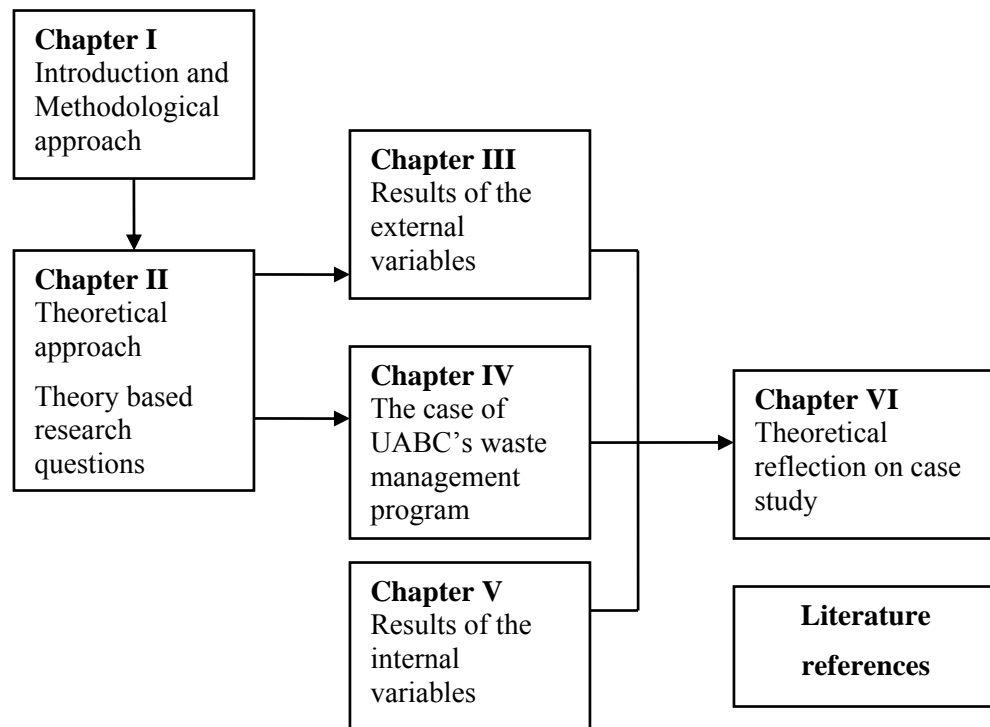


Figure 2. Overview of the components of this research.

Chapter II. Literature review and theoretical framework

In recent years growing attention has been paid to environmental care all around the world. The progress made, however, varies tremendously. Some programs for environmental improvement have progressed significantly and have generated important benefits, while others are starting to reach their potential, and, in many cases, there has hardly been any progress.

A plausible explanation for this mixed success might be the prominent focus on the question of *what to do?* For example, what new technologies or systems should be used? Unfortunately, little emphasis has been given to *how* the organizations can change their internal thinking processes, their assumptions and their behavior to embrace these new practices, techniques and tools (Doppelt, 2003; Shriberg, 2002c). Precisely this lack of insight and reflection on *how to carry out the change* can help explain many of the problems that the organizations face when they seek to put into practice programs that improve environmental performance.

In this sense Gladwin (1993) describes an interesting paradox. He argues that, while environmental issues bring society face to face with one of the fundamental challenges for its existence, there is scarcely any theoretically informed research about the way in which this challenge is being addressed. However, this kind of research is precisely what is needed for the development of efficient ways to confront this challenge. Although the body of knowledge in this area has been increased since Gladwin's appeal (Doppelt, 2003; Heugens, 2003; Fien, 2002; Shriberg, 2002c; Fien *et al.*, 2001) his statement is still valid. Gladwin advocates a type of research which can be approached in two ways; 1) to set in motion innovation which takes into account the environmental aspects (and those concerning sustainability). This integrated approach is so radically different from the already existing institutional practices, that a new theory is required to be able to explain the results of the programs as well as the processes that led to them; or, 2) to consider the environmental programs of the institutions as a specific example of the general processes of organizational change (Boons and LeBlansch, 2000). In the investigation here-under we chose this second option. Therefore the analysis of the results of the solid waste management program of the UABC will be addressed from the theoretical perspective of organizational change.

There are different definitions of organizational change. For Hodge *et al.* (1996) change is simply the alteration of the *status quo*. Daft (1995) considers organizational change as the adoption of a new idea or behavior by an organization. Boons and Le Blansch (2000) define organizational change as the development and spread (innovation and diffusion) of new organizational routines.

In a technical sense change occurs continuously; no moment is exactly like the one that preceded it. But in this research we are interested in deliberate change to the organizational system. Deliberate changes are planned changes to input and output relationships, changes to the technology or transformation processes, changes to structures or design, changes to coordination mechanisms, changes to people and roles in the organization, changes to culture, or basically changes to any of the aspects of the organization (AICPA, 1998; Hodge *et al*, 1996; Daft, 1995).

As mentioned before, in this research the implementation of a new waste management program at the *Universidad Autonoma de Baja California* (Autonomous University of Baja California, UABC) will be analyzed as a deliberate change process. This new system is a departure from previous waste management practices. The change of procedures for waste management was proposed in accordance to the need to make the system more efficient and more environmentally sensitive. Before the program, no reduction, recycling or reusing of waste were being promoted. The waste management program was introduced as a new idea within the organization that was supposed to be diffused progressively through the institution.

In the course of developing the new waste management program different problems arose which made the implementation process slow, difficult and hard. In order to better understand the obstacles for organizational change towards the new waste management program this thesis addresses the question - **How can we explain the difficulty of implementing environmental care programs within universities from a systems oriented perspective?** More specifically, how can one explain the difficulties of implementing a waste management program (or other environmental care program) at the University of Baja California? Which recommendations based on this research can be proposed for improving the setting and implementation of a waste management program?

In order to answer these questions it is important to understand the university is an open system. An open system is a set of interacting elements that requires inputs from the environment, transforms them, and discharges outputs to the external environment (Daft, 1995). The need for inputs and outputs reflects dependency on the environment. Therefore, this study will analyze from an organizational perspective theory, the processes of change at two different levels: 1) external or environment level, and 2) the internal or university level including the departments and people within them (See Figure 3).

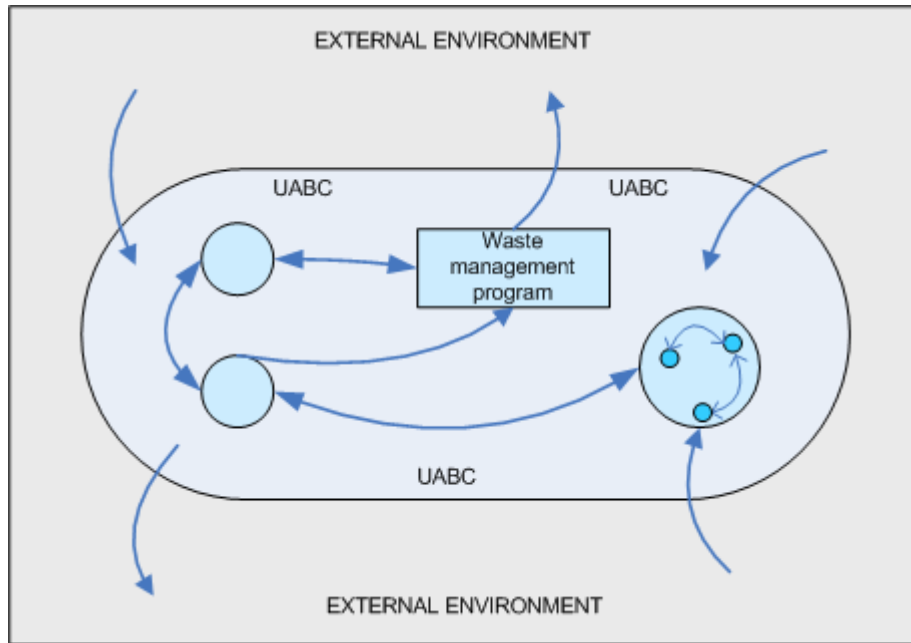


Figure 3. Organizational levels considered in this study.

In the first part of this chapter the external environment level will be addressed. The external environment includes all elements outside the boundary of the organization that have the potential to affect and influence the organization. However, the environment is not the rest of the world which lies outside the system; rather, how something is judged to be part of the environment is determined by whether or not it influences or is influenced by the system which has been perceived (Fortune & Peters, 1995). Because the focus of this research is on waste management emphasis will be directed toward the aspects of the external environment as it relates to the issue at hand as well as with the aspects that relate to the attention paid by Mexican universities to environmental issues.

The internal level of the university entails the elements within the organization's boundaries. However not all the internal elements of the university will be analyzed, the internal elements included in this work are the departments and the people that played a role in the waste management program. In the second part of this chapter these elements will be further analyzed. The analysis will be based on the following theoretical aspects: 1) leadership, 2) structure, and 3) some aspects of pro-environmental behavior related to waste.

Below the theoretical perspectives applied for analyzing both internal and external levels will be explained.

At the end of each main part of this chapter key questions will be posed which will be answered in the following chapters.

2.1 External environment level

No institution can exist in isolation. No organization is self-sufficient; all depend for survival on the types of relations they establish with the larger systems of which they are part (Scott, 1987). This maxim of business also holds for universities. Broadly speaking, the environment is infinite and includes everything outside the organization. However, when analyzing a specific organization in interaction with the external environment one should consider only those aspects of the environment to which the organization is sensitive and must respond to survive (Daft, 1995). Thus, organizational environment is defined as all the elements that exist outside the boundary of the organization and have the potential to affect all or part of the organization.

Establishing the level at which organizations and systems of organizations are to be defined is an important step in determining how environments are to be conceived. Hall (1991) divides an organization's environmental factors into two categories: task environment and general environment. The task environment, first proposed by Dill (1958), includes sectors with which the organization interacts directly and that have a direct impact on the organization's ability to achieve goals. Scott (1987) defines task environment as those features of the environment relevant to the organization viewed as a production system in particular, the sources of inputs, markets for outputs, competitors, and regulators. The general environment includes those actors that may not have a direct impact on the daily operations of a firm but will indirectly influence it. The general environment consists of five major elements described by Tushman and Anderson (1986). These are:

1. The Technological Element - The technological element tends to evolve through periods of incremental change punctuated by technological breakthroughs. It is the current state of knowledge that enhances or destroys the competence regarding the production of goods and services.
2. The Economic Element - The economic element includes the current systems of producing, distributing, and consuming wealth. Operating within economic systems, organizations are controlled, to a large degree, by economic factors over which they have little or no control, such as interest rates and inflation.
3. The Legal-Political Element - The legal-political element includes the legal and governmental systems within which an organization must function. Organizations are governed by laws that address the manner in which they function, and organizations must operate within the legal framework of the countries in which they conduct their operations.

Political pressures and processes also influence the legal system and may also influence the extent of government regulation of various laws.

4. The Social-Cultural Element - The socio-cultural element includes the norms, values, beliefs and behaviors associated with the demographic characteristics of a given area or region. Socio-cultural considerations are subject to change. So organizations must be aware of this aspect of the external environment.
5. The International Element - The international element is concerned with developments in countries outside the firm's home country that may potentially affect the organization.

In essence, the task environment is composed of the set of factors that are unique to an organization, while the general environment includes environmental factors that may not impact directly the organization under consideration (Hall, 1991; Gibson, Ivancevich and Donnelly, 2001).

Aside from the definitions of task and general environments, Meyer and Scott (1983) distinguish between two other types of organizational environments: technical and institutional. *Technical environments* are those in which organizations produce a product or service that is exchanged in a market such that they are rewarded for effective and efficient performance. These are environments that foster the development of rationalized structures that efficiently coordinate technical work. Most types of manufacturing and service organizations operate in technical environments. The definition of Meyer and Scott (1983) of technical environment resembles the notion of task environment previously mentioned. *Institutional environments* are characterized by the elaboration of rules and requirements to which individual organizations must conform in order to receive legitimacy and support. Organizations are rewarded for the institution of correct structures and processes, not for the quantity and quality of their outputs. Organizations operating in institutional environments include schools and mental hospitals whose resources do not depend primarily on evaluations of their outputs in a competitive market (Scott, 1987). Both types of environments place pressures on organizations to which they must be responsive in order to survive. But the types of pressures and the types of responses required vary between the two. Under the classification of environments given by Meyer and Scott (1983) universities should be placed within institutional environments.

Technical and institutional environments have a certain degree of dependency. Dependency is the degree to which the organization becomes dependent on others for vital resources. The dimensions that affect dependency are: degree of munificence – scarcity, degree of concentration –dispersion and degree of coordination – lack thereof. Uncertainty is the lack of predictability on the

environment. The dimensions affecting uncertainty are: degree of homogeneity – heterogeneity, degree of stability – variability, degree of threat – security, degree of interconnectedness – isolation and the degree of coordination – non-coordination (Scott, 1987).

As you can well imagine, external environments have additional dimensions to interact with their environments such as networks, culture and history. *Networks elements* consist of the connections among organizations, whether expressed as flows or linkages, such as shared participants. Networks have some important types of connections among organizations that are based on “interpersonal boundaries” – for instance, common membership in a coalition or federation, the undertaking of joint programs, and interlocking directorates (Laumann, Galajliewicz and Marsden 1978, cited on Scott, 1987 pg. 130). Network approaches differ from conventional social-science methodologies in that they attend to relational and structural connections among units, such as organizations, rather than simply to the attributes of the units. In this sense a variety of types of connections are possible. Some involve flows or exchanges (of services, resources, information); others entail structural linkages. The linkages can take different forms and they can be measured by their connectivity –the degree to which units are linked directly or indirectly, clustering of ties among units, the density of ties, and so on (Scott, 1987).

Cultural elements comprise both cognitive and normative systems on which organizations or fields of organizations draw and are themselves subject to. In general culture shaping organizations and organizational fields cultural beliefs vary not only between but within societies. A highly developed and differentiated society contains multiple, diverse value and meaning systems –cultures associated with regions, ethnic groups, classes, occupational communities, and generations. Similarly cultural beliefs vary among organizational fields and sectors, both in content and in degree of consensus. Particularly important are those belief systems that define the collective goals or values governing the field, values that provide the basis for domain definition (Scott, 1987).

Historical elements call attention to the relevance of past conditions for understanding the present and future prospects of organizations. Just as significant as a system’s own history is the larger historical frame within which it develops and operates. Many of these larger contexts are themselves structured and maybe usefully viewed as systems with their own developmental history. All system elements –units, relations, and beliefs- have a time subscript. Knowing when some element developed may provide important clues as to its characteristics and behavior. Because of differences in technologies, beliefs, and other founding conditions, we would expect the organizations that develop at a given time to differ from those that develop earlier or later (Scott, 1987). Historical elements are important because present conditions in organizations are the result

of a dynamic and dialectical process wherein conceptual meanings and social relations changed over time (Pumar, 2005).

Closely related to the aspects of cultures are the normative structures – collective norms governing behavior in organizational fields. Lauman, Galaskiewicz and Marsden (1978 cited in Scott 1987) describe the normative contexts as varying from competitive to cooperative modalities. Cooperation is further broken down into: 1) contingent- in that organizations are expected to balance their commitments to collective purposes with their more specialized goals, and 2) mandated cooperation – a mode that implies the existence of a centralized control agency, which has the power to structure and restructure the total network (Scott, 1987).

In this work network elements are considered very important since its function facilitates the introduction of new ideas into the organization and the upgrading of those ideas, thus allowing the passing of information into the institution for its further institutionalization or rejection. In a publication by Pumar (2005) about the institutionalization of the idea of sustainable development, this author states that ideas become paradigms after intense social interaction by members of several networks (knowledge networks). Once these networks introduce knowledge into the public sphere, that knowledge becomes part of the public domain. This happens because an ideology dominates public discourse when public intellectuals with close ties to international institutions endorse it (Cox & Sinclair, 1996). The process of diffusion unfolds under intense politicization by public intellectuals. The institutionalization of knowledge goes hand-in-hand with its diffusion. Then paradigmatic knowledge is given a name that has meaning in the policy realm. During institutionalization, organizational actors promote and contest the conceived policy.

New ideas brought by networks are not assimilated on their own. For those new ideas to flourish and to avoid or reduce the impact of external threats, organizations need to formulate strategies. Identifying, monitoring, and evaluating external opportunities and threats are essential for success. As organizations react to change and begin to change themselves, the effects of the changing environment and new behaviors begin to be realized at the micro level within the organization (Carson, 2004).

Because organizations operate as open systems, a relationship between external and internal forces will always exist. It is imperative for managers to recognize the interrelationship between said external and internal forces. When managers are able to recognize the change needed, the organization will be able to appropriately respond and adopt strategies that will enable the organization to be effective (Scott, 1987). In this sense, universities, as any other organization,

should be paying attention to the trends and changes in the environment that could help them transform or modify some of their processes to better match current external conditions and trends.

With the help of the open systems perspective we can see that the way an organization relates to its environment is generally influenced by the organization's structural features, which in turn are strongly affected by the organization's environment. External forces shape internal arrangements and vice versa (Scott, 1987). It would be wise to consider also the view of Dieleman and Cramer (in press). These authors found that the business external environment is interdependent with the business memory capacity. These two variables in combination create the context for adopting or not the trends present in the external environment, for them it was about adopting cleaner production. Dieleman and Cramer (in press) observations underline the importance of the business external environment, especially in relation to variables existing within the companies they studied.

2.1.1. Approach to change

The way an organization responds to their environment can take different forms. Traditionally, conventional universities have defined themselves within the culture of the past. As such, they have been slow to adapt to the requirements of new ways of doing things (Cookson, 2000). Drawing on a typology of institutional responses to environmental change, Ackoff (1981, cited in Banathy, 1996) states that universities and other organizations exhibit one of four orientations:

Reactive Orientation: Those who display this attitude place great stock on the ways things were done in the romanticized past. New technologies, new organizational forms, and new operating procedures are resisted. Management is hierarchical, bureaucratic, and top-down. Plans and problems are dealt with in a piece-meal fashion. The reactive orientation places value on institutional history, tradition, continuity, stability, and security rather than the uncertainties of change.

The Inactivist Style: Those who display this attitude place great value on avoiding change in favor of maintaining the status quo. Inactivists rely on the bureaucratic mode of operation and red tape to slow innovations. They use committees and study groups in an endless process of gathering facts, passing on information from one group to the other, and revising positions and recommendations. This process goes on until there is no longer a reason to change. In the organizational culture, conformity is valued more than creativity. The status quo is valued and "don't rock the boat" is the credo of the organization.

The Preactivist Style: Those who demonstrate this style attempt to anticipate and predict changes, prepare for them, and respond to the fullest when change occurs. They see technology as the source

of most change outside the system. Plans to respond to such changes are formulated at the top and passed down to lower levels. Much of the appeal of this approach stems from its intensive interest in science and technology.

The Interactivist Style: This style incorporates the principles of *systems design*. It is founded on the following belief:

“It is within our power to attain the future we envision and desire to bring about, provided we learn how to do it and have the willingness to do the steering. We place the past, present, and the future in an interactive relationship. We believe that the future depends more on what we do between now and then than it does on what has happened until now” (Ackoff, 1981, p. 146).

As systems respond to changes in the environment, they undergo a process of *self-regulation*, modifying and redefining their relationships with their environment as well as their own internal operations (Banathy, 1992, p. 32). This process of self-regulation is manifested as either *adaptation* or *coevolution by transformation*.

Adaptation consists of the following: "(1) sensing system-relevant changes in the environment, (2) receiving information from the environment on changed requirements, and (after changes have been made in the system) (3) the process of feedback, by which information is introduced into the system about the inadequacy of the output" (Banathy, 1992, p. 32). The focus of adaptation is *negative feedback* (i.e., corrective adjustments are made in response to a deviation of the actual state from an expected state).

Coevolution by transformation involves the positive feedback (i.e., introduction of new functions, components, and operations in the system as positive changes designed to increase the compatibility of a system with the changes in the environment, thus increasing the deviation from past practices).

The manner in which organizations respond to their external environment reflects the perception of the people within them. Those who deny the need for adaptation correspond to the *reactivist* orientation. Those who minimize the need for adaptation correspond to the *inactivist* orientation. Those who acknowledge the need for adaptation correspond to the *preactivist* orientation. On the other hand, those who have adopted an *interactivist* orientation toward their external environment are more like to favor *coevolution by transformation*, a process that involves positive feedback (i.e., introduction of new functions, components, and operations in the system as positive changes designed to increase the compatibility of a system with the changes in the environment, thus increasing the deviation from past practices). Interactivists thus embrace the principles of systems design to create their desired future state, one that is better than the present state and pursue

technological innovations in accord with that desired future state. Assuming empowerment of all the stakeholders relevant to the future system, they seek to design the future, then to organize themselves collaboratively to attain that ideal future. Again, emphasizing the link between the interactivist orientation and institutional coevolution, Banathy (1996) points out that coevolutionary learning often enables organizations to cope with change and complexity, renew their perspectives, and redesign their systems, or help them to get organized at higher levels of complexity.

Evolutionary learning empowers organizations to anticipate and face unexpected situations. It helps to progress from unconscious adaptation to our environment to conscious innovation, co-evolution, and co-creation, and the development of the ability to direct and manage change.

The approaches showed by organizations when responding to the external variables vary depending on the aspects of the organization on which the researcher focuses. Since this thesis focuses on understanding the relationship that different variables play on the waste management program of UABC, it is important to now look specifically at the aspects of the external environment related to waste management at UABC.

2.1.2 Aspects of the external environment related to the waste management program at UABC

What are the main aspects of the external environment that shape the waste management practices at UABC? On the one hand, these are aspects related to environmental policies and on the other hand the way in which universities have responded to the call for more attention for environmental and sustainability issues in their curricula, research, operation and policies.

As it was the case in the industrial sector within universities the attention for environmental care within organizations arose as well. Although this happened somewhat later than in the industrial sector; nevertheless, there has been a great advancement in this matter. During the last two decades various universities have become engaged not only in performing cleaner but also in integrating sustainable development in their activities (van Weenen, 1999). These institutions have responded to pressures from the external environment and from the inside. In words of Bekessy *et al.*, (2001), *“universities across the world are responding to the need for a move towards more sustainable forms of human activity. Several key factors are driving this change including: student and employer demand, economic and social advantages, and the need perceived by the university leaders to address the responsibility of universities to lead society towards a sustainable future”*. These authors report that the Australian industrial sector (an external environment element) called upon universities to improve the environmental literacy of students across all faculties, and to

improve their own environmental performance (Bekessy, *et al.*, 2001). Australian universities have responded in many ways. This call and its effect on universities is an example of the pressure that the external environment is exerting on universities. There are different examples all around the world of universities attending environmental and sustainability issues as responses to the external environment (Herremans and Allwright, 2000; Cote, 2000; Keniry, 1995; Smith and Gottlieb, 1992; Corless and Ward, 1992; Valen, 1992). An example from Latin American is given by the University of Costa Rica. This university responded to the national trends towards sustainability. Three years after the adoption of sustainability policies at a national level, the University of Costa Rica issued its own policy for environmental protection and sustainability (Mata-Sagreda, 2002).

In Mexican universities the trend to improve their environmental performance has been manifested as well. Agreements and guidelines were formulated by the federal government that urges Mexican universities to develop strategies to reduce the environmental impact resulting from their operations (ANUIES-SEMARNAT, 2002). These guidelines also call for the improvement of the environmental literacy of their students. Despite the fact that the implementation of guidelines for greening Mexican universities is voluntary, it is to be expected that the greening trend in the external environment of universities will also impact the internal organization of Mexican universities, for instance through the development of environmental programs and strategies.

In the external environment of Mexican organizations there are many different regulations to protect the natural environment, among them originating from the federal, state and municipalities for the management of solid and hazardous waste. There are also mechanisms in place, such as government audits to assure the compliance of these regulations. It is to be expected that the regulations for solid waste management will impact the way organizations and specifically universities handle their waste.

Therefore we will focus here on a more in depth analysis of the influence of two aspects of the external environment on the waste management program at UABC: 1) the trend towards sustainability in higher education and, 2) the Mexican waste management system. Particularly the following question will be raised: **What is the relationship between the external environment elements considered in this study (Mexican waste management system and sustainability trends in higher education) and the performance of UABCs' waste management program?** Particularly the following questions will be posed:

- What is the impact of the Mexican waste management system upon the waste management program of UABC?

- What is the impact of the sustainability trends in higher education upon the waste management program of UABC?
- What is UABC's approach to change when taking green initiatives like the waste management program?

These questions will be addressed in chapter 3. The analysis of the two external aspects will be made through reviewing and analyzing different published documents related to sustainability in higher education and waste management systems. In order to have a comparative perspective both analyses will include the actual trends in these fields both internationally and more specifically in Mexico.

Waste management system analysis will include the evolution of urban cleaning services in Mexico, the actual urban cleaning systems, generation and composition of the municipal solid waste, waste management programs, aspects of the industrialization and commercialization of recyclable waste in Mexico, and the legal framework and regulations for waste management in Mexico. These aspects will be used to explain how well suited the waste management system was for embracing an integral waste management program at a university and how this readiness, or lack thereof, affected UABC's program.

The analysis on sustainability in higher education will include the first initiatives towards the inclusion of green initiatives, the different international and regional declarations for sustainability in higher education, the response of Mexico to these trends and the initiatives for greening UABC. All this information will be used to explain how these trends in Mexico and in the world have impacted UABC and ultimately the waste management program of the institution.

2.2 Internal environment level

It is commonly agreed that several key variables affect change processes in organizations. Depending on the characteristics of these variables the change process will be more or less difficult. The variables most frequently mentioned as being very important during the change process are: leadership, organizational culture, and structure.

According to Doppelt (2003) the two key variables for attaining change towards sustainability are structure and leadership. Structure plays a major role in shaping the way its members view the world, interact with each other and the external environment, perform their tasks and learn. Effective sustainability leaders have the ability to keep their organization focused on achieving its higher mission while simultaneously managing numerous streams of activity. When an organization

lacks an effective structure or sufficient leadership, its organizational culture will remain frozen around the old practices (Doppelt, 2003). This shows a relationship between these three factors.

Below the variables leadership, structure and culture will be described and operationalized for the purpose of the study under consideration here.

2.2.1 Leaders and leadership

In literature there are different authors (Doppelt, 2003; Senge, 1990; Hall & Hord, 2001; Fullan, 2001; O'Toole, 1995; Oakley and Krug, 1991; Kotter, 1990) who stress the importance that leaders have in the processes of change within organizations. In spite of the diverging positions derived from different studies, there is strong evidence that leaders play a key role to generate differences in the results of their work. There is also evidence that leadership can produce impacts on performance (Gibson, Ivancevich and Donnelly, 2001). Based on this, interest must be paid to the characteristics that distinguish the leaders from the non leaders. But what is a leader? What characteristics differentiate leaders from non-leaders?

As defined by the Bass & Stogdill's Handbook of Leadership (Bass, 1990) leadership is an interaction among members of a group. Leaders are change agents, persons whose acts affect other people more than those other people's own acts. In essence, the leadership challenge is to provide the "glue" to cohere independent units in a world characterized by forces of entropy and fragmentation (O'Toole, 1995). According to Mintzberg (1973) the duty of a leader is to perform administrative tasks to operate with efficiency the department or unit under his responsibility.

It is evident that the issue of leadership is very interesting. Many different theories have been developed to explain how leaders perform, their relationships with their followers, the circumstances that surround their performance and the results of their performance. Nevertheless none of these theories have proven to be totally accepted. To date new approaches to leadership continue to spring from new studies about leadership.

The first theories about leadership that were developed in the last century can be divided in three main groups: 1) theories centered in the features or characteristics of the leader, 2) theories centered on the conduct of the leaders and, 3) theories focused on the situations of leadership. After these groups of theories appeared, a fourth group of more contemporary theories of leadership emerged paying attention to the way the leaders relate to their subordinates and the strategies used by them to inspire them.

The first group of theories tried to identify specific characteristics (physical, mental and personality) associated with the success of leadership. These theories state that personality, motivation and skills are the traits desired in a leader. Table 2 presents the traits or features associated with efficiency in leadership.

Table 2. Traits associated with efficiency in leadership.

Personality	Motivation	Skills
Energy level	Socialized orientation towards power	Interpersonal handiness
Stress tolerance	Strong need of achievement	Cognitive skills
Self confidence	Weak need of affiliation	Technical skills
Emotional maturity		Capacity to persuade
Integrity		

Although some studies conclude that the characteristics of Table 2 differentiate efficient leaders from the non-efficient, the findings from the researches are yet contradictory for many reasons. First, the list of potentially important traits could be infinite. Each year new characteristics are added to the list. This continuous addition creates confusion among those interested in identifying the leadership traits. Second, the scores in the traits tests consistently predict the efficiency of the leader. The traits of the leader do not operate in an independent fashion but act in combination. This interaction influences the interaction leader-follower. In third place, the models of efficient conduct mainly depend on the situation: the conduct that is efficient in a bank could be inefficient in a lab. Finally, the traits approach fails in distinguishing what an efficient leader does in his job. There is a need of observations that describe the conduct of the efficient and non-efficient leaders (Gibson, Ivancevich and Donnelly, 2001).

The second group of theories (centered on the conduct of the leaders) aroused in the late 40's. Researchers started exploring the idea that the way a person acts determines its leadership effectiveness. The studies tried to identify the differences in behavior between effective and non-effective leaders. One contribution of the leadership conduct theories was the recognition that organizations need a leadership centered both on production and on people. Another contribution to the leadership conduct theories is introduction of the concept of co-leadership. Co-leadership means that although the leader doesn't have to exert functions oriented towards people and production, he or she can have good results if he has co-leaders that play those roles for him. The last and perhaps the most important theoretical contribution is the notion that no a leadership blueprint exists that

can be applied to all situations. This was a stimulus to conduct a next generation of studies focused on situational theories of leadership (Lussier and Achua, 2002).

The third group of leadership theories (*Situational Theories of Leadership*) evolved to suggest that effectiveness of leadership depends on the adjustment between personality, task, power, attitudes and perceptions. Researchers recognized that the conduct of leadership needed to improve performance mainly depends on the situation: what it is considered effective leadership in a given situation could be organized incompetence in another. The main assumption of this theory suggests that an effective leader should be flexible enough for adapting to the differences among subordinates and the situations. In simple terms, a situational leader is one who can adopt different leadership styles depending on the situation. In Table 3 are summarized four of the main situational theories of leadership.

Of the three groups of theories described above the Situational Theories of Leadership were chosen to explain the role that leadership played in the waste management program of UABC. In particular the *model of contingency leadership*, developed by Fiedler in 1951 was chosen. Situational theories are suitable to this study because the study here under is a longitudinal case which permits the comparison of the leadership styles present during the different phases of the waste management program. Fiedler's theory was chosen for three reasons:

1. The tasks of the program to be performed by the followers were established since the beginning of the program and these were known by the leaders in the different phases of the program. In spite of this situation different results were obtained in each phase. Considering that the activities of the program didn't change over time, the differences could be explained by the different leadership styles used in each of the phases.
2. The way leaders interacted with their followers and the strategies used to have the job done can be easily tracked down, and
3. The results of the waste management program along with the strategies used by the leaders, together can be used to determine how much power the leaders really had. Consequently, by making an integrative analysis of these three elements (results of the program, strategies used by leaders and power of position) it is possible to explain the effectiveness of the different leaders involved in the waste management program in the terms of Fiedler's Contingency Model. This model will be explained with more detail as follows.

Table 3. Summary of four models for situational leadership theory.

Contingency Model (Fiedler, 1967)	Path-Goal Theory of Leader Effectiveness (House, 1971)	Situational Leadership Model (Hersey-Blanchard, 1969)	Leader-member Exchange Theory
<p>Followers prefer different leadership styles depending on the structure of the task, on the relationships leader-member and on the power of the position.</p> <p>Leaders are oriented to the relationship or to the task. The job should adjust to leadership style.</p> <p>Leader's effectiveness is determined by the interplay between environment and personality.</p>	<p>Leaders can raise the effectiveness of the follower applying the proper motivational techniques.</p> <p>Effective leaders make clear to their followers the paths or the more appropriate conducts.</p>	<p>There is no crisis situation.</p> <p>Followers' levels of maturity vary. Thus leaders should vary their style of leadership based on each follower's level of maturity.</p> <p>Leaders should try to increase worker maturity.</p>	<p>Leaders must adapt because there isn't a consistent leadership conduct that includes all the subordinates.</p> <p>Followers are categorized as "part of the group" (share a system of common values and interact with the leader) and "out of the group" (don't have much in common with the leader).</p> <p>A perceptive leader is capable of adapting his style to accommodate to the needs of the followers.</p>

Fiedler claims that the performance of the followers depends on the interaction between leadership style and the situational factors (Fiedler, 1967). Fiedler identifies two leadership styles: 1) oriented to work, and 2) oriented to relationship. He and his colleagues established a method based on psychological reasoning to identify the two leadership styles. According to Fiedler individuals whose personality favor the completion of chores and lean towards achievement will probably exert the type of leadership oriented to tasks. Individuals whose personality values warm relationships and support to others will probably exert leadership oriented to relationship. But, according to Fiedler, an individual can't have both types of leadership.

Fiedler proposes three situational factors that determine if a style oriented to relationship or one oriented to task is more probable to be effective. These situations are: 1) member-leader relationships, 2) the structure of the task, and 3) the power of the position within the organization. The factor *member-leader relationships* refer to the degree of safety, confidence and consideration that followers have of their leader. The influence of the leader depends, in part, on whether or not the followers accept him as such. The *structure of the task* refers to the characteristics of the job to

be done, in other words, it refers to the nature of the task assigned to the leader and the group. Some characteristics of the job are:

- The degree to which tasks and duties are clearly established and known by the people that do the job.
- The degree to which the working problems can be solved by a wide range of procedures.
- The degree to which the “correctness” of a decision that comes up in a job can be demonstrated appealing to an authority, to logic procedures or to feedback.
- The degree in which there is generally more than one correct answer.

The *power of the position* refers to the power inherent to the position of leadership. This situational characteristic considers that leadership occurs in a variety of groups and different organizations that vary according to the amount of formal authority which the leader possesses to make decisions and to demand obedience from his subordinates.

These three situational factors mentioned can be combined for describing different situations. These situations will change depending on the degree to which the factors favor the attempts of influence from the leader. In Table 4 the three situational factors are arranged in a way that eight different situations are generated. These situations go from 1, a very favorable situation for the leader, to 8 a very unfavorable situation for the leader.

Table 4. Summary of Fiedler’s situational variables and the preferred leadership styles. (Modified from Fiedler and Chemers. 1982).

Situation	I	II	III	IV	V	VI	VII	VIII
Member-leader relationships	Good	Good	Good	Good	Bad	Bad	Bad	Bad
Structure of the task	High	High	Low	Low	High	High	Low	Low
Power of position	Strong	Weak	Strong	Weak	Strong	Weak	Strong	Weak
Preferred Leadership styles	Task	Task	Task	Relationship	Relationship	Relationship	Task	Task
Very Favorable	→	→	→	→	→	→	→	→
							Very unfavorable	

According to Fiedler, a task-oriented style of leadership is more effective than a considerate (relationship-oriented) style under extreme situations, that is, it is either very favorable (certain) or very unfavorable (uncertain) situations. Task-orientated leadership would be advisable when a natural disaster occurs, like a flood or fire. In an uncertain situation the leader-member relations are usually poor, the task is unstructured, and the power of the position is weak. The one who emerges as a leader to direct the group's activity usually does not know any of his or her subordinates personally. The task-orientated leader who gets things accomplished proves to be the most successful. If the leader is considerate (relationship-orientated) in a disaster situation, he or she may waste so much time that things may get out of control and lives get lost.

Blue-collar workers generally want to know exactly what they are supposed to do. Therefore it is usually highly structured. The leader's power of the position is strong if management backs his or her decision. Finally, even though the leader may not be relationship-orientated, leader-member relations may be extremely strong if he or she is able to gain promotions and salary increases for subordinates. Under these situations the task-orientated style of leadership is preferred over the (considerate) relationship-orientated style.

The relationship style of leadership seems to be appropriate when the environmental or certain situation is moderately favorable or certain, for example, when (1) leader-member relations are good, (2) the task is unstructured, and (3) power of the position is weak. For example, research scientists do not like superiors to structure the task for them. They prefer to follow their own creativity and knowledge in order to solve problems. Under a situation like this is when a relationship style of leadership is preferred over the task-orientated style.

These situational leadership theories are not without its detractors. Some opponents state that these theories couldn't be used under different circumstances. Opponents also claimed that there were also other important characteristics that were left out of these models.

As an alternative to this quandary a fourth group of leadership theories that includes new approaches arose. Among the leadership models and theories more recently developed are: transactional leadership, strategic leadership, and transformational leadership.

Transactional leadership means that the leader is capable of identifying what followers want and prefer and helps them to reach a performance level that brings about the rewards that satisfy them. The transactional leader works through creating clear structures whereby it is clear what is required of their subordinates, and the rewards that they get for following orders. The early stage of transactional leadership is in negotiating the contract whereby the subordinate is given a salary and

other benefits, and the company (and by implication the subordinate's manager) gets authority over the subordinate. It works only where the organizational problems are simple, clear and technical in nature. Transactional leadership has often been associated with the military. However, successful militaries have long known that it is ineffective (Strategos, 2005). The main criticisms of transactional leadership are: 1) some use transactional leadership behavior as a tool to manipulate others for selfish personal gain; 2) it can place too much emphasis on the “bottom line” and by its very nature is short-term oriented with the goal of simply maximizing efficiency and profits; 3) the leader can pressure others to engage in unethical or amoral practices by offering strong rewards or punishments; 4) transactional leadership seeks to influence others by exchanging work for wages, but it does not build on the worker’s need for meaningful work or tap into their creativity. If utilized as the primary behavior by a leader it can lead to an environment permeated by position, power, perks and politics (weLEAD, 2003).

Strategic leadership is a process which offers the direction and inspiration needed to create and instrument a vision, a mission and the strategies to reach and support the organizational objective (Maghoori & Rolland, 1997). Strategic leadership is the ability to anticipate, envision, maintain flexibility, and empower others to create strategic change as necessary. Multifunctional in nature, strategic leadership involves managing through others, managing an entire enterprise rather than a functional subunit. The main drawback of strategic leadership; however, is the difficulty that leaders face as they try to effectively influence human behavior, often in uncertain environments.

The most promising leadership theory of today claims that effective leadership is based, among other characteristics, on the respect for others, trust, their shared values, their shared vision, coherence making, integrity and open communication, all these are characteristics of *transformational leadership*. In fact, transformational leadership has become a synonym for leadership theory in recent times (Hunt, 1999). Transformational leadership is a branch of leadership theory that is growing in influence and is potentially applicable to management for sustainability in higher education (Shriberg, 2002c). Transformational leadership is the capacity of inspiring and motivating the followers to reach greater results than the originally planned (Avolio and Bass, 1988), transformational leaders orient organizational systems toward a higher ethical purpose (Bass and Steidlmeier, 1999). Bass (1998) and Bennis (2003) identified the factors that describe transformational leaders. According to these authors a transformational leader ...

- has the ability for creating and expressing a vision of a desired state, to be clear about the vision and to persuade followers to compromise with the vision;
- is capable of setting up a sense of value, respect and proud and of articulating a vision;

- pays attention to his followers needs and assign them meaningful projects for their personal growth;
- helps his followers to rethink rational ways for looking into different situations and to encourage his followers to be creative;
- informs his followers about what is to be done to obtain the rewards they want;
- lets his followers work on the task and doesn't intervene unless they are not reaching the goals within a reasonable timeframe or a reasonable cost;
- shows aptitude for keeping the course of the organization; and
- has aptitudes for creating environments that can channel energies to produce the desired results.

In addition to the factors enlisted above, O'Toole (1995) highlights that *trust* is the element that has been identified as powerful enough to overcome centripetal forces. Recent experience shows that such trust emanates from leadership based on shared purpose, shared vision, and especially, shared values (O'Toole, 1995).

Transformational leaders also need evaluating abilities, communication capabilities and sensitivity to others. They should be capable of articulating their vision and must be sensitive to the skill deficiency showed by their followers (Lussier and Achua, 2002; Gibson, Ivancevich and Donnelly, 2001).

According to O'Toole (1995, p. 11) "thanks to a handful of scholars who recently have transformed leadership into a serious field of study, it is now better understood that the role of a leader is to bring about constructive and necessary change; the responsibility of a leader is to bring about that change in a way that is responsive to the true and long-term needs of all constituencies; and the greatest source of power available to a leader is the trust that derives from faithfully serving followers".

Instead, leaders now have to appeal to the minds and hearts of their followers (O'Toole, 1995). Fullan (2001) adds that leadership is not mobilizing others to solve problems we already know how to solve, but to help them confront problems that have never yet been successfully addressed. On the other hand, Oakley and Krug (1991) mention that there may be no better way a leader can leverage his or her time than through empowering people by helping them maintain their optimal focus towards the final goals of the organization.

For Senge (1990) a leader who facilitates change and learning should behave more like a designer, a butler and a teacher. In the first case, the leader’s role is to design the learning processes to address critical situations in a productive way. This makes sense because many well-intentioned efforts often fail because the leaders forget the first rule of learning: people learn what they need to learn not what others think they ought to learn. In the second case, being the butler of a vision alters the relationship between the leader and the vision, in which it stops being a possession to become a vocation. This situation is based on the premise that an organization can embrace change only when it is guided by a vision. In the third case, the leaders as teachers help people reach a new perspective where reality constitutes a means and not a limitation, to create Senge, 1990).

In an attempt to construct a comprehensive framework for leadership Fullan (2001) summarizes what have been stated in the previous paragraphs. Figure 4 represents his framework for leadership (Fullan, 2001, p. 4).

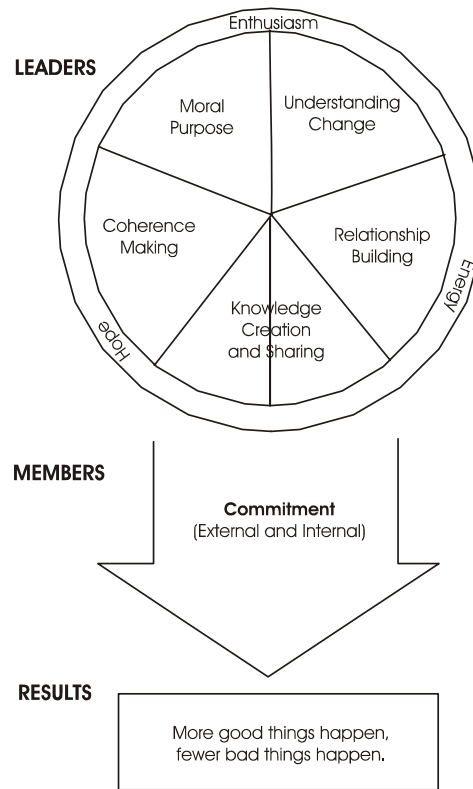


Figure 4. A framework for Leadership (Fullan, 2001 P.4)

According to Fullan (2001) *moral purpose* means acting with the intention of making a positive difference in the lives of employees, customers, and society as a whole. This moral purpose must be explicit in the vision and mission of the institution (Collins, 2001).

Fullan (2001) states that “all the complexity of the change processes keeps people at the edge of chaos... therefore, effective leadership tolerates enough ambiguity to keep creativity flowing, but along the way leaders seek **coherence**. Coherence making is a perennial pursuit” (Fullan, 2001, p. 6).

Second, it is essential for leaders to **understand the change process**. “Moral purpose without an understanding of change will lead to moral martyrdom. Leaders who combine a commitment to moral purpose with a healthy respect for the complexities of the change process not only will be more successful but also will unearth deeper moral purpose” (Fullan, 2001, p.5).

Third, the single factor common to every successful change initiative is that relationships improve. According to Fullan (2001) “if relationships improve, things get better. Thus leaders must be consummate relationship builders with diverse people and groups. Effective leaders constantly foster purposeful interaction and problem solving, and are weary of easy consensus” (Fullan, 2001, p.5).

Fourth, leaders commit themselves to constantly generating and increasing knowledge inside and outside the organization. “First, people will not voluntarily share knowledge unless they feel some moral commitment to do so; second, people will not share unless the dynamics of change favor exchange; and, third, that data without relationships merely cause more information glut” (Fullan, 2001, p.6).

All these aspects are important and have to be immersed in an atmosphere of what Fullan (2001) has called the *energy-enthusiasm-hopefulness* constellation. This constellation has a dynamic, reciprocal relationship with the set of five leadership components.

In conclusion leadership is a key element to achieve a change effort in any organization. Leaders can inspire and mobilize employees and stakeholders to embrace change as an exciting opportunity to learn new things. In the case of implementing the new waste management program at UABC addressed here, leadership was a problem. The question however is which role leadership exactly plays. Therefore the following question will be addressed in Chapter IV: **What is the relationship between the role of leadership and the results obtained during the implementation of the waste management program at UABC?**

In order to answer this question the Situational Theories of leadership in particular Fiedler’s model and the transformational leadership factors summed up in Fullan’s Model (2001) will be used. This model was used in this research because it summarizes the characteristics of a transformational leader described by other authors but also because it describes what is to be expected from those

particular characteristics. This allows the researcher to look for certain outcomes as a result of the presences of certain characteristics, in this case, the characteristics of a transformational leader.

The launching and implementation of the waste management program at UABC covers different situations, structures and people. The goal of the analysis is to detect according to Fiedler's model which situation best describes the case in each of the phases of the waste management program. As it was previously explained in this chapter Fiedler's contingency model includes 3 different elements and 2 different styles. The elements, through which the situation is measured, are: a) a good or poor leader-member relation, b) a high or low task structure and c) a strong or weak position power. The two different leadership styles are based on the either task oriented or relation oriented.

In this study the LPC (least preferred coworker) questionnaire developed by Fiedler to test his model **was not used**. The reason is that as a result of the structural change of the university, several of the employees that were involved in the waste program during the first phases were fired. This situation made very difficult to find them to apply the questionnaire. Fiedler's model will only be used as a general theoretical and departing framework to look at leadership. The variables that will be used are: power of position, structure of the work and member-leader relationships.

The specific research questions that will be answered using Fiedler's and Fullan's models will be:

- What was the relationship between the structures of the tasks and the results obtained?
- How were the relationships between leader and followers and what role did these relationships played on the results of the waste management program?
- What role did the power of the position of the leaders played on the results of the waste management program?
- Did the leaders in place during each of the phases of the waste management program showed the characteristics of a transformational leader (vision with a moral purpose, relationship building, knowledge creation and sharing, and coherence making)?

Although Fiedler's model uses questionnaires that are applied to leaders, these questionnaires were not used here. Instead interviews with leaders and with followers of the different phases of the program were used. In this study Fiedler's model was used only as a framework to describe the following parameters: the institutional situation under each of the phases, the extent to which the tasks of the waste management program were structured and the power of the people that faced the different problems of the program. This analysis will be made in five stages:

- Interviews with the supervisors of the Maintenance Department that participated in the program and with the people working with them. The construction of the questions for the interviews will be based on in Fullan's characteristics of the best leadership style.
- A review of the results obtained in each of the phases of the waste management program at UABC.
- The results of the main stages of the program will be contrasted.
- A plausible explanation of leadership styles will be constructed to interpret the results of the different phase's results.
- The lessons learned from the case will be used to formulate recommendations for the improvement of waste management program and other environment related programs that might emerge in the institution.

Although leadership is *per se* an important variable to be analyzed, it is also important to recognize that this variable is linked to other influential variables.

Quoting Ogawa & Paredes-Scribner (2002, p. 577) "structure and leadership are related in three ways:

1. Structure can inhibit and even replace leadership. Organizations' members grow committed to existing patterns of action and interaction, often blunting efforts to change arrangements with which they have grown comfortable. Structure can also substitute for leadership by producing reliable patterns of activity and social relations that do not require the insistence or oversight of a leader.
2. Organizational structures can affect leadership by determining the access to resources that leaders can ply to exert influence over others. Explanations of leadership as a form of social influence have noted that leaders exchange resources for the compliance of followers. Some of the resources on which leaders rely are tied to their positions, including rewards, punishments and the authority of office.
3. Leadership is a form of social influence that occurs when any actor affects an organization's structure".

2.2.2 Structure

Much of the criticism of change in higher education arises out of the failure to appreciate the importance of the differences in organizational structure and processes compared to business

(Birnbaum, 2000). Thus it is important to know them and look into ways these structures are affecting any change attempt. The structures model the individual actions; they create the necessary conditions which bring about a certain type of event (Senge, *et al.*, 1999). Therefore it is important to know them and understand them in order to be able to explain different happenings during different organizational structures. Because the case study here under is in a university it was considered important to include the organizational structure as one of the variables to be analyzed.

Organizational structure is an abstract notion. The concept of organizational structure is used when referring to the scheme of continuous behavior and the activities though time of the members of an organization. Organizational structure is also considered as the way in which the interrelated groups of an organization are constructed and the way the activities, responsibilities, authorities, etc. inside the organization are controlled (Salman, 1984). An organization's structure includes the "recurrent set of relationships between organizational members," such as authority and reporting relationships, behaviors as required by rules, patterns of decision-making, communication and other behaviors (Donaldson, 1996). Thus the structural frame looks beyond individuals to examine the social context of work.

Various organizational structures types have been identified and defined, among them mechanistic, organic (Burns & Stalker, 1961), bureaucracy, machine bureaucracy, professional bureaucracy, adhocracy, divisionalized form (Mintzberg, 1979), clan (Wilkins & Ouchi, 1983), and network organizations (Quinn, Anderson, & Finkelstein, 1996). All these organizational structures can be analyzed in terms of their formality, complexity and centralization (Hall, 1991).

Organizational structures determine the flow of information through the organization and the extent of centralization or decentralization in decision-making. They decide who will have the authority and responsibility to implement strategic tasks. Therefore, it is critical to ensure that an organization's structures meet the needs of its corporate and competitive strategies (Shrivastava, 1994). Organizations divide work by creating a variety of specialized roles, functions, and units. They must then tie the different elements together by means of both vertical and horizontal methods of integration. There is no one best way to organize. The right structure depends on an organization's goals, strategies, technology, and environment (Bolman and Deal, 1997).

One of the most prominent authorities in the field of organizations and strategy in organizations is Henry Mintzberg, whose division of organizational forms or structures has been largely used in the organizational field. According to Henry Mintzberg (1979), an organization's structure is largely determined by the variety one finds in its environment. For Mintzberg, environmental variety is determined by both environmental complexity and the pace of change. Mintzberg (1979) holds that

organizations are made up of a combination of five elements (though not all elements need to be present in all organizations): the **operating core**, who does the work, the core consists of manufacturing, service, professional, or other workers who produce or provide products or services to customers or clients: teachers in schools, assembly-line workers in factories, physicians and nurses in hospitals, and flight crews in airlines. Directly above the operating core is the **administrative component** (strategic apex and middle line): managers who supervise, control and provide resources for the operators, The **strategic apex**, who does the planning and controlling, senior managers focus on the outside environment, determine the mission, and provide the grand design. In school systems, the strategic apex includes superintendents and school boards (Bolman and Deal, 1997). The **middle line** is the part that joins the operating core to the strategic apex. Two more components sit alongside the administrative component. The **technostructure** which plans the work and organizes the assets of the organization, houses specialists and analysts who standardize measure and inspect outputs and processes. Quality control departments in industry, audit departments in government agencies, and flight standards departments in airlines perform such technical functions. The **support staff** performs tasks that support or facilitate the work of others. In schools, for example, the support staff includes nurses, secretaries, custodians, food service workers, and bus drivers (Bolman and Deal, 1997). They provide support outside the workflow of the organization.

According to Mintzberg (1979), these five elements combine in different forms to produce five organizational structures that have varying degrees of formality, complexity and centralization: simple structure, machine bureaucracy, professional bureaucracy, divisionalized form and adhocracy.

The **simple structure** uses direct supervision as its primary coordinating mechanism, has as its most important part its strategic apex, and employs vertical and horizontal centralization. Relatively small corporations controlled by aggressive entrepreneurs, new government departments, and medium-sized retail stores are all likely to exhibit a simple structure. These organizations tend to be relatively young. The CEO (often the owner) retains much of the decision-making power. The organization is relatively flat and does not emphasize specialization.

The **machine bureaucracy** uses standardization of work processes as its prime coordinating mechanism; the technostructure is its most important part; and limited horizontal decentralization is established. This kind of organization is generally mature in age, and its environment is usually stable and predictable. A high level of task specialization and a rigid pattern of authority are also typical. Spans of management are likely to be narrow, and the organization is usually tall.

The first comprehensive definition of bureaucracy as a form of organization was made by Max Weber (Weber, 1947). He defined it as the organization that emphasizes precision, speed, clarity, regularity, reliability, and efficiency achieved through the creation of a fixed division of tasks, hierarchical supervision, and detailed rules and regulations (Morgan, 1997). Weber also stated that a bureaucratic approach has the potential to routinize and mechanize almost every aspect of human life, eroding the human spirit and capacity for spontaneous action. As a consequence, one of the machine bureaucracy's prime weaknesses is the lack of space for experimentation that stimulates innovation (Bolman and Deal, 1997).

In the **machine bureaucracy** the patterns of authority serve as points of resistance and coordinate activities by restricting activity in certain directions while encouraging it in others. By giving detailed attention to patterns of authority and to the general process of direction, discipline, and subordination of individual to general interest, the classical theorists sought to ensure that when commands were issued from the top of the organization they would travel throughout the organization in a precisely determined way to create a precisely determined effect (Morgan, 1997). But in understanding organizations as a rational, technical process, mechanical imagery tends to underplay the human aspects of organization and to overlook the fact that the tasks facing organizations are often much more complex, uncertain, and difficult than those that can be performed by most machines (Morgan, 1997). Thus in the machine bureaucracy a key challenge is how to motivate and satisfy workers in the operating core (Bolman and Deal, 1997).

The third form of organization design suggested by Mintzberg is the **professional bureaucracy**. Examples of this form of organization include universities, general hospitals, and public accounting firms. Its operating core is large relative to its other structural parts –particularly the technostructure. The professional bureaucracy uses standardization of skills as its prime coordinating mechanism, has the operating core as its most important part, and practices both vertical and horizontal decentralization. It has relatively few middle managers. Further, like some staff managers, its members tend to identify more with their professions than with the organization. Control relies heavily on professional training and indoctrination. Professionals are insulated from formal interference, freeing them to use their expertise. Coordination problems are common.

Professional bureaucracies respond slowly to changes in the environment. Waves of reform typically produce little impact because professionals often view change in their surroundings as an annoying distraction from their work. The result is a paradox: individual professionals may be at the forefront of their specialties while the institution as a whole changes at a glacial pace (Bolman and

Deal, 1997). Professional bureaucracies regularly stumble when they try to rationalize the operating core.

Mintzberg's **divisionalized form**, exhibits standardization of output as its prime coordinating mechanism, the middle line as its most important part, and limited vertical decentralization. Power is generally decentralized down to middle management—but no further. Hence each division itself is relatively centralized and tends to structure itself as a machine bureaucracy. As might be expected, the primary reason for an organization to adopt this kind of design is market diversity. The distinctive feature of a divisional structure is that grouping is based on organizational outputs (Daft, 1995).

The **adhocracy** uses mutual adjustment as a means of coordination, has at its most important part the support staff, and maintains selective patterns of decentralization. Most organizations that use a fully-developed matrix design are adhocracies. An adhocracy avoids specialization, formality, and unit of command. Even the term itself, derived from “ad hoc,” suggests a lack of formality. Unlike the professional bureaucracy, the adhocracy cannot rely on the standardized skills of these experts to achieve coordination, because that would lead to standardization instead of innovation. Rather, it must treat existing knowledge and skills merely as bases on which to build new ones. Moreover, the building of new knowledge and skills requires the combination of different bodies of existing knowledge. So rather than allowing the specialization of the expert or the differentiation of the functional unit to dominate its behavior, the adhocracy must instead break through the boundaries of conventional specialization and differentiation. Whereas each professional in the professional bureaucracy can operate on its own, in the adhocracy professionals must amalgamate their efforts. In adhocracies the different specialists must join forces in multi-disciplinary teams, each formed around a specific project of innovation.

Besides the Mintzberg classification, there are other classifications of organizational structures. Three of the basic types frequently used are: functional, matrix and network. These structures definition is more centered on the activities of the organization than in their coordination mechanisms.

The most common structure is the *functional* structure. In a functional structure, activities are grouped together by common function from the bottom to the top of the organization (Daft, 1995). In this type of structure one unit, headed usually by a single individual, focuses on a major organizational activity. Power and authority are usually concentrated at the top. Information flows up to senior executives and decisions flows down to mid and junior level staff. This form resembles Mintzberg's divisionalized form/structure. This form can work well in small organizations or in

those with relatively stable environments where synchronization across functions is not critical. When a large-scale change is needed, such as that often required for sustainability, however, functionality based structures often struggle because it is difficult to work across departmental and functional boundaries (Dopplet, 2003).

The *matrix structure* is a hybrid of the functional and divisional approaches. Functional and division managers have equal authority within the organization and employees often report to both individuals (Daft, 1995). While this approach can integrate functional expertise with the autonomy that a divisional approach provides, it can also lead to confusion and power struggles over who is in control. For this reason, matrix structures work best when executives have high levels of trust in each other. The matrix structure resembles Mintzberg's adhocracy.

The *network* structure has numerous variations. Its common characteristic is that semi-independent groups form to accomplish specific tasks and disband when the tasks are accomplished. New groups then form to take on specific new challenges. Because they tend to be temporary groupings, power and authority are usually based more on resources and expertise than on one's place in the formal hierarchy. The advantage of this approach is that it can respond quickly to changing needs and tends to prevent entrenchment problems related to power and authority. This form also resembles Mintzberg's divisionalized form. The downside is that they often operate without many bureaucratic controls and therefore can seem chaotic. Many sustainability-oriented organizations utilize the network structure at some point in their journey (Doppelt, 2003).

The classifications of organizational structures described above are mainly used in the business realm, anyway they can also be applied to higher education. Although some scholars argue that educational organizations do not mimic corporate or industry organizations, either in terms of economic decision-making or in the history or ideology that govern institutional choices (Gumpert, 2000), many scholars and practitioners have come to assign business diagnostics and prescriptions to educational institutions (Kusmierk, 2001).

Whatever the structure of the organization it behaves according to the different layers of management, which may be added to create hierarchy. As hierarchy increases power becomes difficult to concentrate at the top because a distribution of power to the lower managers takes place. Decentralization can occur as lower level managers assume decision-making. However to retain some degree of standard operational procedures, the organization increasingly relies on written policies and procedures. This formalization of organizational rules helps to maintain order across the growing organization and ensures conformity and continuity in practices (Hodge, et al, 1996; Daft, 1995; Filley & House, 1969).

The tall pyramid structure is created by the hierarchical layering required to maintain a low manager-to-employee ratio. The tight supervision inherent in the mechanistic structure is characteristic of bureaucracy. Work is performed under tight controls, little variability of tasks is permitted, and there is high specialization or departmentalization. On the other side, the flat pyramid structure is characteristic of organizations with low hierarchy. Less hierarchy with a larger number of employees per manager means that workers have more autonomy or freedom to perform their tasks. Control is sacrificed for creativity (Mintzberg, *et al.* 1995).

For Birnbaum (2001) the relatively tight coupling of business organizations permits control through hierarchical directives, while higher education institutions are more loosely coupled. What happens in one part of a university often has little direct or immediate effect on other parts of the institution. Control through managerial coordination is therefore more difficult; instead, controls are provided by the routines and culture of the institution and the professional training and socialization of the participants. Actions of those at the top of educational organizations are not tightly connected to behaviors by those further down in the organization (Birnbaum, 2001).

In universities innovation is often not necessarily initiated by, or even related to, the desires of top managers. Even though major innovations proposed at higher levels of centralization in colleges and universities may never be implemented, the initiatives of individuals and small groups may lead to constant innovation and change (Birnbaum, 2001). This is explained by Oakley & Krug (1991). They mention that the power/control-based structures create separation between organizational functions dependent on each other. They create and perpetuate the barriers that limit the ability to work well together across departmental lines (Oakley & Krug, 1991).

Ironically, it is the ability to work together which strengthens the organizations in order to survive. Therefore, present day organizations tend to make more decisions at the lowest levels within the organizational hierarchy. As a result, the classical management hierarchy is turned upside down. This effort of pushing responsibility downward is a direct assault on the bureaucratic methods and mindset that characterizes life in most organizations (Senge, 1990). Most Universities have traditionally used the bureaucratic/ patriarchal approach to hold on the power. But as Oakley & Krug (1991) have stated, “you cannot drive responsibility down without providing the power and authority –letting go of some of the control- at the same time”.

The actual trend in organizational theory is to look at a more empowering style of organization; yet, in spite of the fact the term “empowerment” is so widely used, most organizations today –including many of those striving for sustainability- still operate essentially as patriarchies (Doppelt, 2003).

The definition of empowerment is giving away power and control. People who empower others have reached a stage in self-development where they no longer feel threatened by someone else having power. These people know that giving away power does not subtract from their power, but adds to it (Senge, 1998; Oakley & Krug, 1991).

The previous paragraphs have asserted that structure and power influence directly the management approach. But how does structure and power influence a change initiative or an innovation? Oakley & Krug (1991) state that organizations that delay their evolution from the traditional top-down style of management to a more empowering style are creating obstacles that keep them from effectively managing change. In fact, the traditional management approach itself actually creates resistance to change among employees.

To understand said relationship we must understand that the implementation of innovations involves political and social change processes as well. Therefore, the success of an innovation is a consequence of the application of power by various interest groups at numerous levels. Particularly in settings of ambiguity, the fate of an innovation may depend on the ability of one ideology to gain ascendance over another within an existing system of organizational influence (Doppelt, 2003; Fullan, 2001; Birnbaum, 2001; Hall and Hord, 2001). Thus the vertical paradigm must be replaced by a horizontal perspective in which all of the actors are viewed as being on the same plane, with none higher or lower than any others (Hall & Hord, 2001).

How can these new models of organizing social change be linked with the more traditional theories on organizational structure? Lam (2000) is one of the authors to connect the two. Her work is therefore challenging and also interesting as the theoretical underpinning of the study presented here. For Lam (2000) an interactive relationship between dominant knowledge types and organizational forms result in different dynamics of learning and innovation. According to this author the organization that is characterized by an explicit knowledge base tends to have formal structures of control and coordination, and exhibit highly standardized tasks and work roles. Explicit knowledge can be standardized and aggregated. It is thus possible to specify and pre-determine the repertoire of knowledge and skills required for task performance. In contrast, organizations with tacit knowledge base will exhibit a decentralized structure and use informal coordination mechanisms. This is because tacit knowledge is dispersed and subjective; it cannot be standardized, disembodied and commitment is required on the part of the knowing subject (Lam, 2000).

Drawing upon Mintzberg's (1979) typology of organizational forms and on the work of Aoki (1986) and Nonaka & Takeuchi (1995) on the Japanese model, Lam (2000) further distinguishes

four contrasting institutional configurations underpinning the different organizational forms and knowledge types. These institutional configurations can be taken to represent different societal modes of organizing knowledge and learning: the professional, bureaucratic, occupational community and organizational community models (see Figure 5). Their effects on the learning and innovative capabilities of firms are mediated through these different organizational forms.

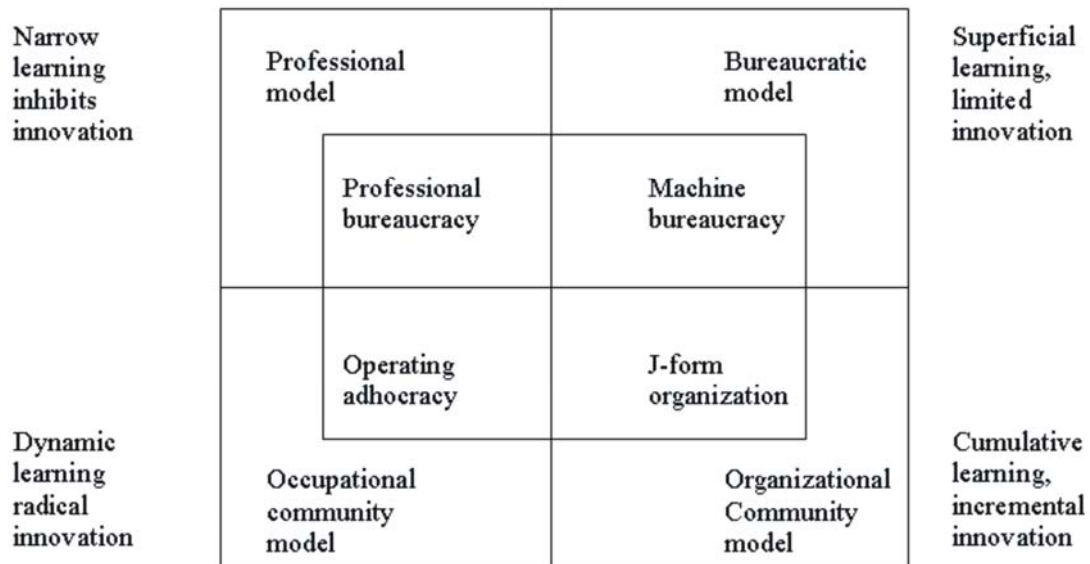


Figure 5. Innovation feasibility and organizational forms (modified from Lam, 2000).

The professional model is characterized by a narrow, elitist education based on a high degree of formalization of knowledge. The system is geared to the generation of explicit knowledge and favors an individual approach to learning; the incentives and social structure required for the diffusion and accumulation of tacit knowledge are relatively weak. The professional model generates a narrow approach to learning and inhibits innovation.

The bureaucratic model is rooted in an internal labor market organized around narrowly defined jobs and tiered career hierarchy. This model seeks to control and eliminate tacit knowledge. It generates a superficial approach to learning and has little capacity to innovate.

The occupational community model is characterized by a high rate of inter-firm mobility which fosters the development of social networks and the transmission of knowledge. It provides an institutional framework and social infrastructure for tacit learning to emerge. The tacit knowledge-creating capability of the operating adhocracy can only be sustained if it operates as a member of a localized firm network. Such networks of social relationship provide the ‘social capital’ and

'information signal' needed to ensure the efficient transfer of tacit knowledge in an inter-firm career framework. The shared industry-specific values within the regional community ensure that tacit knowledge will not be wasted when one changes employers, and thus gives the individual a positive incentive to engage in tacit know-how learning.

The organizational community model generates a decentralized and cooperative approach to problem solving. It facilitates the transmission and accumulation of tacit knowledge through collective learning within a stable career hierarchy. It has a unique capability to generate innovation continuously and incrementally.

In the above four contrasting models the key factor that differentiates their learning capability is their ability to create organizational relationships for harnessing tacit knowledge. This is particularly relevant for initiatives focused on sustainability.

For Doppelt (2003) horizontal relationships are required for sustainability initiatives to take place in organizations. Organizations structured around sustainability require the seamless integration of all units and functions in planning and decision-making. Patriarchal, vertically focused organizations have very difficult time producing this type of close assimilation. Doppelt proposes that teams of people from throughout the organization with multiple skills and perspectives must work together seamlessly to address these types complicated, counter-intuitive problems (Doppelt, 2003). Here it is important to highlight the resemblance of this approach to Lam's occupational community model (Lam, 2000).

The results published by Shriberg (2002c) agree with Lam (2000) and Doppelt (2003). In his research aimed to assess sustainability initiatives in higher education institutions Shriberg (2002c) found that when more individuals are involved in decision making through collaborative structures (as opposed to "top-down" processes), environmental issues and sustainability are more likely to become a major campus concern (Shriberg, 2002c). The author states that since environmental issues and interrelated social issues span multiple divisions, departments and stakeholders, they are only to become a priority when cross-functional and interdisciplinary decision making is prevalent.

The above statements lead to the conclusion that different structures produce different outcomes. Understanding the current structure of an organization and how it can facilitate or block a change initiative can provide the understanding needed to restructure the organization in a manner that best facilitate success (Doppelt, 2003). Therefore, the understanding of the organizational structure could also help to explain the results of a sustainability initiative such as the waste management at UABC. Thus it is interesting at this point to ask the following questions:

- Which type of structure best describes UABC's?
- What was the relationship between the organizational structure at UABC and the performance of the new waste management program?

These questions will be answered through reviewing the organizational structure of UABC. This is particularly interesting because during the execution of the waste management program under analysis two different organizational schemes were in place. A comparison can therefore be made of the organizational structures that were present during the different phases of the program. Special attention will be paid to the organizational sub-units involved in the waste management program.

The organizational typologies described by Mintzberg and interpreted in terms of innovation feasibility by Lam (2000) will be used here as analytical framework. The models described by Lam (2000) contain the elements to relate the organizational structure to innovation in terms of learning. The waste management program will be considered an innovation since it is a departure from the traditional way of dealing with waste at UABC.

2.2.3 Culture

Besides leadership and organizational structure also organizational culture may play a role. The word culture appeared in the scholarly literature of early anthropologists in the late 1800s. Early definitions were based on the study of primitive cultures as whole systems. They generally incorporated perceptions, attitudes, behaviors, institutions, and material artifacts as components of culture (Wilkening, 1999). In the early 1950s the term culture came to be associated only with the non-observables, and hence culture came to denote something that could only be inferred. Thus, anthropologists came to see culture as something in the hearts and minds of a people; not in their material items or tangible actions. In sum, culture is an ideational system which is the total sum of feelings, perceptions, assumptions, values, norms, theories, and any mechanisms through which people order their experiences.

In the literature about organizations the term "organizational culture" is defined as the dominant patterns of thought, of perspectives, of values, beliefs, rules, norms, behavior, of administration styles, and of ways to solve problems (O'Toole, 1995). Values and norms provide the cognitive framework through which people interpret what they observe and experience; they shape the way people communicate and interact with each other. Thus, culture is a force that orients and directs the behavior of individual organizational members so that there is consistency and predictability within the organization (Harrison and Beyer, 1993 cited in Hodge *et al.*, 1996). According to Schein

(1992) culture is the accumulated shared learning of a given group, covering behavioral, emotional, and cognitive elements of the group members' total psychological functioning. The learning process for the group starts with one or more members taking a leadership role in proposing courses of action and as these continue to be successful in solving the group's internal and external problems, they come to be taken for granted and the assumptions underlying them cease to be questioned or debated (Schein, 1992). Then culture is dependent on learning processes implying that a group has a culture when it has had enough learning through shared history to have formed such a set of shared assumptions.

Organizational culture and change are very closely related. Lawler *et al.* (1983) mention that organizational change is the product of the work of related behaviors of individuals and groups, with these in turn partially determined by the prevailing attitudes, beliefs, and expectations of individuals and of individuals clustered in work groups (Lawler, *et al.*, 1983). This implies that within an organization different subcultures can be present or even countercultures, competing to define the nature of situation within organizational boundaries (Smircich, 1983). Culture and leadership are also very closely related, for Schein (1992) culture and leadership are two sides of the same coin in that leaders first create cultures when they create groups and organizations. Once cultures exist, they determine the criteria for leadership and thus determine who will or not be a leader. Schein (1992) states that it is the unique function of leadership to perceive the functional and dysfunctional elements of the existing culture and to manage cultural evolution and change in such a way that the group can survive in a changing environment. Also in relation with leadership this author says that when new values and assumptions will be learned, leaders must create a reward, promotion, and status system that is consistent with those assumptions. Whereas the message initially gets across in the daily behavior of the leader, it is judged in the long run by whether the important rewards are allocated consistently with that daily behavior (Schein, 1992).

Because cultures are so hard to discern and are deeply rooted, change can be very difficult. Simply changing technologies or improving management systems is not likely to alter culture (Doppelt, 2003). This is also true for the case of different sustainability initiatives in different kinds of organizations. For this reason, the first step to be taken to change organizational culture is to understand the nature of the organizations and their culture. To avoid the boomerang effects of failed change initiatives, sustainability initiatives must explicitly focus on altering the culture of the organization (Doppelt, 2003).

Change processes are related to various cultural elements which, in turn, define the people and the groups within an organization. For this reason resistance can be expected in case a change in culture

appears. Therefore people within the organization are unlikely to support a management change if they do not see the value of it (Birnbaum, 2001).

Besides, change often requires new tasks and activities to be performed. In the special case of new environmental programs like a new waste management program in an organization, it requires new forms of dealing with waste –use of recycling bins, reuse of paper, avoidance of certain types of materials, etc. For many of these activities, the organization does not have explicit rules. In performing these activities, members turn to the organizational culture as a source of guidance. In this sense, culture is a very valuable tool for implementing change (Shrivastava, 1994). Change implies learning new ways of doing things.

A successful change toward sustainability requires new practices that include the transformation of norms and values which are related to the well-being of the environment, the society and the economy (Doppelt, 2003).

In this study we are interested in culture related to environmental issues. Therefore culture is considered here as the organization of environmental meaning, environmental shared-value preferences, and templates for environmental action (Hudson, 1997). In particular we are interested in the part of the culture related to solid waste handling and disposal and particularly the attitudes people have towards those issues. It was mentioned above that simply changing technologies or improving management systems is not likely to alter culture. Thus, what elements must be present to achieve a more environmentally friendly behavior? In the following paragraphs a review of studies focused on environmental attitudes will be presented. Next the analytical approach adopted here will be justified.

Any approach for understanding culture will depend on how we conceive culture: as something the organization *has* or as something the organization *is*. If we choose the first approach culture is considered an independent variable that is imported into the organization by its membership. Its presence is believed to be revealed in the patterns of attitudes and actions of individual organization members (Smircich, 1983). The second approach recognize that organizations are themselves culture-producing phenomena. Under this approach organizations are seen as social instruments that produce goods and services, and, as a by product, they also produce distinctive cultural artifacts such as rituals, legends and ceremonies (Smircich, 1983). The approach chosen for this study is the second one because it is expected that, independently of the cultural background of each of UABC's members, normative glue holds the different groups together while at the same time these groups express their values and norms under which they operate.

2.2.3.1 Pro-Environmental Behavior

Culture in the form of feelings, perceptions, assumptions, values, and norms affects behavior.

Individuals arrive at organizations with variant motivations, experiences, and values. These natural individual differences tend to direct behavior in numerous, often divergent directions (O'Neill, Beauvais and Scholl, 2001). But, what makes an individual to adopt pro-environmental behaviors?

One of the fundamental aspects of culture is the relationship it prescribes between individuals and environment. Am I part of the natural environment, a separate being or perhaps superior to nature? The answer to this question influences the types of attitudes that individuals within a given culture are likely to develop, the types of environmental behaviors that individuals are likely to adopt also influences the beliefs about how to solve environmental problems (Schultz, 2002).

Culture is an important mediator between behavior and the environment, impacting on social participation and environmental action, and thus in turn on sustainable development. Schultz (2002) reported that in collectivistic cultures the importance of social relations (the core element of a collectivistic culture) leads people to work harder toward goals that benefit the group, rather than the individual. This suggests that in collectivistic cultures, people should be more likely to engage in actions that address large-scale social issues like environmental problems, even when the problem does not directly affect them or when the action does not directly benefit the individual. On the other side, research conducted in the United States suggests that on broad, dispersed types of issues, there is a tendency for people to loaf -to exert less effort when working collectively toward a common goal (Karau & Williams, 1993). Generally, in a social dilemma, short-term rationality favors behavioral choices that, irrespective of others' choices, maximize personal gains at the expense of collective gains (Messick & Brewer, 1983 quoted in Harland, 2001).

Nevertheless there may be more elements involved than a strict weighing of personal advantages and disadvantages when making choices in the environmental domain. As an example Thøgersen (1996) argued that behavioral decisions such as recycling are based on moral, rather than on rational considerations. Additionally, because many pro-environmental behaviors are performed in public, social influences might be important determinants (Harland, 2001). Vining and Ebreo (1992) found that, with regard to recycling, social influence is definitely a factor. Additional ingredients are situational factors such as the efficacy of pro-environmental behaviors or the ability to perform them, which may also affect behavioral decisions.

It seems that to explain pro-environmental behavior there is a need to focus on different factors. Various disciplines ranging from psychology and sociology to marketing and advertising, describe a plethora of theories which components mediate behavior and also how these components are related

to each other (Kibert, 2000). In social psychology, attitude-behavior models have been developed as viable means for identifying the determinants of pro-environmental behavior. Also, psychological analyses of the effectiveness of behavior change techniques offer suggestions for understanding the effectiveness of behavior change attempts (Harland, 2001).

Perhaps the most frequently referenced model used to describe the correlative components of behavior is Azjen's (1991) Theory of Planned Behavior that resulted from Fishbein and Azjen's (1975) Theory of Reasoned Action. The Theory of Planned Behavior (TPB) (Azjen, 1991) assumes that behavior is predicted by behavioral intention which in turn is determined by three factors:

1. a person's attitude toward the behavior, which is shaped by an evaluation of advantages and disadvantages of behavioral performance,
2. a subjective norm, shaped by the perception of what are important expectations of others with regard to the person's behavior, in other words, subjective norms refers to individual's beliefs about whether their society's members—family, friends, and co-workers—believe that the individual should or should not engage in a specific behavior, and
3. Perceived behavioral control is shaped by the person's estimation about the strength with which behavioral performance may be hindered (or facilitated) by the person's capabilities or situational factors.

The three independent variables in Azjen's theory of planned behavior together determine behavioral intention. His attitudes variables examine a person's disposition toward a behavior. The subjective norms variable includes attributes of a person's social environment. The perceived behavioral control variable addresses variation in a person's ability to control the performance of a behavior. Behavioral intention indicates the amount of effort a person exerts to perform a behavior. It captures the motivational factors that produce planned behaviors (Cordano and Hanson-Frieze, 2000).

Azjen's theory of planned behavior (TPB) has been employed successfully in many studies linking attitudes and behaviors. In the environmental arena, several studies found support for relations specified in the TPB, for example: Boldero (1995), Cordano and Hanson_Frieze, (2000); Cheung, Chan and Wong (1999); Taylor and Todd (1995); Goldenhar and Connel (1993); Jones (1990); Kantola, Syme and Campbell (1982); Lynne, *et al.* (1995); Sparks and Shepherd (1992).

The Theory of Planned Behavior makes clear that people's attitudes towards a behavior are not the only variables that are important when explaining behavioral intentions or actual behavior. Another important factor which is not part of the theory is called 'personal norm'. Various psychological

studies on pro-environmental behavior have also suggested that issues such as personal norms (Schwartz, 1977) which include feelings of moral obligation are important factors (Harland, Staats and Wilke, 1999).

Based on the assumption that environmental behavior can be defined as a form of pro-social behavior, the Schwartz Theory (1977) concerning altruistic behavior, can also be used for explaining pro-environmental behavior (Blöbaum, 2000). Schwartz's theory is called the norm activation theory or NAT. This theory predicts that when the personal costs of behaving in a way that primarily benefits others or the society at large are perceived to be too high people tend, as a defense reaction, to post-rationalize the situation. People may neutralize the moral attitude or norm dictating pro-social behavior by denying that continuing their current behavior has any serious consequences or by denying their own responsibility for solving the problems produced by their current behavior (Schwartz, 1968, 1973, 1977; Schwartz & Howard, 1980).

The NAT describes the relationship between activators, personal norms, and behavior. It postulates that personal norms are intrinsically motivated self-expectations regarding morally appropriate behavior. NAT presumes altruistic values which is the awareness of adverse consequences of events for other people. Finally, in Schwartz's theory, norm activation depends on ascription of responsibility to self for the undesirable consequences to others, that is, the belief or denial that one's own actions have contributed to or could alleviate those consequences (Stern et al, 1995).

According to the NAT, personal norms, if activated, are experienced as feelings of personal obligation to engage in a certain behavior. According to this model activation of personal norms occurs under the influence of four situational activators and two personality trait activators. The four situational activators are:

1. *Awareness of need* or the extent to which a person's attention is focused on the existence of a person or a more abstract entity, such as the environment, in need.
2. A person's sense of feeling *responsible* for the behavioral consequences for the welfare of the party in need.
3. *Efficacy*, which refers to the extent to which persons recognize actions that might alleviate the need, and
4. *Ability*, or the extent to which one possesses the resources or capabilities needed to perform the focal action.

Personality traits refer to predispositional influences on norm-activation: *Awareness of consequences*, which refers to a person's receptivity for situational need cues, and *denial of*

responsibility, which refers to people's inclination to deny responsibility for the consequences of their behavioral choices for the welfare of others. These two personality traits along with the four situational activators determine whether or not a behaviorally specific personal norm becomes activated (Harland, 2001).

Schwartz & Howard further published in 1981 the Model of Normative Decision-Making or NDM that deals with behavior that is referring to social and personal norms and is therefore triggering the individual's normative system (Schwartz & Howard, 1981 quoted in Klöckner & Matthies, 2004).

Schwartz & Howard (1981) conceive of normative decisions as being reached in a four-stage process as follows:

- Attention stage
 - Awareness of need
 - Awareness of consequences
 - Perceived behavioral control (identical to the construct used in Azjen's TPB model)
- Motivation stage (generation of feelings of obligation)
 - Personal norms
 - Social norms
 - No moral motives (for example motives to save money or time)
- Evaluation stage
 - Feelings of guilt/satisfaction
 - Shame/Pride
 - Further negative/positive consequences of behavior (e.g. monetary costs)
- Denial stage
 - Denial of need
 - Denial of ability
 - Denial of control

According to this model the denial stage is entered if the decision is uncertain or if there is no decision at all because the evaluation ended in a tie of pros and cons.

Besides the variables covered by the theories presented above (attitudes, subjective norms, perceived control, awareness of need, sense of responsibility, efficacy and ability), for the specific case of behavior related to recycling programs, there are other variables that seem to play an important role. These variables are: knowledge, demographics, situation and motivations. These variables aren't part of a specific theory but different authors have found them to influence pro-environmental behavior.

2.2.4 Other variables

2.2.4.1 Knowledge

Environmental awareness influences several spheres of an individual's life. The level of an individual's public environmental awareness affects choices in private life. Professional environmental awareness exerts an impact on actions in working life and political environmental awareness has an influence on voting habits and political activity. For this reason, environmental information is one of the most important aspects of raising environmental awareness (Kreft-Burnman, 2002). For the specific case of waste recycling behavior, Garcés *et al.* (2002) reported that environmental awareness and knowledge of the environmental impact of urban waste were factors that did seem to determine an individual's recycling behavior. On the other side, McKenzie-Mohr & Smith (1999) state that while education and advertising can be effective in creating public awareness and in changing attitudes; numerous studies show that behavior change rarely occurs as a result of simply providing information. These authors said that community-based social marketing is a better alternative to information-based campaigns. Community-based social marketing is based upon research in the social sciences that demonstrates that behavior change is most effectively achieved through initiatives delivered at the community level which focus on removing barriers to an activity while simultaneously enhancing the activities benefits (McKenzie-Mohr & Smith, 1999).

Finally, recycling programs can sometimes be burdened by complicated sets of rules and regulations. They can also be hampered by a lack of participation on the part of the public. Thus, information and knowledge of the existence of recycling programs and the knowledge required complying with the rules and regulations are thought to be the basic issues that prevent individuals from participating in recycling programs (Cursio, et al, 2003).

2.2.4.2 Demographics

Some researchers have been looking to a link between socio-demographic traits and pro-environmental behavior. As an example, Garcés *et al.* (2002) found that individual recycling behavior is affected by socio-demographic characteristics. These authors reported positive relationships between recycling, age, and family income. Other studies like the one of Ewert & Baker (2001) also reported a relationship between environmental attitudes and age and gender. Their findings indicated females and older individuals responded more pro-environmentally than younger and male individuals. These findings agree with those reported by Nelkin (1981), and by Slovic (1992) (quoted by Orduña, Espinoza & González, 2000; 101), who reported that females express more concern about environmental problems than men. Nevertheless, other studies haven't found such a link between socio-demographic traits and pro-environmental behavior. Guerin *et al.* (2001) reported that behaviors such as recycling, was found to be inconsistent in previous European studies. Furthermore, Guerin *et al.*, (2001) attempted to re-run the meta-analysis study on new data and found that education and income had a modest impact on recycling behavior.

For the case of household waste management in Mexicali city, Mexico, Márquez-Montenegro (2004) found that the interaction among socio-demographic traits have an effect upon pro-environmental behavior that can hinder or promote this behavior. This author also states that other elements like cognitive, affective and conduct issues could have more influence on environmental behavior (Márquez-Montenegro, 2004).

2.2.4.3 Motivations

The motivational factors behind recycling behavior have been researched in several studies, which have sought to isolate specific traits that can be attributed to recycling participation. Bratt's (1999) research emphasized the need to understand the influences of consumer environmental behavior and to identify variables that predicted such behavior. The study concluded that the social norm, which is the consistent behavioral patterns of a majority of individuals surrounding the individual, provided no link to behavior. Oskamp *et al.* (1991), identified peer pressure, as an important predictor or motivational factor of recycling behavior. This means that when in the presence of others, the subjects were inclined to make more socially responsible decisions, especially when peers actually recycled. In a research about motivators for household recycling the authors found that money was the most powerful incentive toward recycling (McGuire, Hughes, and Rathje, 1982). However other researchers (DeYoung, 2000; Gamba & Oskamp, 1994) have found that short-term monetary incentives, such as lotteries that reward random recycler for his or her efforts,

do not produce lasting behavior change. Community recycling rates return to prior levels when the incentive is no longer available.

Other studies (Davio, 2001; Gamba & Oskamp, 1994; Oskamp, *et al.* 1991; Simmons & Widmar, 1990) suggest that the more that people see recycling as effective, the more likely they are to participate, or to participate more fully, thus the perceived effectiveness of recycling is a strong motivator.

2.2.4.4 Specific context variables

The specific context variables are those elements that are present in a specific situation, in other words those elements that affect a particular desired behavior in a particular environment (institution, house or facility). For the case of a recycling program these variables would include the location of the recycling receptacles and the policies in place for the new recycling program. One example for the first variable is offered by the study carried out in the University of Massachusetts by Williams (1991). This author found that three-fourths of students would be more likely to recycle if there were more convenient places to recycle, such as a drop-off facility on campus. In other words, if there were more receptacles for different recyclable items at convenient locations, students would be more inclined to recycle. A later study by Ludwig *et al.* (1998), agreed with Williams' (1991) findings. Ludwig *et al.* (1998) examined the recycling behavior of students in academic buildings by contrasting the results when individual recycling receptacles were placed in the classrooms with the results when the receptacles were placed in one central deposit centre. Results showed that the convenient classroom location increased the recycling response by the students. Both studies expose the influence of location and convenience of recycling facilities in recycling program participation.

Policy perception is defined as the interpretation and understanding of governmental (or institutional) policy by individuals. In their study, Garcés *et al.* (2002) concluded that when a recycling program is thought to be supported by sound environmental policies and is felt to be organized and controlled by good management, it has a positive influence on the individual recycling behavior. The study also proposed the idea that the amount of effort required to participate in a program was a major barrier for those wishing to diminish their environmental impact but unwilling to go to any extra lengths for a governmental initiative. Therefore responsibility is placed on the government (or any other institution) to implement effective programs that consider the needs of individuals and the environment. As a side note, Guerin *et al.* (2001) also studied the reaction of citizens after gauging the effectiveness of the government in

managing environmental problems. People who believed that their government was making a reasonable effort to protect the environment were more inclined to adopt environmentally friendly behaviors (Guerin *et al.*, 2001). These results suggest that an individual's decision to participate in recycling programs does not solely depend upon monetary rewards and incentives but instead, it partly depends on the example set by governments; for instance, by creating a policy, and then initiating and maintaining recycling programs. If individuals perceive that recycling is an important issue, perhaps because of their awareness of pro-active decisions taken by the government (or the institution), they will invest time and effort in a recycling program (Guerin *et al.*, 2001).

2.2.4.5 Habit

A final important factor is habit. Habit is a behavioral script that mediates between situational cues and behavioral patterns. The association between cues and patterns of behavior is learned by repeating the same behavior under the same circumstances over and over again (Klößner & Matthies, 2004). Most of people's behavior is habitual. When we walk through the supermarket we do not think about every item we put into our shopping basket. Our previous experiences have shown us that this product is satisfactory to us so we use it again (Gatersleben and Clark, 2001). For example Thøgersen and Olander (2003) found that the propensity of Danish consumers to shop in an environment-friendly way is highly stable, and that this stability is positively correlated with the purchase frequency of a product, indicating that it is at least partly due to habit. These authors also indicate that many of the analyzed behaviors in their study were performed frequently and in a stable context, which are the ideal conditions for developing habits. However, the stability also depends on the perceived environmental relevance of the choice, indicating that it is partly due to stable preferences (Thøgersen, 1999).

For the specific case of everyday waste disposal; habit plays an important role since disposing waste is a repetitive activity that has been carried out a certain way for a long time already. As Klößner and Matthies (2004) state "*past behavior is the complete pattern of behavior shown prior to the actual behavior. It included habitual components as well as intentional behavior, behavior guided by norms or behavior under control of the situation. Furthermore, past behavior includes repeated actions as well as actions shown only once or occasionally*". Thus, if a new waste management and recycling program is set up, it will be wise to consider waste disposal habits of the people aimed to become participants in it.

From the previous paragraphs above one could easily conclude that there are many variables in play for the understanding of pro-environmental behavior. If organizational change is the result of the

behavior of individuals and groups and these are determined by their attitudes, beliefs and expectations, then the change required for the good performance of the waste management program at UABC must also be influenced by these variables. Thus for this study a question that could help the understanding of the attitudes of the people in UABC towards the waste management practices at the university is: What is the relationship between the culture related to pro-environmental behavior and the performance of the waste management program at UABC? For answering this question Azjen's Theory of Planned Behavior (TPB) will be used. Based on this theory the following questions were constructed:

- What is the attitude of the people in the university towards the waste management strategies (reduce, reuse and recycle) employed in the waste management program?
- What is the attitude of the people to actively participate in the waste management program?

TPB was chosen for two reasons: 1) it has been used successfully in other studies linking attitudes and pro-environmental behavior, and 2) because the data required were more easily accessible than those required to test other theories (NAT and NDM). In using Azjen's model not all variables were tested, but only those that were considered as the most relevant ones.

Furthermore, some of the other variables that influence pro-environmental behavior like knowledge (information), demographics and specific variables like the location of the recycling bins, were included as well. Through a questionnaire all these variables were tested.

2.2.5 Conclusion

The main research question of this thesis is: How can one explain the difficulties of implementing a waste management program at universities, in particular at the Autonomous University of Baja California? And which recommendations can be derived from analyzing this case? In order to answer the main research question of this thesis; a systemic approach was chosen. Two different perspectives were selected: 1) analysis of the external environment of the university and 2) analysis of the internal environment of the university. Within each of these perspectives a set of theories and relevant background information has been selected. Figure 6 presents a scheme that summarizes the theoretical approaches that were used to answer the main research question.

For each of the end branches in the scheme specific research questions are formulated based on theory or background information on the subject. Together the answers to those questions will bring light for answering the main research question.

For the analysis of the external environment the two aspects that were considered for answering the main research question were: 1) the waste management system in Mexico and 2) the sustainability trends in higher education system. These two elements were selected because of their perceived direct relationship with the waste management program at the University of Baja California. Because the external environment is characterized by uncertainty and change organizations must have ways for communicating and being prepared to respond to the external environment. In this way a set of networks, channels of communication, cultures develop and influence the way organizations get attuned with the environment. Based on this the following question will be addressed:

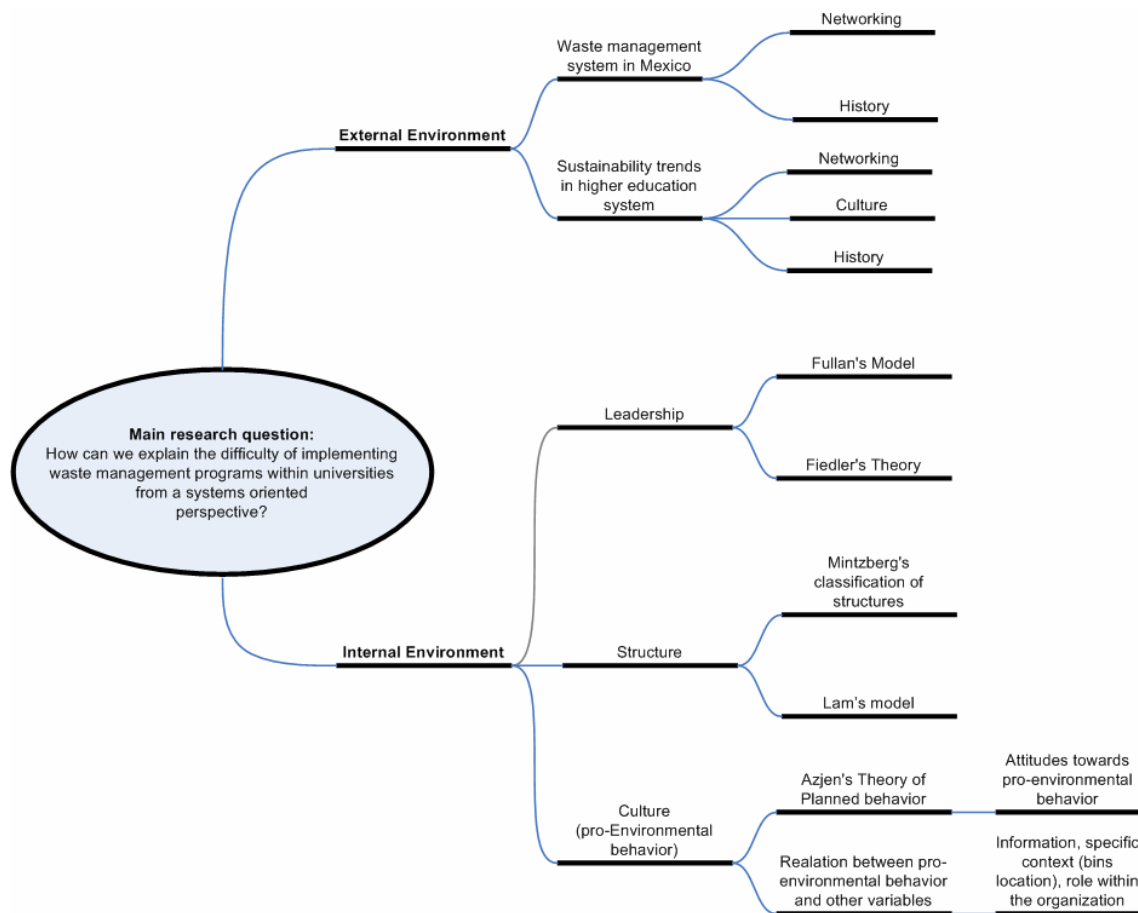


Figure 6. Summary of the theoretical approaches used to answer the main research question.

What is the relationship between the external environment elements considered in this study (Mexican waste management system and sustainability trends in higher education) and the performance of UABCs' waste management program?

For the analysis of the internal environment three aspects will be considered for answering the main research question: 1) leadership, 2) organizational structure and 3) culture specifically the aspects of culture related to pro-environmental behavior. These three aspects were chosen because they have shown by other studies to influence the types of results that new initiatives have. The specific questions that were constructed for each of these aspects are:

1. Leadership

- a. What is the relationship between the role of leadership and the results obtained during the implementation of the waste management program at UABC? For answering this question the Situational Theories of leadership in particular Fiedler's model and the transformational leadership factors summed up in Fullan's Model (2001) will be used.

2. Organizational structure

- a. What was the relationship between the organizational structure at UABC and the performance of the new waste management program? For answering this question Mintzberg's and Lam's organizational models will be used.

3. Culture (pro-environmental behavior)

- a. What is the relationship between the culture related to pro-environmental behavior and the performance of the waste management program at UABC? To answer this question Azjen's Theory of Planned Behavior (TPB) will be used. Other variables not included in TPB that will also be taken into account in this analysis are: information about the program, location of the recycling bins, and the role of the people within the university.

The question related to the external environment will be addressed in chapter three and the questions related to the internal environment of the institution will be addressed in chapter four and five.

Chapter III. Results of the external environment elements

It was said in chapter II that organizations don't exist in isolation. They interact with their external environments and are influenced by them at the same time that the organizations have an impact upon their external environment. As stated by Scott (1987) external forces shape internal arrangements of an organization and vice versa.

The external environment of institutions of higher education can be characterized by change and turbulence. Administrators of colleges and universities have witnessed major shifts in the demographics of their institutions' clientele. External agencies have tightened their control of policymaking and fiscal decisions made by the institutions' administrations. There has been a growing criticism of the value of the curriculum offered and the quality of instruction provided by many institutions of higher educations in the increasingly competitive environment of the global economy (Morrison and Mecca, 1989). Less obvious, but not less significant there has been a pervasive spread of environmental awareness and "sustainability initiatives" all around the world, challenging the dominant instructional, operational and managerial paradigm of higher education institutions.

The environmental protection and sustainability trends are starting to get through the Mexican higher education system. However, different factors make its adoption vary from institution to institution. The pace and type of adoption of these trends and their magnitude also varies between institutions including the specific set of initiatives that take place in each institution.

To understand the impact that the external environment had on the waste management program of the Autonomous University of Baja California, two elements of its external environment are going to be described and analyzed in this chapter: 1) the Mexican waste management system and, 2) the sustainability trends in higher educations (Figure 7).

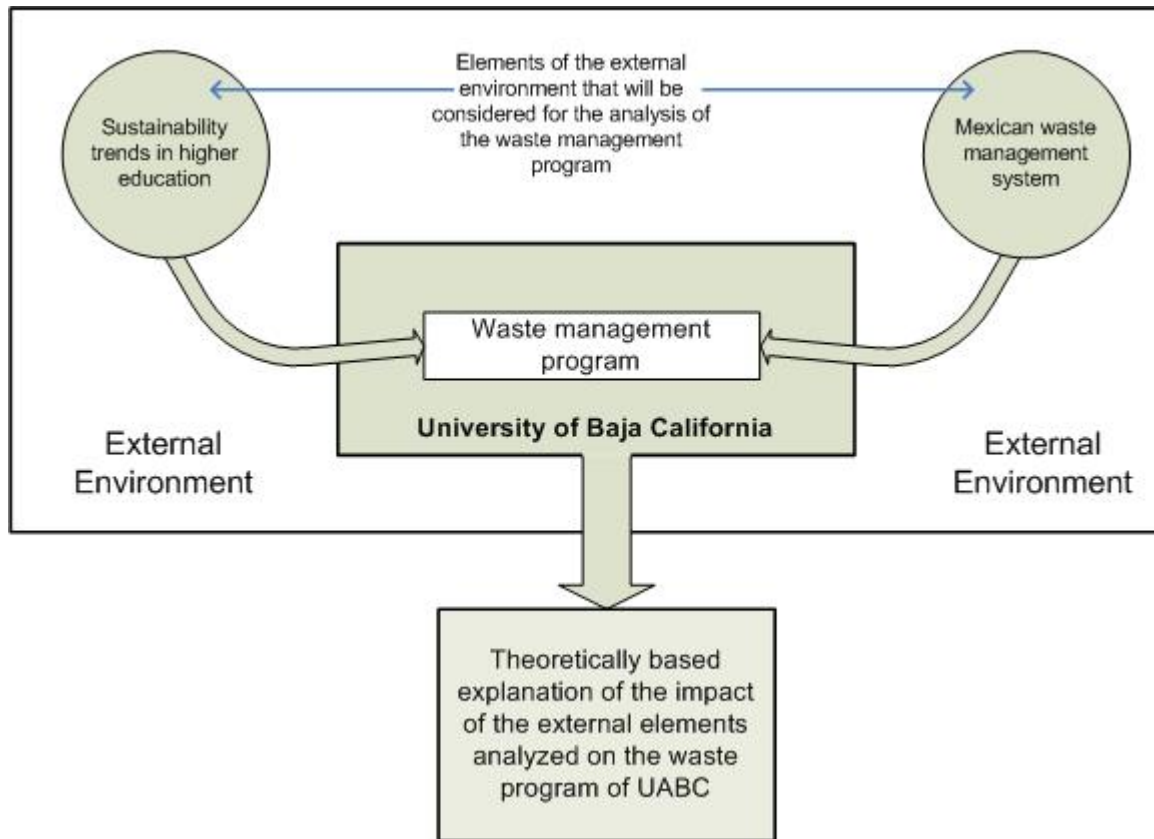


Figure 7. Elements of the external environment of the university that will be analyzed

First each of these two elements will be described separately. After that, an analysis of both elements will be done together based on the theoretical aspects of the external environment described in Chapter 2 (Figure 7). This analysis is aimed to answer the question: What is the relationship between the external environment elements considered in this study (Mexican waste management system and sustainability trends in higher education) and the performance of UABCs' waste management program? For answering this, two more specific questions were raised in the previous chapter:

- What is the impact of the Mexican waste management system upon the waste management program of UABC?
- What is the impact of the sustainability trends in higher education upon the waste management program of UABC?
- What is UABC's approach to change when taking green initiatives like the waste management program?

3.1 Waste management system in Mexico

One of the most urgent issues in Mexico at the beginning of the 21st century is the one dealing with the rapid generation of waste both in urban and rural areas, including the areas where extraction processes are being carried out to obtain resources (mining, oil wells, forest and others) to be used as raw materials in the manufacturing industry. Said issue has not only environmental and sanitary implications, but financial, commercial, technological, social and political ones as well; furthermore these implications can spread beyond the country's borders turning into a global issue which can affect other countries as well (Cortinas de Nava, 2001).

In order to address these issues, the creation of programs for the integral solid waste management has been proposed. These programs seek to diminish waste output and to create a culture of waste management which can be environmentally adequate, that includes recycling the waste with that potential, as well as disposing of it in the least impacting way for the environment.

In order to be able to understand the elements which have to be present in every integral program for solid waste management, it is necessary to first understand the context in which said program is to be carried out. The understanding of this context will be useful in the future to plan the initiation procedure of this type of program in various institutions, and, at the same time, this can be used to get to know what options the program will count with and, the limitations of the environment as well, in order to be able to respond to the program's particular needs.

This chapter describes the characteristics of the context for solid waste management in Mexico. This information will demonstrate the importance of the introduction of integral programs for waste management in the country. It will serve to understand the limitations that said programs face and will make evident the need to search for alternative solutions to those limitations.

The first part of the chapter presents the historical chronology of the control of municipal solid waste (MSW) as well as the evolution of urban cleaning services in Mexico. This information is being included in order to understand the stage in which this service finds itself currently in Mexico.

The urban cleaning systems in the different municipalities around the country are divided, in most cases, for their operation and control, into the following stages: street and public areas sweeping, collection, transportation, treatment and final disposal. The second part of this chapter presents the current situation in which these stages are at from the technological point of view.

The information about the generation and composition of the MSW is a fundamental part of the analysis of any integral MSW's management system. This is why, in the third part of this chapter, we make reference to the classification, composition and generation of waste.

Finally, we deal with the aspects the integral MSW management programs should contain. Those of them which are currently used in Mexico are described and up to what degree they are being implemented. This section of the chapter also explains the role the waste-pickers play within the Mexican recycling industry.

In the following section there is a detailed analysis of the problems in the industrialization and commercialization of recyclable waste in Mexico including a description of the recycling industry structure, the aspects that affect the commercialization of the recyclable products as well as the importance of the community's participation.

In this chapter the legal framework and regulations for waste management in Mexico are also described, including the competent authorities and the standards relative to municipal solid waste management.

The waste management system in Mexico represent a part of the external environment which could be (or not) exerting certain impact upon the waste management programs of the different institutions. Thus, it is to be expected that, for the particular case of the waste management program of the Autonomous University of Baja California (UABC), certain permeability between both systems (UABC program/Mexican waste management system) would be present.

3.1.1 The state of solid waste in Mexico

3.1.1.1. Historical chronology

The control over municipal solid waste (MSW) generated by the inhabitants in the country began in the days before Cortes arrived to Mexico and public health in Mexico was legally put forward on July 15th, 1891, which is the date on which the First Sanitary Code was created by the Health Council.

The first major works by the federation for MSW control was carried out in the decade of the 1960's when the first sanitary waste landfill in the whole country was designed and began to operate in the city of Aguascalientes. This sanitary landfill was followed by integral collection and disposal plans in the principal capital cities of the states as well as in other cities which.

Due to the growing environmental deterioration, it was until the decade of the 1970's, when a nationwide interest on environmental issues began and became formalized with the creation, in 1976, of the Environment Improvement Sub-secretary (*Subsecretaría de Mejoramiento del Ambiente, SMA*) (Buenrostro, 2001). The SMA's Technical Council started a nationwide program. Through this program, the executive projects for the final MSW management and disposal were developed in the cities of Acapulco, Tijuana, Mexicali, Saltillo, Cd. Juárez, Tuxtla Gutierrez, Monterrey and Ensenada. Also, the first training courses for the municipality's personnel staff were begun and the first institutions for the identification of industrial solid waste problems were developed.

At the end of the decade of the 1970's and up to 1982, a series of projects were carried out and it is then that standard for MSW control begun.

From the beginning of 1983, the RS100 program was launched. This program consisted of executive projects for sanitary landfills in cities with more than 100,000 inhabitants. Also, the manuals for the design of sanitary landfills and the programs for the collection routes design were elaborated, as well as the executive projects for industrial waste confinement. Besides that, training and coaching courses continued to be given to the municipal personnel nationwide.

The Secretariat of Environment, Natural Resources and Fishing (*Secretaría de Medio Ambiente, Recursos Naturales y Pesca, SEMARNAP*) was created in 1994. Within its structure was included the National Institute of Ecology (INE). In this framework, the INE assumed the responsibility of the development of municipal solid waste regulations standards and, in the year 1996, it proclaimed the Official Mexican Standards (*Normas Oficiales Mexicanas, NOM*) which establishes the requirements for the selection of sites for the location of sanitary landfills.

In the year 2000 the Secretariat of Environment and Natural Resources (*Secretaria de Medio Ambiente y Recursos Naturales, SEMARNAT*) was created which substituted the SEMARNAP. The change of name went beyond transferring the fishing sub-sector department to other Secretary because the aim was to take a functional measure which would permit to set off a national environment protection policy which could serve the ever growing national expectations to protect the natural resources and which could succeed in having an influence on the cause of contamination and the loss of ecosystems and biodiversity. In this way and under this new structure, the INE continued to be responsible for the development of solid waste regulations standards (SEMARNAT, 2002b).

3.1.1.2 Urban cleaning systems

Since few publications exist describing the Mexican cleaning systems in existence, this section has been based almost exclusively on the descriptions made by the National Institute of Ecology (*Instituto Nacional de Ecología*, INE) (INE, 1999) as these are the most complete founding existence. The text from INE (1999) in the rest of this section has been copied, that is why quotes have not been used here, except in cases where a different source from the one mentioned, were used.

Since the beginning of the last century, the municipalities in the country have faced the responsibility of carrying out the necessary actions in order to be able to provide the urban cleaning services (UCS), and/or cleaning service, in their localities, in such a way that they can maintain good efficiency levels and thus achieve the control over municipal solid waste (MSW). This brings about a series of issues which are inherent to the rendering of a public service.

For many years, the rendering of the UCS was considered during a very long time the exclusive and sole responsibility of the government. The lack of involvement of the society including NGO's, academic institutions, industries and the affected community, besides other factors, resulted in a UCS that lagged behind the technical and administrative progress which was being achieved quickly in the rest of the world. This lag had repercussions on the efficiency levels for the rendering of this service because all the efforts carried out were aimed mainly at the collection and in many cases, at the sweeping. Nevertheless the management infrastructure and systems are extremely precarious given the disproportion between the growing amount of the MSW generated and the existing management, vigilance and control capacities. Likewise, clandestine waste disposal can be noted frequently in garbage dumps, ravines, road thoroughfares or bodies of water.

3.1.2 Current urban cleaning system

The urban cleaning systems in Mexico consist of six elements: 1) storage in the generating source; 2) manual and mechanical sweeping; 3) garbage collection; 4) transportation and transference; 5) treatment and, 6) final disposal. The following is a description of each one of these.

3.1.2.1 Storage

In Mexico temporary waste storage is perhaps one of the elements of the cleaning system that has received the least technical and professional attention. There are few cities which have an adequate storage system in homes, stores, industries and hospitals (SEDESOL, 2002b). Nevertheless, the storage areas are deficient, especially in large generation sources (markets, supermarkets,

entertainment shows, and whole sale markets). In general, these areas were not designed or built with this in mind thus provoking a series of risks to health, environment and the economy of the waste generators.

Another important aspect is the storage in public areas such as parks, beaches, archeological areas and meeting places which generally count with equipment for temporary waste storage.

Nevertheless, the solid waste collection from these places does not get carried out in a regular way, mainly because, in most cases, the necessary infrastructure is lacking. This situation has provoked the generation of smaller dumps around the containers.

3.1.2.2. Manual and mechanical sweeping

The street and sidewalk sweeping system was a task which was shared for many years, between the authorities and the citizens. Nevertheless, the community's participation has decreased and it has become practically inexistent at present in the larger cities and is much reduced in the smaller ones.

The sweeping activities carried out by the UCS's are mainly done manually whereas they are done mechanically on main avenues and speedways. For manual sweeping they use wheelbarrows or carts with 200 liter metal barrels, brooms, brushes and collecting pans. The areas with priority attention are the paved areas such as main town squares, shopping areas, main streets, avenues as well as parks and public gardens.

The use of mechanical sweeping is to be found in the larger Mexican cities (SEDESOL, 2002b). In general, this type of equipment receives very little maintenance and the sweeping machines work below their full capacity. Although mechanical sweeping implies less expense than the manual one, it provokes displacement of hand labor and favors the exportation of foreign currency because the equipment is imported.

3.1.2.3. Collection

The collection stage is the medullar part of an urban cleaning system. Its main goal is to preserve public health through waste collection from the generation centers and its transportation to the treatment or final disposal site in an efficient way and at the lowest cost (SEDESOL, 2002b, INE, 1999).

In Latin America it is estimated that an average 75% of the solid waste generated is collected, leaving the remaining 25% lying around in public areas, empty lots, sewage system, ravines, rivers, etc. (Acurio, *et al.*, 1997; Careaga, 1997). According to the INEGI – INE's (2000) in the medium sized cities of Mexico the amount collected by waste collection services at the end of the year 1998

was 84%, and just 50% of the total produced had an adequate final disposal. Within the rural communities the amount collected is not very significant. In the country's northern border, it is estimated that some 192 thousand tons of municipal solid waste are generated per month and only 73% of this amount is collected.

In Mexico, most of the municipalities provide and administer the collection services. Nevertheless, there are private collectors as well, which provide collection services to all sorts of sources.

As far as the collection routes are concerned, in 75% of the cities are divided into operative sectors. Only 43% of the cities make a design through technical methods in order to carry out the waste collection. Nationwide, just 26.67% of the cities count with efficient collection routes. The most commonly used collection equipment is the compacting trucks with a capacity for 10 to 15 m³, which can collect from 6 to 8 tons per trip.

Summing up, it can be said that the majority of cities do not count with a route design and that they are insufficient. This shows that the municipalities, besides not counting with the sufficient financial resources, do not count with good planning to increase the collection scope adequately, or at a lesser cost, especially in the peripheral places which are difficult to reach or which have been created recently. As a result of this situation, considerable amounts of waste are concentrated in areas such as empty lots, ravines and peripheral neighborhoods.

3.1.2.4 Transportation and transference

In Mexico are used two types of MSW transportation: a) the collection vehicle realizes the trip all the way to the treatment or final disposal site and b) the MSW's are transported all the way to the transference sites for their subsequent transfer to the treatment or final disposal sites. The goal of the transference systems is to minimize the transportation time from the collection units thus diminishing the MSW operation costs.

The great distances from the towns to the final disposal sites have driven the municipalities to an ever greater use of the transference stations. This situation has begun to arise more frequently among the middle sized towns in the country where important economical activities are carried out as this brings about the growth of population settlements in the periphery of the cities, and with it, the difficult task to find appropriate sites for the final disposal close to the center of the towns.

Together with this, the cost of land and the rejection of the population against the construction of landfills make it difficult to select the land in the periphery of the towns. In the metropolitan areas of Mexico more than 75% of the collected waste goes through a transference station.

3.1.2.5 Treatment

The incineration treatment processes, the utilization of sub-products to be recycled and those to be used to produce compost have not had the result expected in Mexico. For this reason, most of the treatment sites have stopped operating for lack of market, the high operation costs and the bad quality of the finished product. It is for this reason that most of the collected waste is not treated at all and its final destiny lies in the landfills. It is important to note that in Mexico there are few landfills which comply with the required technological characteristics, the majority of the final MSW disposal sites are open air dumps.

On the other hand, if one observes the tendency in MSW management in the developed countries (Figure 8) it is striking to note the use of diverse treatments. In the above figure it can be noted that in the developed countries, in spite of having progressed in the creation of waste recycling infrastructure, composting either with or without energy generation, solid waste final disposal in landfills is still very significant. Nevertheless, in some countries like the Netherlands, waste incineration is a method of final disposal which has been increasing. Thus, from 1989 to 1999 there has been an 84% increase in the incinerating capacity in that country. At the same time, the number of landfills has diminished; from 1,000 active sanitary landfills which existed in Holland in 1970, by 1996 the number had decreased to 47 sites (de Jong, 1999). One of the reasons that made this change possible in the Netherlands was the prohibition in 1996 for landfilling combustible waste and the higher tariffs for landfilling instituted since 1999 (de Jong, 1999).

The recycling, composting and incineration aspects in the case of Mexico will be studied in more detail in the section about “Waste management options in Mexico” within this same chapter.

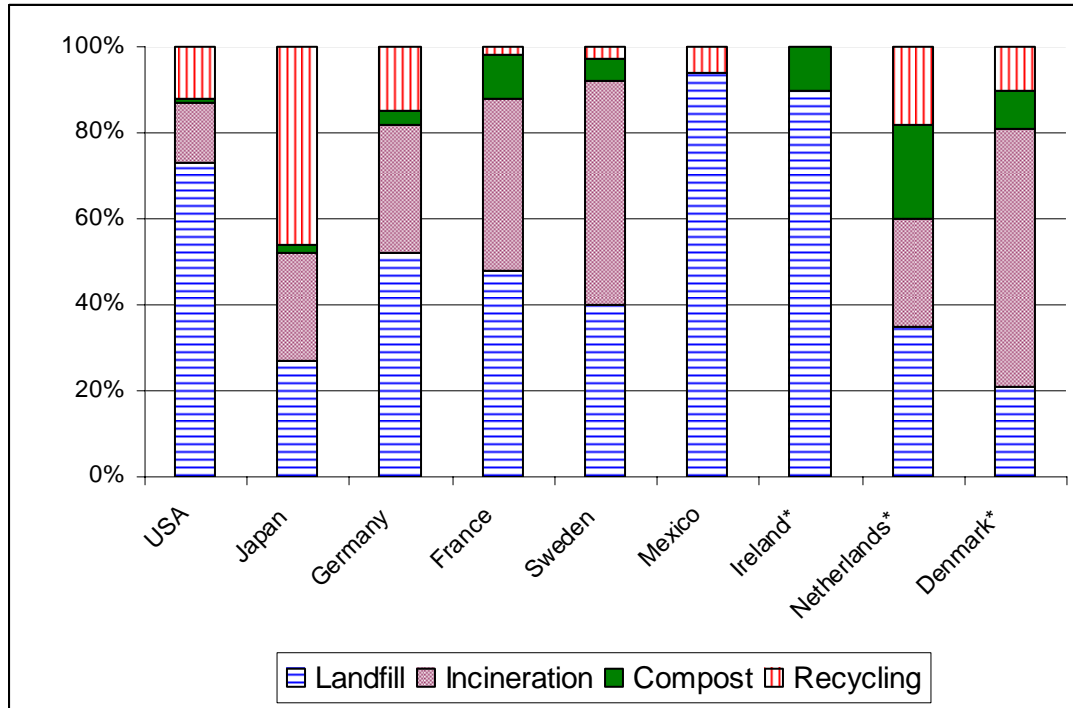


Figure 8. Municipal Solid Waste treatment in various countries

Sources: Cortinas de Nava, C. 2001. *Hacia un Mexico sin Basura*. LVIII Legislatura, H. Congreso de la Unión. Mexico.

* Mullingar Chamber of Commerce, Ireland. 2003. *Environmental Comparison Between Ireland and the EU Countries*.

3.1.2.6 Final disposal

Landfills are used for an adequate final MSW disposal, in the best of cases. They are a planned and designed work of engineering which is executed and operated to prevent negative effects on the environment and public health. Nevertheless the final disposal of more than 50 percent of the MSW generated in Mexico is carried out in controlled open air dumps or landfills. These methods do not comply with the technical requirements to achieve an adequate MSW disposal. A manifest lack of control is evident in the final disposal sites and the majority show health and environment risk conditions.

Because of the above mentioned problems, when the usable life of the final disposal sites is over, they become useless for any productive or recreational purpose. The deterioration of the urban image, the sanitary unpleasantness, the inherent risk of the growth of harmful fauna and the noise, should be added to the above, as well as the social problems involved in the waste-picking activity of the materials that can be commercialized.

In the last few years, have been encouraged actions to improve the MSW disposal. As a result, in mid-sized cities, the final disposal in sanitary landfills has increased 20% during the last eight years.

At present, in Mexico there are 40 sanitary landfills in mid-sized cities and metropolitan areas and 13 in small cities operating in a satisfactory way, nationwide. Nevertheless, the 83,831 tons of waste produced daily in Mexico would require 111,775 m³ per day for its disposal. This gives an idea of the need to find land and the importance in designing strategies for the waste's integral management which should include actions such as reducing the amount of waste from the source.

3.1.3 Municipal solid waste generation and composition

3.1.3.1 Generation

The information concerning MSW generation and composition is a fundamental part of the analysis of any system of MSW integral management; it is for this reason that we will refer to said aspects below.

The rates of municipal solid waste generation vary according to the consumption patterns which are in turn influenced by the different lifestyles, attitudes y culture (Reddy, *et al.*, 2000; Shah, 2000). As far as behavior is concerned, this is influenced by socio-demographic factors (including age and family lifecycles) together with income levels (Coggins, 2002). In addition to these factors, Buenrostro (2001) also considers the economic globalization as another element that affects the population's regional consumption patterns and is reflected in similar patterns of municipal solid waste generation in the developing and developed countries.

Considering the elements mentioned above, it seems logical that the *per capita* rate of solid waste generation should vary from country to country. Furthermore, those same factors that affect the rates of MSW generation between countries also apply to the various regions within a country. The *per capita* waste generation in Mexico varies between 0.680 Kg per day to 1.33 Kg., the lowest estimations corresponding to the rural areas and the highest ones to the metropolitan areas and Mexico City (INEGI, 2000). According to SEDESOL (2002a) the average waste generated *per capita* is 0.870 kg.

In order to have the necessary elements to make a comparison of Mexico's situation, Table 5 presents different MSW generation rates in different countries and cities around the world.

Analyzing the data presented in Table 5 we find that the *per capita* generation of solid waste in Mexico represents 43.3 % of the waste per person, per day, produced in the USA. This comparison might sound alarming; however, in order to know the size of the implications of these waste generation rates, it is necessary to know the composition of the waste and the type of measures

taken (transportation, treatment, transformation or reuse processes and final disposal) to deal with the waste.

Table 5. Per capita MSW generation rate in different countries during 1998.

Country	Per capita generation rate (Kg/person/day)
United States of America	1.970
Canada	1.900
Finland	1.690
The Netherlands	1.300
Swiss	1.200
Japan	1.120
Brazil (Sao Paulo)	1.350
Argentina (Buenos Aires)	0.880
Chile (Santiago)	0.870
Mexico	0.853 — 0.870 *

Modified from: Situación Actual del Manejo Integral de residuos sólidos en Mexico (Current Situation of Integral Solid Waste Management). Sedesol. 1999

* Data for 2001 according to SEDESOL, 2002a.

Since the case study of this work took place in a Mexican border city (Mexicali, Baja California) following is the data concerning the waste generation in this city. Mexicali accounts for 33% of the population in the state of Baja California, which means 2.1 million inhabitants. The population in Baja California has grown rapidly— with an average of 3.6 % between 1980 and 1990 increasing to 5.5% in 1992 and falling to 4.3% in 1995. This behavior is explained by the state’s economic success and its proximity to the United States of America. Baja California also has one of the highest *per capita* incomes in the country (Ojeda-Benítez, *et al.*, 2000).

The rate of solid waste production in Mexicali increases 3.3% per year. The total waste generation is currently 169,546 tons per year in urban areas and 10,526 tons per year in rural areas. This is translated into an average waste density of 255.2 Kg/m³ (Ojeda-Benítez, *et al.*, 2002). Considering this data, the community and municipal authorities in Mexicali have seen the need for solid waste management, there being as yet no concrete plan for the state or for any of the municipalities.

3.1.3.2 Composition

The term composition is used to describe the individual components making up the waste stream and their relative distribution, which is usually based on percentage by weight (Shah, 2000). The knowledge of the composition of MSW and the processes that determine their production is important in the making of decisions that will lead to an appropriate management of them. Dividing waste according to its characteristics also permits to make an estimate of the space and infrastructure required for the landfills (Acurio, *et al.*, 1997).

Just like waste generation volumes, the composition of MSW is influenced by the factors of economic income, culture, educational level, gender, lifestyle, attitudes, environmental awareness of the generators, as well as incentives or lack of them to reuse, reduce and recycle waste (Cortinas, 2003; Coggins, 2002; Buenrostro, 2001; Shah, 2000; Orduña *et al.* 2000; Sicular, 1992).

There are various data regarding the composition of MSW in Mexico. Table 6 shows the data of the composition of MSW in Mexico for the year 2003 according to IVEX (2003).

Organic matter is the most frequent type of waste in Mexico's MSW; however, literature reports the existence of a gradual change in the type of composition of solid waste (Buenrostro & Bocco, 2003; Ojeda-Benítez & Beraud, 2003; Buenrostro, 2001; Bhurtel *et al.*, 2000; Sitarz, 1998; Tchobanoglous *et al.*, 1996). For example, a reduction of organic waste and an increase in plastic and paper waste has been observed due to the increasing introduction of other materials whose high durability and safety increase their demand, as well as to the growing consumption of disposable goods. This phenomenon is also influenced by market strategies which seek better product presentation.

When comparing the composition of MSW in other countries and in Mexico it can be noted that in the industrialized countries like USA and France the contribution of paper and cardboard is greater, whereas in the developing countries, (Mexico and Colombia) organic waste is the one which is produced in a more significant way. The differences in waste composition may be interpreted as indexes of the average family income and the existing degree of consumerism (Acurio, *et al.* 1997).

The composition of municipal solid waste is not homogeneous throughout the national territory; rather it depends on the distribution of consumption habits and purchase power of the population. Thus, the composition in the southern zone of the country has greater contents of gardening waste, whereas in the largest urban zones this same waste appears in a smaller proportion. Miller (1994, quoted en Ojeda-Benítez *et al.*, 2000) mentions that the general dynamics in the composition of

waste from 1991 to 1997 showed an increase in waste such as plastic, glass and paper, which could be recycled or reused.

Table 6. Percentage composition of municipal solid waste in Mexico.

Type of waste	Percentage contribution
Paper and cardboard	14
Plastic	6
Metal	3
Glass	7
Textile	1
Organic waste (gardening and food)	42
Others	27
Total	100%

Source: Instituto Valenciano de la Exportación (IVEX) 2003. Sector medio ambiente: residuos urbanos de Mexico. IVEX, España. Environmental sector: Mexican Urban Waste (Spain).

The information given in the above paragraphs illustrates the great potential for recycling and reduction that has the waste generated in Mexico. However in Mexico this potential has been wasted. The options for waste management that have been used for years in other countries have not had success in Mexico. Thus, what alternatives does Mexico have for managing its solid waste? In the next paragraphs the options for waste management in Mexico are described in order to answer this question.

3.1.4 Options for waste management in Mexico

In this part of the chapter, the aspects that an integral MSW management programs should contain are discussed. There is also a description of those systems which are present in Mexico and to what degree they are being applied.

In broad terms, Municipal Solid Waste (MSW) management involves decisions by product manufacturers, government institutions, private businesses, and householders concerning (1) source reduction of wastes; (2) diversion of wastes that enter the waste stream from ultimate disposal via

recycling, municipal or commercial composting, and waste-to-energy conversion; and disposal of non-diverted wastes through incineration and landfilling (Siwar y Hossain, 2000; Pratt & Phillips, 2000). The three major components of MSW management are source reduction, waste diversion (recycling) and waste disposal, although Phillips (2001) places “avoiding” before source reduction or minimization, thus, the waste management hierarchy will look as shown in Figure 9.

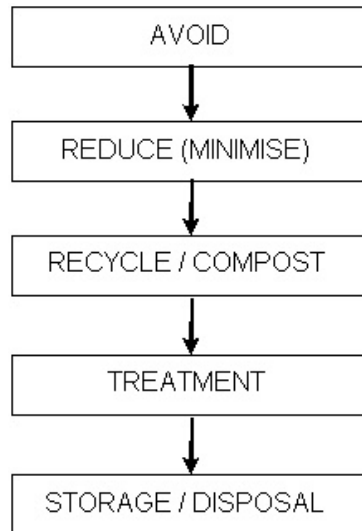


Figure 9. Waste management hierarchy. Source: Phillips (2001).

These main components in the integral MSW management have been introduced recently into the Mexican law concerning solid waste management. According to the principles described in the General Law for Integral Waste Prevention and Treatment (*Ley General para la Prevención y Gestión Integral de Residuos*) (SEMARNAT, 2003), the federation, states and municipalities in Mexico, as well as the main generators of waste, will have to use the following hierarchy in order to reduce the waste management problem more efficiently: (1) Reduce at the source; (2) Reuse; (3) Recycle; (4) Treatment, and (5) Disposal.

The first three elements deal with the prevention of waste and the separation of materials from the waste stream. The next two involve the transformation, destruction or disposal of materials once they enter the waste stream. The last one refers to the waste stream that can no longer be reduced or diverted and which will inevitably end in the landfill.

3.1.4.1 Source reduction

“The waste that is not produced does not need to be collected” is a very sound concept; consequently, the prevention of waste generation and pollution has become a very important matter. The programs for waste reduction at the source may include the design, manufacturing and

packaging of products with little or no toxic waste, a minimum volume of materials, and, or, a longer life. All this involves a change in the way products are made and marketed.

Through source reduction, the capacity of landfills and natural resources are preserved, less energy is required in manufacturing and the pollution of air, water and soil is reduced. Furthermore, source reduction is deemed the key to sustainable waste management (Pratt & Phillips, 2000).

At an international level, source reduction and minimizing waste programs were started over ten years ago. However in Mexico source reduction (included in the main categories of pollution prevention) is a relatively new concept which was mainly introduced in about the year 2000. However, towards the end of the 1980's when the General Law for Ecological Equilibrium and Environment Protection (*Ley General del Equilibrio Ecológico y la Protección al Ambiente*) (LGEEPA) was passed, some aspects related to waste reduction were already being mentioned (Careaga, 1997), although not specifically enough in order for them to become concrete actions.

3.1.4.2 Recycling

After avoiding waste production and source reducing it, recovering materials to be utilized is the following activity in order of importance in the waste management hierarchy (Phillips, 2001; Shah, 2000; Cortinas de Nava, 2001). The separation of wastes from the main stream may be achieved through waste recycling, waste composting and reusing. Recycling is the processing of wastes that may be used as raw materials in manufacturing.

The trend at a worldwide level of how recycling programs are applied is based on separation and collection of sub products at the source or at the plant. It is important to point out that the infrastructure, the equipment and the costs implied by carrying out an integral system for waste utilization and treatment, besides the collection routes, broadcasting and marketing campaigns, etc., are not readily accessible for developing countries, because they are just in the process of consolidating their traditional collection systems (Sicular, 1992; López, 1997; Ogu, 2000). In the cities of developing countries approximately 30 to 50% of wastes aren't collected, ending up in illegal dumps, plots of land, streets and in rivers and lakes (Ogu, 2000; Murad & Siwar, 2000). In view of these problems, it is easy to understand the scarce attention Mexico has paid to waste separation and recovery programs for its recycling.

Some authors (Hounsou, 1998; Missionaries, 1998; Ojeda-Benítez *et al.*, 2000) state that in recent years the interest in recovering and recycling solid waste has increased. In the developed countries, the recycling activities have increased, mainly due to political pressure coming from the public opposition to final disposal sites. Economic pressures linked to the high costs of disposal, joined in

turn to the scarcity of lands as well as public opposition to garbage dumps near their homes; also affect the practices of solid waste management in these countries (Ojeda-Benítez *et al.*, 2000).

The recovery of recyclable wastes in Mexico is minimal, different between cities and uncontrolled, so there is no exact data regarding it. For example, there is data for Mexico City indicating that out of the total waste generated, the material collected for recycling does not exceed 7.5% (Carega, 1997). According to data from SEDUE and SEDESOL reported by the National Ecology Institute (*Instituto Nacional de Ecología*) (1999), the economic potential for recovery and recycling of products contained in MSW in Mexico would total over 16.8 million pesos daily. This calculation is based on the economic potential represented by the recoverable materials from the solid wastes generated in the country.

The data presented in the above paragraphs refers to information about recyclables at a national level. Specifically for the zone of interest for this study, Ojeda-Benítez *et al.*, (2000) reports that 18.6% of the waste generated in a midlevel income neighborhood in the city of Mexicali, could be recycled locally, 68 % has a recycling potential, but there are no recycling industries for those wastes in the area, and 13.3 % could not be recycled.

Although the recovery of recyclables is not new to the world, in everyday practice this potential is wasted in Mexico because there is no waste management system that promotes the separation of wastes with recycling potential.

In Mexico the supply of materials for the recycling industry is achieved through the recovery of recyclables both in the formal and informal sectors. Formal recovery is carried out by businesses established legally who pay taxes and work under a trade name. These types of business are concessionaire collection firms, engineering offices, wastepickers cooperative society which are duly registered and which fulfill their duties according to law (Floribela & Wehenphol, 2001), as well as those commonly known as scrap collectors (“*chatarros*”), “junkers”, or *yaldas*.

The sale of recyclables is made to the buyer offering the best price, which varies depending on the supply and demand of the products both locally and abroad. The markets for all recyclable materials are cyclical, although for some materials they are more so than for others. This is the reason for the variation in price, the differences appearing at the level of production being greater than at the level of purchases by the end-user of the sub-product (INE, 1999). The price variation implies problems for those in the business of buying and selling recyclable materials for it creates uncertainty as to the type of waste on which one must invest time and money to make a profit. At times, traders are

forced to store a type of waste for weeks until there is a market for them (Ojeda-Benítez, *et al.*, 2000).

Several authors (Cortinas de Nava, 2003; Ojeda-Benítez *et al.*, 2000; Bartone, 1999; Jaramillo, 1999; Hernández *et al.*, 1999; Sicular, 1992) acknowledge the informal sector as an important element in the system of waste recovery for recycling in the developing countries. However, and in spite of its important contribution to waste recovery and recycling processes, its role in the municipal waste management systems has not been acknowledged as yet and its income continues to be low (Sicular, 1992; PRECEUP, 1996; Hernández, *et al.*, 1999; van Beukering *et al.* 1999; Fujita, 2000). Table 7 presents the volumes of MSW that was separated for recycling in Mexico according to the official numbers, that is, this data is based on the volumes of recyclables that finally reached a formal sector recovery or recycling site and that managed to enter the official numbers, due to which the contribution of recyclables recovered by the informal sector are left out, except in the cases where this sector has traded the wastes recovered with the formal sector.

Table 7. Percentage (%) of waste recycled by type of waste generated in the period 1992 – 1998.

Type of waste	1992	1993	1994	1995	1996	1997	1998
Paper, cardboard	2.04	2.04	2.05	2.05	2.05	2.06	2.04
Textiles	0.03	0.05	0.05	0.04	0.04	0.07	0.04
Plastic	0.02	0.01	0.02	0.03	0.03	0.02	0.03
Glass	3.83	3.84	3.84	3.83	3.83	3.83	3.83
Aluminum	5.53	5.52	5.52	5.51	5.52	5.51	5.53
Non ferrous Metals ¹	5.55	5.46	5.52	5.50	5.49	5.55	5.49
Ferrous Metals	5.54	5.31	5.48	5.51	5.52	5.53	5.51
Used tires	0.72	0.75	0.74	Na	Na	Na	Na

Constructed from the data presented by Cortinas de Nava, 2001. (For a Waste Free Mexico) Hacia un Mexico sin Basura and by INEGI – INE, 2000. Indicadores de Desarrollo Sostenible en Mexico (Sustainable Growth Indicators in Mexico).

¹ Includes copper, lead, tin and nickel.

Na = Not available

As can be seen in the above table, the percentages of waste recovered in Mexico for recycling are very low, metals being the ones with the highest levels of recovery. However, considering the total

waste produced in Mexico yearly, the proportion of waste recovered for recycling is even lower (Cortinas de Nava, 2001).

From the data presented in the above table, the increase in waste generation is clear whereas the proportions of separated materials for recycling have remained constant. This shows that in Mexico there is no trend of increase in the separation of recyclables because there is a great lag regarding strategies to promote this practice.

Problems concerning recyclable waste industrialization and marketing

Recycling is a fundamental part of any community's integrated waste management scheme. While recycling is not a complete answer to solving a municipal waste problem, a well developed waste reduction and recycling program with a well operating inert waste landfill can save many communities the increased costs of waste disposal and environmental damage.

However, recycling in Mexico faces various problems in each of the different phases encompassed by the chains of segregation, classification, collection, transportation, recycling and marketing of recycling sub products. These problems are analyzed below.

Several authors (Ojeda-Benítez, *et al.*, 2002; INE, 1999; López, 1997; Belausteguigoitia, 1997) agree in that some of the elements to be considered for a municipal recycling scheme are:

- The material recovered in a recycling scheme is waste until a market is found for it to be transformed into a useful product. Often, the most problematic aspect of a recycling scheme in Mexico is finding stable markets for the recovered materials.
- Inefficient marketing can be translated into profit loss, managerial problems and lack of interest from the public to participate in the selection and collection stages of recyclable materials. Because of this reason upon setting up a recycling scheme, it is fundamental to give priority to the marketing of recycled sub products.
- The marketing of secondary materials involves the need to contact a company (micro, small or large) and reach a purchase agreement, so they will take the material "as it is" or with minimal conditioning, to be used in the making of a new product.

Concerning the composition of the recycling industry it is of a large variety of actors that includes from self-employed individuals to transnational companies; they are grouped into five types: collectors, storers-conditioners, independent brokers, recyclers, and end users.

Since the interests of each group are very specific and they seek their own profit, the interaction between this diversity of actors is at times problematic and competitive. Together with this, within these five groups of actors, there may be some who belong to the informal sector and others, to the formal sector, which adds friction to the conflict due to the different approaches to their work practices.

The markets for all secondary materials are cyclical, although it is more so for some than for others. This also explains the price fluctuations, the differences being greater at the production level than at the level of purchase by the end user of the sub product (INE, 1999; Cortinas, 2001; Ackerman, 1997). The market economy of secondary materials depends directly on the total amounts recovered, the rates of recovery of each type of material and the potential supply of recyclable materials, coming from industrial activities and MSW. Since the market for many of the recycled materials depends on the demand, a greater recovery of them won't necessarily lead to a greater utilization if there is no one to buy them (DWM, 2001). Therefore, the sub products obtained from waste recycling, might not get sold, become a financial burden for those who generate them, be stored until the market recovers, or end up in landfills (INE, 1999; López, 1997).

Another aspect that influences recycled materials marketing is the fear that using them will mean making adjustments to the production processes in the manufacturing companies. Also, manufacturers frequently quote consumers' resistance to buy products made with recycled materials because of their lack of trust concerning the quality, so these sub products are discriminated against and in many cases, new materials may turn out to be cheaper than recycled ones (INE, 1999). The high cost of recycled products in Mexico may be due to the fact that most of them are imported, because the recycled products' market in Mexico is not developed yet, and therefore, neither is the culture for consumption of this type of waste.

According to the INE (1999), the industry will set up plants for processing and using waste, as long as this represents a profitable investment and not because it is a moral imperative to contribute to the environment. Thus the benefits that the recycling industries being promoted can have, must be clearly emphasized (Careaga, 1997; McKenzie-Mohr & Smith, 1999). In this way, governments obtain various benefits through the existence of recycling industries, since these potentially represent the option of reducing solid waste disposal costs. The transformation of recyclable materials into new products adds value to waste in each stage of the process and may be translated into a large amount of job sources in the manufacturing, processing and transportation industrial sectors (Quadri, 1997).

In the case of Mexico's northern border, the market for recyclables is influenced by the same type of market in the United States, because, the recyclable materials are sold, in most cases, to the North American market. This feature is partly due to the high costs linked to the transportation of recyclables towards the inside of the country where most of Mexico's recycling plants are located, making it more attractive to sell recyclables to recycling plants on the border strip on the side of United States (Ojeda-Benítez, et al, 2002). Although this may seem to be an advantage, due to the consolidation of the recyclables market in the United States, this fact represents in turn a weakness since the recycling programs of various institutions along the border depend on the fluctuations of that market in the USA. Likewise, the sale of recyclables to foreign plants prevents the search for local solutions to waste recycling, a search that could lead to the creation of Mexican recycling plants, thus strengthening the national market and providing a solution for the regional demand.

3.1.4.3 Composting

Composting is one of the methods contemplated in integral waste management practices for transforming organic contents of waste into soil fertilizers. There is little information available about composting plants in Mexico, However it is known that some plants have already been set up in different cities around the country. Some demonstrative projects of bioconversion and solid waste recovery, promoted and sponsored by non-profit organizations (NGOs) and operated by the community, have been successful. However, they were successful as projects with an academic value and technical process, but only in rare cases has the experience continued over a span of time and repeating them on a mass level hasn't been achieved, for they lacked the institutional, administrative, economic and financial self-sufficiency mechanisms. It can be said that although one of the main elements in MSW in Mexico is organic waste, speaking in general terms, in Mexico the utilization of organic matter through composting is incipient. Although the only information available about the composting plants shows them to be inactive or to have never been operational, it is possible that some plants have become operational since; however, no results have been published to that effect.

3.1.4.4. Incineration

The benefit of incineration is that it can reduce municipal solid waste 90% in volume and 75% in weight (EPA, 2002). New technology that eliminates many air contaminants from incinerator ash is becoming available, but it is costly (TEP, 2002; EPA, 2002)

Municipal solid waste (MSW) incineration plants tend to be among the most expensive solid waste management options, and they require highly skilled personnel and careful maintenance. For these

reasons, incineration tends to be a good choice only when other, simpler and less expensive choices are not available. For these reasons incineration plants are commonly adopted by developed countries (World Bank, 1999).

In Mexico legal MSW incineration is not practiced currently. However it is known that there is a great amount of illegal burning of MSW and other types of waste (hospital, hazardous and industrial) which usually takes place in the peripheral areas of the cities or in the rural areas which are not provided with a waste collection service, and in the MSW open-air dumps. It is estimated that of the 12 million tons of MSW with informal and inadequate disposal in the year 2000, 741,000 tons were burnt (García, *et al.*, 2001). This type of illegal waste “incineration” provides a partial solution to the problem of waste disposal, because, at the same time, it creates air pollution problems.

Summing up it can be said that at present in Mexico the only measure to control waste is by collecting and disposing it in landfills. The other measures for an integral waste management such as avoiding, reducing, recycling, composting, and incineration, for an integral waste management are not being used. Technical, political, cultural and economic reasons are behind this situation.

3.1.5 Solid waste legal framework

The Political Constitution of the Mexico establishes that it is the municipalities’ responsibility to offer the cleaning service with the state’s assistance. Generally, this attribution is ratified by the Political Constitution of the States and based on the Ecological Equilibrium and Environmental Protection State Law (*Ley Estatal de Equilibrio Ecológico y Environmental Protection*). This framework serves as a reference to establish the general guidelines of the Police Cleanliness Edicts and in a particular way, the Municipal Cleaning Regulations. Figure 10 shows the attributions of the three orders of government.

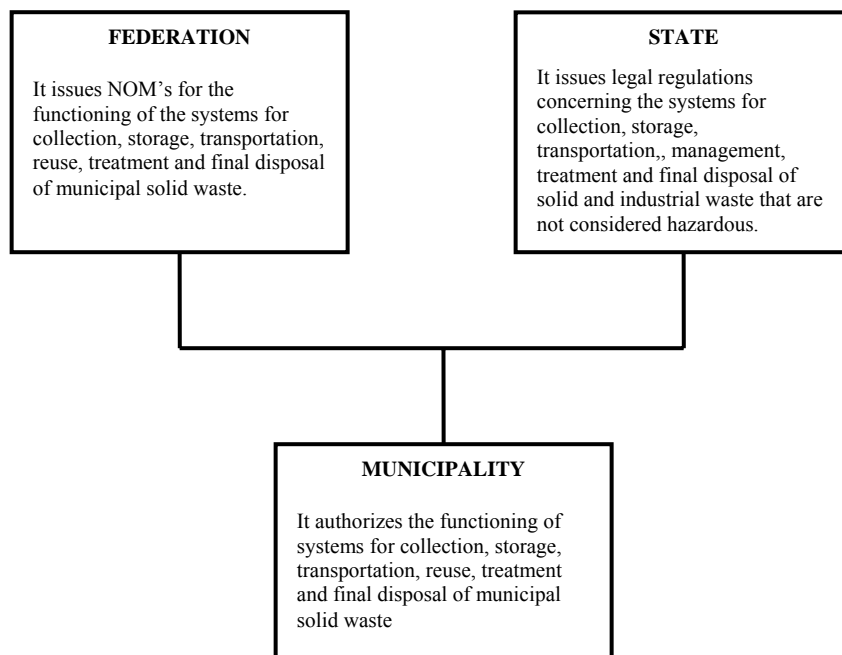


Figure 10. Attributions regarding the services for solid waste collection, storage, transportation, reuse, recycling, treatment and final disposal.

Source: INE, 1999. *Minimización y Manejo Ambiental de residuos sólidos*. SEMARNAP, Mexico. (Solid Waste Minimization and Environmental Management).

Currently, most of the medium sized municipalities have regulations to establish the commitments as to who offers and who receives the service. Generally, the chapters related to general dispositions, obligations of the users and service providers, sanctions, fines, disagreement appeals, organization and duties of the urban cleaning system (UCS), and operation aspects, are met to a high degree. However, aspects related to the attention to users, payment for the service, inspection and vigilance, tax incentives, solid waste generation and items related to pollution prevention show significant gaps.

It was only till October 8th, 2003 that the General Law for Waste Prevention and Waste Integral Management (*Ley General para la Prevención y Manejo Integral de Residuos*) was published in the Official Federal Bulletin (*Diario Oficial de la Federación*) filling in many of the regulation gaps mentioned before regarding solid waste management.

This Law considers waste from a double perspective: 1) as a potential contaminant that must be avoided, reduced and managed in an environmentally adequate manner, and 2) as material endowed with a value, that can be employed through reuse, recycling or recovery of the energy contained in it—as long as this is done in an environmentally adequate manner. This leads as a consequence, to

the establishment of sustainable mechanisms to regulate and control waste within the Law (Cortinas de Nava, 2003).

The General Law for Waste Prevention and Waste Integral Management (*Ley General para la Prevención y Gestión Integral de Residuos*) acknowledges the existence of the informal sector that takes part in the gathering and separation of potentially recyclable waste, which has already been discussed earlier in this chapter. The formal incorporation of this sector is suggested to be carried out in a gradual and flexible manner, in accordance with the needs and possibilities of each location.

Concerning municipal solid waste management, as a public service, the competent authorities are the states and municipalities. The LGEEPA acknowledges the legal authority of both states and municipalities to regulate and provide public cleaning service, (urban cleaning). The LEGEEPA also empowers the Federal Government to issue Mexican Official Standards on the various elements that organize the public cleaning service.

The above indicates that the Federal Legislative Power considered it convenient that, in addition to the intervention of local authorities provided for in the Constitution, the Federal Government should also take part when it comes to protecting the environment, through the possibility of issuing mandatory technical regulations –called Mexican Official Standards- referring to integral solid waste management, which are to be observed in addition to those issued by the local authorities. Up to date, only one Mexican Official Standard (NOM-083-ECOL-1996) has been issued. It establishes the conditions that must be met by the sites destined for municipal solid waste final disposal. The one concerning the design, construction and operation of landfills is currently being developed. Besides, there are Mexican Standards which are concerned with the determination of generation and composition of municipal solid wastes and with the determination of different components in the laboratory.

At the light of the new General Law for Waste Prevention and Waste Integral Management, new official regulations will have to be issued in order to regulate and enforce the new resolutions concerning municipal solid waste prevention, generation, management and disposal.

3.1.6 Importance of community participation

It has been proven all over the world, that community participation plays an important and decisive role in the performance of recycling programs. One of the main drivers for the success of integral solid waste management is to involve the public in all the phases, from diagnosis to planning and actions. This will ensure that the decisions made aren't alien to the community that is directly concerned (Green Nature, 2003; McKenzie-Mohr & Smith, 1999). Environmental education actions

must be considered within the program. The diagnosis stage is useful in defining the methodologies and educational messages that will contribute to solve the priorities of the municipality and of the shaping of an educational strategy. In order to do this, prior experiences must be gathered and evaluated and the progress achieved in connection with the work carried out by the community regarding MSW management, must be known (SEMARNAT, 2001; DWM, 2001).

According to INE (1999) there are several aspects that affect the decision of communities to participate in waste recycling programs. The following stand out:

1. Final disposal costs in landfills are low and enough space is available to build new landfills.
2. Involving thousands (or millions) of citizens in the communities, restructuring the conventional administrative management practices and the final disposal of solid waste, is a process that takes several years and also requires substantial investment.
3. Commercial and institutional solid waste must be incorporated into the community recycling programs through private mechanisms other than those used for public services.
4. The amounts of recyclables generated may not be financially attractive to recycling companies.
5. It is necessary to promote an accelerated growth of permanent markets to commercialize recyclable wastes.
6. Policies and technical standards are needed to the establishment of municipal regulations and programs concerning municipal solid waste recycling, including promotion and development of markets for the sub products.

The proposals described above allow defining the factors that must be solved if the community recycling programs are expected to achieve a significant impact within the integral municipal solid waste management; none of them presents an insurmountable obstacle quite the contrary, once identified they become areas of opportunity that can be used very efficiently.

As a mechanism to get in contact with the community and involve local people in generating waste management solutions the SEMARNAT created a network called Mexican Network for Environmental Management of Waste (REMEXMAR). This network includes representatives from different sectors of society: academia, the industrial sector, NGO's and the private and public sectors related with waste management. Each state has a local network. Since 1999 the state of Baja

California also has a representative in this network who is a faculty member of the University of Baja California (Ramos, personal comment, 2001). Among other objectives the aim of each local network is to create programs to link all sectors in society and in this way establish an integral solid waste management. In spite of this, to date there is not a local program with these characteristics promoted by REMEXMAR in Baja California. Neither has a proposal been formulated to involve UABC in the discussion for the actions that must be taken for the state integral solid waste management, although this could be a great opportunity for both parties (UABC and REMEXMAR) in trying to find waste management solutions.

Summing up, appropriate waste management is a complex problem because it requires the participation of many different sectors. It also requires the financial backing to try new and different ways of dealing with waste. For many years developed countries have successfully put into practice integral waste management plans. Said plans include different alternatives for waste management such as composting and incineration but after reduction measures have taken place.

In spite of the different options that are being developed and used in industrialized countries for managing waste, developing countries such as Mexico, are lagging behind. Waste handling, treatment and disposal alternatives like recycling, composting, and incineration have not been successful in Mexico or their implementation have been very limited. This is in part due to the lack of knowledge and financial resources to promote these waste handling and treatment alternatives but also this is due to the lack of policies that support them. What makes the problem even bigger is the scarce public participation and involvement in proposing alternatives for solving problems derived from waste. This could be caused in part, because historically the whole responsibility for waste management has resided on the government.

For Mexico to solve its waste problems alternative solutions must be sought. In addition to solving of the present day problems Mexico should also pay attention to waste reduction and waste avoiding alternatives to waste generation. This way the problem generated by waste would be less. Concomitantly the problems derived from the lack of capacity for waste collection, treatment and disposal would also decrease.

With the new policies for waste management in Mexico it seems that in a near future it will be possible to have real waste management plan in every municipality. However, this will take time and it also will require a pro-active attitude from all the sectors involved. Within the sectors involved, the higher education sector plays a key role.

In the next part of this chapter a description of the recent trends towards sustainability in higher education internationally and in Mexico will be made. Special attention will be paid to the environmental program in universities and in particular to waste management programs in higher education institutions.

3.2 Sustainability trends in the higher education system

Other elements of the external environment of universities that have been impacting the way these institutions behave are the sustainability trends. For nearly three decades it's been recognized that education is the key to addressing environment and development issues, and more recently to achieving a more sustainable society (Sterling, 2001). On the other hand, several authors agree in that more education is not the answer to achieving that goal; fundamentally a changed educational paradigm is needed (Leal-Filho, 2002; Shriberg, 2002c; Sterling, 2001; Creighton, 1998; Bowers, 1997; Orr, 1994). A change of educational culture which both develops and embodies the theory and practice of sustainability is indispensable. This type of education requires breaking free of old pedagogical assumptions of the discipline-centric curriculum and even of confinement in classrooms and school buildings (Orr, 1991). Education for sustainability means changing (a) the substance and process of education contained in curriculum, (b) how educational institutions work, (c) the architecture within which education occurs, and most important, (d) the purposes of learning (Orr, 1991).

The requirements of education for sustainability have been acknowledged world-wide. Nowadays there are different guidelines both at a national level and at international level that invite colleges and universities to implement strategies for sustainable development. These strategies must be present in the curricula of the different programs, in the research and outreach activities and in the operation of their campuses.

This part of the chapter concentrates on the main international sustainability trends in higher education. Included are the actions taken so far by the Mexican higher education system in response to these trends.

3.2.1 International trend

For many years now, it has become evident that higher education participates in a more decisive way in the search of developing schemes that consider social, economic and environmental aspects. The will to confront this need has been included in different declarations. In these declarations the

agreement of acting in accordance to sustainable development, has been signed off by the representatives of higher education institutions.

One of said declarations, among others that will be mentioned later, is the one adopted by the United Nations 2005 to 2014 known as the “decade of education for sustainable development”. The United Nations General Assembly resolution designated UNESCO as the lead agency for the promotion of the Decade and requested the Organization to develop a draft international implementation scheme (UNESCO, 2004). The objectives of the decade are to:

1. give an enhanced profile to the central role of education and learning in the common pursuit of sustainable development;
2. facilitate links and networking, exchange and interaction among stakeholders in ESD;
3. provide a space and opportunity for refining and promoting the vision of, and transition to sustainable development – through all forms of learning and public awareness;
4. foster increased quality of teaching and learning in education for sustainable development; and
5. develop strategies at every level to strengthen capacity in ESD.

Thus, it is to be expected that a series of actions and implementation plans will be proposed by UNESCO and that there will be more declarations and activities related with education for sustainable development relevant for different regions and contexts.

To date, there are nine main declarations related to sustainability and education, signed by the representatives of diverse countries. In Table 8 is the chronology of the main declarations about sustainability and education.

These declarations will not be discussed in this chapter since they have been discussed elsewhere, see for instance Wright (2002). In short, these declarations invite the signatories to implement practices for a more sustainable research, teaching, operation and out-reach within their universities and colleges.

Most of the declarations mentioned above have an international scope; while others have a regional scope like CRE-Copernicus signed by 23 European countries, or national scope, like the “Universities of Australia Sustainable Development Charter” promoted by the National Union of Students Sustainable Development Campaign (Bekessy, *et al.*, 2001). In either case, some authors (Shriberg, 2002b; Wals & Jickling, 2002; Wright, 2002) mention that the signing of these declarations does not necessarily lead to action for sustainability among the signing universities.

Table 8. Chronology of some declarations related to sustainability in higher education.

Year	Declaration
1972	<i>The Stockholm Declaration on the Human Environment</i> (UNESCO)
1977	<i>Tbilisi Declaration</i> (UNESCO-UNEP)
1990	<i>The Talloires Declaration</i> (UNESCO)
1991	<i>The Halifax Declaration</i>
1992	<i>Report of the United Nations Conference on Environment and Development – Chapter 36: Promoting Education, Public Awareness and training</i> (UNESCO)
1993	<i>The Kyoto Declaration</i> (International Association of Universities)
1993	<i>The Swansea Declaration</i> (UNESCO)
1994	<i>CRE- Copernicus Charter</i> (CRE – Copernicus)
1997	<i>Declaration of Thessaloniki</i> . International Conference on Environment and Society – Education and Public (UNESCO)
2000	<i>The Earth Charter</i> (Earth Council – IAU)
2001	<i>The Lüneburg Declaration</i> (Copernicus-IAU-ULSF and UNESCO)
2002	<i>The Unbutu Declaration</i> (UNU-UNESCO-IAU and others)

Not all sustainability efforts in higher education institutions are guided or driven by specific declarations. This is the case of the “learning for a sustainable environment project”. The purpose of this project was to expand the range of innovative practices used in teacher education programs in the Asia-Pacific region. This was done by introducing educators to the curriculum planning skills and teaching methodologies of environmental education. This project illustrates how educational change towards environmental sustainability in higher education may be fostered at a regional level through the professional development of teacher educators (Fien, Kumar and Ravindranath, 2001). Another example comes from the UK, according to Sterling (2001) there were then funded pilot projects that were beginning to address sustainability issues, both in higher and further education; for example the Higher Education Partnership. In accordance with this line of initiatives an interesting one is the “German Network for Environmentally Sound Development of Universities”. This network was established in 1999 by several German universities in order to actively support a sustainable development of universities, focusing on environmental subjects (Viebahn, 2002). Although its initial activities focused on communication, information and further education at present the network has gone beyond. Now the network has 188 members and has become very

active in organizing environmental training, workshops, seminars and conferences for promoting sustainability in higher education (Eco-Campus, 2006).

Throughout the world, just like the examples above, there are numerous institutions of higher education pursuing environmental sustainability. The content of these endeavors however, vary tremendously. Some institutions' representatives believe that they have met the challenge of sustainability through the signing of national or international declarations. Others create individual institutional policies.

According to Schriberg (2002c) a necessary condition for identification as a sustainable university is explicit recognition of the institution's central role in the degradation or support of the ecological, cultural and economic fiber of our planet and our species. A sustainable institution explicitly acknowledges its contribution to unsustainability and sustainability, through official statements, audits or other media, to "clear the path" and set baseline for a more sustainable future.

An example of the above mentioned is the University of Florida (UF) which reports its sustainability performance in accordance to Global Reporting Initiative (Newport and Chesnes, 2001). These reporting efforts of the University of Florida are rather exceptional, in fact, according to the information on the web page of the Global Reporting Initiative, UF is the only university that is doing this kind of reporting (GRI, 2002). This university is one of the leading institutions that have included sustainability aspects in all of its dimensions (UF Sustainability Task Force, 2002) and is also one of the signatories of Talloires Declaration.

In spite of the different assessment tools for sustainability in higher education there exists little evidence that documents how well universities are advancing in their efforts for sustainability. Except for UF none of them is systematically reporting about the three fundamental aspects of sustainability: social, natural environment and economy (Elkinton, 1998). This situation might also arise from the fact that several different tools are being used to assess sustainability in higher education and each of these tools focuses in a portion of the sustainability task. Shriberg (2002b) for example reported the review of eleven of these tools. He concluded that campus sustainability tools vary greatly in purpose, scope, function and state of development. However these tools provide a foundation for strategic planning by identifying important issues as well as methods to set and achieve prioritized sustainability goals (Shriberg, 2002b).

The many different initiatives to incorporate sustainability in the diverse activities of the higher education sector are encouraging signs of change in several countries and in regions. This trend

continues to grow and each day the number of experiences in this field grows as well. For this reason now, more than ever, it is important to look at these experiences and learn from them.

3.2.2. Different focuses of sustainability initiatives in higher education

Various initiatives for the advancement of sustainability in higher education had made emphasis on particular aspects of the sustainability endeavor. Some have put emphasis on the operations side of the campus while others had paid more attention to the research and curricular aspects. For example John Fien (2002) states that the one of the major impacts of higher education on the advancement towards sustainability is through its research. He mentions that higher education has an essential role in advancing the pillars of sustainability such as democracy and social justice and that all research paradigms can support institutions in fulfilling this role. Fien (2002) also mentions that higher educational strategies for advancing sustainability need to be developed by individual systems and institutions so that they remain locally relevant and culturally appropriate. In this respect, different institutions have had different approaches and experiences.

Another example is given by the University of Catalonia in Barcelona (UCB), Spain. The UCB set an environmental plan which put special attention to the aspects of curriculum greening and environmental research (Capdevilla, Bruno and Jofre, 2001). The measures set up at UCB succeeded in raising awareness among the university community; however, they have not brought about any large-scale changes in the teaching or research being carried out but strategies to improve this situation are already in place (Capdevilla, Bruno and Jofre, 2001). Another example of a university that focused its sustainability efforts on teaching and research is given by the University of Costa Rica. In this case the University joined the national efforts towards sustainability and created a program called PRINSOPAZ, which developed an environmental dimension for teaching, research and social action with special attention to teaching strategies (Mata-Sagreda, 2002).

Some environmental initiatives at universities arise as a result of the recognition from top management of the importance that graduates from universities must be environmentally literate. This was the case of Tufts University. Creighton and Cortese (1992) reported that in 1990 Tufts president announced a goal that all students graduating from Tufts must be environmentally literate. As a result the Tufts Environmental Literacy Institute (TELI) was created with the aim of providing educators from a wide range of disciplines with tools to incorporate environmental issues into existing and new courses, and, ultimately to provide students with a foundation for evaluating difficult environmental issues in the context of their professions and their lives.

Other higher education institutions have focused on the environmental part of the sustainability challenge. This is because the environmental pollution caused by universities in the form of energy, material consumption, air emissions, and solid waste could be considerably reduced by an effective choice of organizational and technical measures. This way these institutions seek to operate in cleanest way possible thus decreasing their environmental impacts and avoiding wasteful practices.

Several universities internationally have environmental programs. Some of these programs focus mainly in one specific area for example in energy or water saving strategies, while other programs are more comprehensive and try to implement environmental initiatives in different areas at the same time. An example of the former is the University of Rochester which, since the 1973 oil crisis, has implemented a number of energy conservation programs (Pierce, 1992). An example of the latter approach is given by Harvard University through its Harvard Green Campus Initiative (HGCI). To improve its environmental performance the HGCI launched a number of projects such as the Higher Performance Building Initiative, the Harvard alternative fuel vehicle program, the greenhouse gas inventory, the energy-star and environmental procurement program, among others (Sharp, 2002). Tufts University has also an environmental program called Tufts CLEAN which goal is to create a set of model for pollution prevention that will lead to a reduction of the adverse local, and global environmental impacts of Tuft's own activities (Creighton and Cortese, 1992). Other example of a comprehensive program is the University of Kansas in Lawrence, USA. This university created the environmental ombudsman office which has been involved in a diverse range of projects such as the formulation of an ozone depletion policy, increased recycled fiber content of the toilet paper purchased for the campus, solvent recycling, increase energy efficiency of lighting, etc (Hamburg & Ask, 1992).

Still other types of environmental initiatives are lead by students. For example at Oklahoma Baptist University, in Shawnee, USA, students used an environmental audit to expand their efforts beyond a recycling program by establishing an appointed position on the students' council for a campus environmental commissioner. The commissioner was responsible for creating an annual task force on the campus environment to review possible avenues for change. As a result of these activities the university attracted matching funds from the U.S. Department of Energy for designing and implementing campus energy efficiency programs (Smith & Gottlieb, 1992). Another environmental initiative led by students is the Campus Environmental Stewardship at the University of Wisconsin, Madison (UW). The initiative utilized existing courses, specifically those requiring individual or group projects. Faculty invited students to focus their projects on questions related to campus natural history or to environmental issues (Eagan, 1992).

There have been more comprehensive approaches to environmental performance in higher education. Some of these are based on the strategies used by industries for improving the organization's environmental performance –the environmental management systems approach. One of these is the environmental management model for universities at the University of Osnabrück in Germany reported by Peter Viebahn (2002). This model includes ten building blocks which help to carry out the steps for constructing an environmental management system (EMS) for a university. The building blocks are quite comprehensive, going from analyzing the organizational structure, constructing environmental guidelines, considering external environmental regulations, environmental auditing, to setting of and measuring environmental goals (Viebahn, 2002). A similar approach was used for a multiple-university consortium. The consortium was formed by three universities of South Carolina in the USA, which supported on the EMS approach to coordinate and integrate their activities (Barnes & Jerman, 2002).

3.2.3 Waste management at universities

With thousands of students, faculty and staff on universities the amounts of waste generated in these institutions are huge. For this reason waste management programs in universities are among the most common type of environmental initiatives. Recycling is becoming a way of life for most universities in developed countries. Rising disposal costs, shrinking landfill space, concerns about incineration, and legislative mandates have led campuses to separate their trash for recycling (Watson, 1990).

Some of the waste management programs have begun as result of waste audits carried out in most of the cases by students. In fact, the majority of the reported cases where recycling practices were implemented were the result of students' initiatives campuses. For example in a study reported by Ching and Gogan (1992) they found that seven out of the ten recycling programs analyzed were initiated and maintained by students. After eight to ten years of their implementation these efforts were finally institutionalized. Other waste management programs in universities have been implemented as a result of a more comprehensive environmental program, like the ones mentioned previously in this chapter. In either case waste management programs at universities have been present for more than thirty years.

In order to adequately plan the activities for a waste management program it is important to know what materials show up in the campus waste stream, from which buildings, and at what point of the academic year. For this purpose waste audits were created (Ching & Gogan, 1992). According to Hull and Associates (1999) waste audits is the best initial step towards the implementation of an

integral waste management program in a university. This statement is based on several reasons such as the following.

Waste audits help participants to:

- develop university profiles and guidelines for managing waste,
- judge the feasibility and requirements to begin their own programs,
- estimate the potential types and quantities of recyclable materials that may be collected;
- evaluate their own programs, identifying both strengths and areas needing improvement,
- compare their level of administrative support for recycling and waste reduction with that of other universities;
- identify potential funding sources for enhanced university recycling programs; and,
- identify additional opportunities for the collection of recyclable materials.

In spite of the benefits of waste audits, many waste management programs at universities are launched without this type of previous analysis. In other cases, in spite of the audits that have taken place, the amounts of recovered material for recycling are not as high as initially expected.

Regardless in most universities the percentages of recovered material for recycling goes from 1% to 45% of the total amount of waste produced. Above 45% a program would be considered exceptional or very successful such as the one from Santa Clara University (SCU), California (USA). Clugston & Calder (1999) reported that SCU's recycling program compares with the best programs in the USA in approaching up to a 50 percent of recycled solid waste. However the average recycling rate is around 30 percent. This is indicative of the commitment to reducing waste disposal and increasing recycling and recycling awareness currently on university campuses. In a waste characterization study conducted by Hull and Associates (1999) in 19 university campuses at Ohio (USA) it was found that the average recycling rate was 35.5 percent. Of the 19 campus buildings audited in that study, 14 of them had a solid waste stream which contained at least 40 percent of readily recyclable materials. One buildings' waste stream actually consisted of 80 percent recyclable material. This indicates that the volume of recycling collections in those buildings could increase substantially through a variety of approaches: increased efforts applied toward education programs, increased access to recycling containers, or modification or enhancement of current practices.

The composition of the wastes generated at higher education institutions may vary from institution to institution. According to Ching & Gogan (1992) most residential campuses produce 10 to 20

percent high-grade office paper, 10 percent newspaper, 20 to 30 percent leaves and yard waste, 15 to 25 percent food and dining service waste, and 10 percent used beverage containers) these percentages exclude hazardous wastes, construction and demolition debris). It is to be noted that these are average percentages correspond to campuses in the USA. Different composition results could be obtained when analyzing wastes from campuses at other parts of the world. For example in a waste study conducted at kitchens and concourse areas at Massey University, New Zealand, it was found that the recycle potential of these areas was 88 and 84 percent respectively (Mason, Oberender and Brooking, 2004).

The above numbers give a clear idea of the recycling potential that is present in the wastes generated at higher education institutions. It is also possible that different results could be obtained when using different characterization techniques, different buildings², sampled in a campus or the season of the year when the characterization study took place.

The goal of establishing an effective waste management program is challenging but achievable (Ching and Gogan, 1992). Different unexpected problems arise during the launching, information campaign, collection of the recyclables or any other phase of the waste management programs. Among the most common challenges for the people in charge of waste management programs at universities are the following:

- Changing people's mindset from a trash disposal mentality to a recycling mentality.
- Increase education, awareness and participation.
- Keeping people informed.
- Low pay for student workers which leads to high turnover of students
- Low pay for management
- Obtain more space for the waste program
- Funding
- Contamination of the recyclables by solid waste

Some of these challenges are related to the difficulties to embrace innovations, which are obvious barriers. In the next paragraphs the major barriers to change towards a green campus will be described.

² Each section of the campus, perhaps each building, yields a different waste profile depending on its function.

3.2.4 Major barriers to change

In responding to sustainability, higher education has been one of the slowest sectors to take up the challenge (Sterling, 2001). Different explanations for this slow response to the sustainability challenge can be offered. According to Sharp (2002) universities are multi-structured, complex organizations that exist without any single observation point or any single control center from which university wide changes can be programmed and implemented (Sharp, 2002). For this reason it is obvious that multiple problems can arise at different parts of the university when an innovation is implemented. This is the case for environmental sustainability initiatives. The problem lies in the newness of the sustainability agenda (Sterling, 2001) and the need for a fundamental change in thinking (Corless and Ward, 1992). For Sterling (2001) the interdisciplinary and transdisciplinary nature of the area, the need for learner-centered approaches, “green management” and organizational learning, all pose a challenge for established norms.

Besides the above mentioned barriers, other various elements have been reported as such to successfully implement sustainability initiatives in higher education. Below the most recurrent barriers reported are described.

Time: Time has been identified as one of the problems for engaging in sustainability efforts. People involved in sustainability initiatives often indicate that they often use their own time to participate in the various activities being promoted (Fien, Kumar and Ravindranath, 2001).

Lack of funding: Different authors have reported that funding is another problem that faces sustainability initiatives in higher education institutions (Shriberg, 2002b; Dahle & Neumeyer, 2001; Fien, Kumar and Ravindranath, 2001; Allen, 1999; Bowers, 1997).

Competing priorities: Generally speaking the environmental trend in higher education is relatively recent. For this reason when advocates manage to get the environmental imperative on the agenda of university decision makers it is often seen as a late arriving competing priority (Dahle & Neumeyer, 2001; Fien, Kumar and Ravindranath, 2001; Shriberg, 2002c; Bowers, 1997; Corless & Ward, 1992).

Lack of environmental policies: The lack of environmental policies has been reported as a barrier to environmental programs in universities. This is the case because policies help to create an institutional support system for the initiatives which in the majority of the cases require the participation from different departments within universities (Corless & Ward, 1992). When policies are absent or are developed without broad input, efforts are likely to be uncoordinated, and the

result will be unfocused and short-lived (Allen, 1999; Bowers, 1997; Creighton, 1998). The presence of policies helps to foster the continuous administrative support and commitment.

Lack of an institutionalized leader dedicated to coordinate environmental issues: The lack of coordination hampers the communication between the different stakeholders which results in friction, unnecessary duplication of work and bad relations (Viebahn, 2002; Shriberg, 2002c; Allen, 1999; Ching & Gogan, 1992). A central position in the university management is required to coordinate actions and carry out environmental planning (Viebahn, 2002).

Lack of incentives for people who participate in environmental initiatives (Allen, 1999): A reward system should differentiate between high- and low-sustainability performers. If no one or everyone gets rewards, there will be little incentive to excel. When those who shine are rewarded, people can see the benefits of exemplary effort (Doppelt, 2003).

Lack of clear performance measures for environmental activities: The control instruments required to measure the environmental performance in higher education are often lacking. The performance measures are needed to evaluate the overall performance of environmental initiatives (Shriberg, 2002; Viebahn, 2002).

Distance between people in charge of environmental projects and core functions: The operations managers (frequently administrative staff) who are responsible for minimizing the university's environmental damage are not close to the core functions of the organization (research, teaching) (Barnes & Jerman, 2002). For this reason it is difficult for them to realize what processes generated environmental problems and how to deal with them. This problem is also explained by Sharp (2002). This author states that the most significant organizational trait that limits faculty engagement in pursuing campus environmental sustainability is the fact that historically, the demands of academic life resulted in the structural removal of faculty from managing the operation of the campus. This structure has served to imbed the assumption, amongst the faculty, that focusing on the campus is a distraction from the core mission of teaching and research.

Turnover: Turnover seems to be a more significant problem at a university than in industry when implementing environmental programs. Barnes & Jerman (2002) reported that one of the universities in an environmental consortium lost its strong environmental focus when a provost moved on; another suffered when a key staff member took another job. Students are generally in residence for about four years, thus limiting their ability to serve as a "conscience" for the university.

There are other elements that were not mentioned as barriers but as important elements to consider when implementing an environmental initiative in higher education institutions. One of these elements is that any environmental change must be systems based (Doppelt, 2003; Shriberg, 2002a; Hamburg & Ask, 1992). A systems perspective considers all interactions of the component parts. Without a reasonably complete analysis of the potential impact and consequences of a proposed action on the university community and beyond, it is impossible to know whether an action is positive or negative, that is, advised or ill-advised (Hamburg & Ask, 1992).

The environmental imperative requires a rapid and wide-reaching response from the university sector far beyond the kind of respond we have seen to date (Sharp, 2002). The barriers to change towards environmental initiatives in campus can be overcome. For this to happen it would be advisable to learn from the reported cases of environmental initiatives in different universities and how they have overcome those barriers.

3.2.5 How to overcome the barriers

Different experiences of environmental initiatives at universities have been reported. Some of these give advice about how to overcome the barriers encountered during the implementation of these initiatives.

According to Sharp (2002) any effort to bring about wide-scale participation must be responsive to the existence of three predominant subcultures that exist within universities –faculty, administration and students organizational cultures. In words of Sharp (2002) “these subcultures are the product of different group histories associated with decision-making practices, time constraints, priorities, opportunities, threats and experiences that each group has had within the university.... evidence suggests that the greatest leverage in achieving institutional change occurs when all three subcultures or groups have a shared vision and a sense of organizational alignment in their respective actions”. According to this, Sharp (2002) suggests different approaches to each subculture so they can effectively increase their impact in generating an institutional commitment to environmental sustainability. Other authors such as Creighton (1998), Ching & Gogan (1992) and Keniry (1995) recognize that different strategies must be followed to enroll each group, although these authors didn’t call them subcultures. The lesson for environmental advocates is to carefully assess potential reasons for support or resistance to environmental initiatives before approaching individual groups or stakeholders (Shriberg, 2002c).

The most common reasons to include all subcultures in campus environmental initiatives are:

Students: Students have high potential power to catalyze and drive organizational transformation. Students for many years have been organizing to address the issue of environmental performance in campus. An example is given by the University of California, Los Angeles, where student involvement and pressure were the primary forces behind the high level of campus commitment for recycling (Keniry, 1995).

Faculty: Many faculty members are actively expanding the environmental content in teaching and research (Sharp, 2002). When woven into the curriculum, environmental responsibility becomes part of the fabric of academic life (Keniry, 1995; Eagan, 1992). By involving students in research, administration and staff not only educate but also foster collaboration in place of divisiveness.

Administrative staff: Due to their consistency, relationship building and access to organizational information, administrative staff is able to significantly influence decisions, through the establishment of informal channels of influence and the provision of information (Sharp, 2002; Eagan, 1992).

Numerous suggestions have been proposed for expanding participation, commitment and success in environmental initiatives within universities. Next some of the most mentioned elements that should be present in environmental initiatives are described:

Top management support: In many of the most successful stewardship initiatives, executive staff play crucial role (Boulder Environmental Center, 2001; Allen, 1999; Keniry, 1995). Presidents, vice presidents, chancellors, vice-chancellors and trustees have helped make possible a broad range of initiatives on campuses, including the development of environmental policy; the establishment of a committee or other structure to encourage environmental accountability and innovation; the development of new specifications for purchasing, investment, and research; and the incorporation of environmental criteria into plans for new buildings and infrastructure (Keniry, 1995).

Environmental policy statement: A policy statement is a public declaration of university commitment to environmental protection and serves as a framework for decision making and goals (Creighton, 1998). When it is supported by senior administrators, written environmental policy can help ensure that commitment to the environment survives among competing priorities, limited funds, and perpetual turnover in campus leadership (Keniry, 1995).

Environmental committees: Many people in a university have environmental responsibilities yet may not fully understand these obligations or see how they are related to their jobs or to others at the university. A university-wide committee can help institutionalize environmental initiatives and

bring stakeholders to the table. The committee membership should reflect the university community (students, faculty, staff, and administrators (Creighton, 1998).

Resources and rewards must be at hand: The provision of resources and incentives, both for launching new programs and to increase participation in existing ones, has helped ensure the success of many campuses stewardship initiatives. Rewards are helpful for motivating change (Creighton, 1998). Well placed publicity can help motivate and reward individual action.

Data for measuring progress: By measuring their success program coordinators can give participants campus-wide a sense of efficacy and accomplishment.

Pilot programs: Pilot programs are very useful when implementing an innovation. Pilot programs to test the effectiveness of a program, new piece of equipment, policy, or other changes on a small scale can be invaluable for identifying unforeseen problems and working them out before a program is instituted university-wide (Creighton, 1998; Corless & Ward, 1992).

Program coordinator: Environmental advocates need to create organizational changes that become integral to the campus, such as creating an environmental coordinator position (Shriberg, 2002). Although the actual work of environmental programs is carried out by students, faculty and staff in their respective areas, it is always helpful to have someone coordinate all the initiatives, keep track of environmental activities and information, and develop a comprehensive understanding of the place (Eagan, 1992). It is advisable that the environment coordinator have both academic and operational responsibilities –rare in most universities- to articulate the commitment needed, influence the financial and personnel resources, promote efforts, and assist where needed. The coordinator can serve as a catalyst for action and provide assistance to others throughout the university who are taking action (Creighton, 1998).

Mission: Another important element to consider is the institutional mission. If the environment becomes integral part of the educational mission it is likely that the process of paying attention to the university environment will have the greatest impact (Eagan, 1992).

3.2.6 The context of sustainability in Mexican Higher Education

Compared to developed countries, the reporting about sustainability efforts in Mexican higher education institutions is lesser. One reason for this lagging behind is that sustainability efforts started much later than in developed countries. Another reason is that these kinds of efforts are not

considered by top administration people as valuable as other more traditional academic initiatives. Therefore, little importance is given to them to invest time and resources on its reporting. The third reason is that these efforts are being carried out within Mexican universities in an isolated way. It is often a personal or a group initiative of academics or students. These efforts are not part of a formal institutional program. Due to this lack of formality no need exist for reporting these efforts and their results.

3.2.7 National efforts towards sustainability

Despite the fact that the reported environmental experiences in Mexican universities are scarce, very well documented initiatives exist. In Mexico, from the late 1980's and through the 1990's a significant increase of experiences took place for the inclusion of the environmental perspective in teaching, research and outreach (Nieto-Caraveo & Súcar, 2004). These experiences were documented by several authors such as González (1993), Medellín-Millás & Nieto-Caraveo (1999), Bravo & Sánchez (2000), and Nieto-Caraveo (2002).

The growth on environmental initiatives evidenced the need to have coordination mechanisms to institutionalize the initiatives (Nieto-Caraveo & Súcar, 2004). This is when the National Association of Universities and Higher Education Institutions in Mexico (ANUIES), recognized that universities are called to be an active factor in the promotion of desirable changes because they have a key role to play in the construction of a society with more justice and equity; more decentralized and equalized; more open to the world and at the same time more active in the satisfaction of the needs of their inhabitants (ANUIES, 2000). Even though, there was not a national plan or strategy for coping with this challenge in the Mexican higher education system.

One strategy to face the challenge of sustainable development in higher education in Mexico was the creation of a consortium of universities. It was in December 2000 that the CECADESU and ANUIES created the COMPLEXUS which is the Mexican Consortium of Universities' Environmental Programs for Sustainable Development. CECADESU is the Center of Education and Training for Sustainable Development dependent on the Mexican Environmental Agency (SEMARNAT). The mission of COMPLEXUS is 'to stimulate the improvement of the quality of academia processes in environmental issues and sustainable development through the development and collaboration of programs and environmental agencies with institutional goals set by each institution'. The objectives of COMPLEXUS are:

- Achieve the improvement of academic work on environmental issues and sustainability in higher education institutions.

- To promote among its participants, the establishment of programs that propitiate the development of knowledge, attitudes, skills, and values needed for sustainable development, for students and community to become the direct beneficiaries of a formative high quality process.
- To promote the incorporation of the environmental dimension into all curricula.
- Strengthening of teacher training and updating programs on environmental education and sustainable development.
- Set the ground for diffusion of information on sustainable development among the institutions that belong to COMPLEXUS, by enhancing the means of on-going communication for improved sharing of knowledge and experiences.
- To promote the creation of environmental programs within higher education institutions.
- To promote the creation of environmental management systems within higher education institutions.
- To find external funds for the development of the specific inter-institutional projects.
- To promote the integration into COMPLEXUS of more higher education institutions that has institutional environmental programs.
- To promote the participation of higher education institutions in the activities that organizes COMPLEXUS.
- To establish collaborative relationships with other organizations that seeks the same kind of purposes (Complexus, 2002).

COMPLEXUS was a good first approach to try to include sustainability in Mexican Higher Education System but a national plan was still lacking. It is until year 2002 that ANUIES along with the Mexican Environmental Agency (SEMARNAT) published the **Action Plan for Sustainable Development in Higher Education Institutions** (*Plan de Acción para el Desarrollo Sustentable en las Instituciones de Educación Superior*). In this document it is recognized that higher education is one of the fundamental columns of human rights, democracy, sustainable development and peace. It is also recognized that there is a need for means to assure the coordination and cooperation among the different sectors and within them (ANUIES-SEMARNAT, 2002) as it was recognized by UNESCO in *Higher Education in the Twenty-first Century: Vision and Action* (UNESCO, 1998). The *Action Plan* is the document that directly invites Mexican higher education institutions to take

an active position in favor of sustainable development and specifically defines the dimensions that should be addressed: teaching, research, out-reach, operation of infrastructure and information dissemination. The vision of the action plan for the year 2020 is based on the premise that none of the knowledge arenas are out of the environmental problems and that these are in a close linkage to social and economic problems and the equal distribution of resources.

The **Action Plan for Sustainable Development in Higher Education Institutions** highlights that the actions that have to be initiated in institutions of higher education must be stronger and that this can be achieved through a plan that articulates the different efforts, searching for synergistic effects and is designed to bring about more and broader effects. The action plan also has the purpose to promote the participation in the analysis, searching for solutions, prevention of environmental problems and the construction of future scenarios for development and environmental status for strategic actions of research, teaching, out-reach and information dissemination (ANUIES – SEMARNAT, 2002). In this document the general policies are defined as well as the working mechanisms for sustainability in higher education institutions highlighting the need of promotion and consolidation of institutional environmental management systems.

Two other actions to foster sustainable development in Mexican Higher Education Institution are the *Hermosillo Declaration* and the *Declaration on Education and Sustainable Development*, both made in Mexico. The *Hermosillo Declaration* was signed on January 2002. The main emphasis of this declaration is on the concepts of sustainable development, pollution prevention and cleaner production in higher education. In this declaration the proposed lines of action are: a) consortiums and associations among universities for the development and sharing of educational resources, tools and information; b) networks to assure an effective follow-up and future communication; c) communication about the initiatives of sustainable development, cleaner production and pollution prevention in universities; d) environmental management systems for the dissemination of the environmental performance of the campuses; e) implementation of the chapters 35, 36 and 37 of Agenda 21, these three chapters cover the “science of sustainability”, “education and training for sustainability” and “capacity building for sustainability” (*Hermosillo Declaration*, 2002).

The *Declaration on Education and Sustainable Development* was signed on May, 2002. The most relevant aspects of this declaration are the following: a) the recognition that education for sustainable development should be present at all levels of education; b) that education for sustainable development is a key element for the reduction of social inequities; and c) that this kind of education should be placed at a higher level in the political agendas. Specifically related to higher education, this declaration states that: a) universities are useful arenas to disseminate

responsibility with society as well as to promote programs related to sustainable development, and b) universities should be considered the main group in the global scenario because they are social interlocutors as well as areas of essay and interactions that have shown their contribution in social and environmental issues (Universidad de Guadalajara, 2002).

Summing up the actions described above we can say that a clear, long term vision exists in Mexico of the implications for higher education system imposed by sustainable development. However no blueprint to implement the necessary changes exists that is valid for all institutions. Therefore, a common prerequisite may be the formulation of each institution's own vision of education for sustainable development.

Although in some institutions a clear vision of education for sustainable development is not yet formalized, there are many actions that show that they are facing that challenge. This is the case for the Autonomous University of Baja California (UABC) where there is not a sustainability action plan or program but there are many initiatives that, when putting them all together, shows a trend. The actions that the UABC has taken as the first steps towards a sustainability program are described below.

3.2.8 Environmental activities in Mexican Universities

Mexican universities have undertaken similar approaches to sustainability as those reported for universities in other parts of the world. Some Mexican universities have only initiated activities in the teaching and research areas, other institutions have initiated environmental programs on their campus operations while others have embarked in more comprehensive programs.

An example of a comprehensive approach is given by the Tecnológico de Monterrey (ITESM). This is a Mexican private university that has emphasized sustainable development in agreement with its mission. For more than ten years this university has implemented diverse environmental initiatives both in the curricula of different programs (Noriega-Crespo, 2004; Castaño & González, 2004) and in the operations of their campuses (Aguilar-Juárez, *et al.*, 2004; Díaz-Sánchez, 2004; Pedroza, 2004). Within its different campuses the ITESM has developed different initiatives. The campus that has launched internal programs promoting environmental performance within their operations is the Campus Querétaro, Monterrey and Estado de Mexico. In its campus Guadalajara, key faculty and staff members decided to convene and tailor a strategy for the design of a permanent sustainability program to be established in their facilities. The first step of this program was an environmental audit (Aguilar-Juárez, *et al.*, 2004).

Among the public universities that have implemented curricular reforms in different educational programs are the Metropolitan Autonomous University campus Azcapotzalco (Juárez-Nájera, 2004); the Autonomous University of San Luis Potosi (Medellín-Milán, 2004); Technology Institutes (Ramírez-López, 2004); and the University of Guanajuato (Súcar, *et al.*, 2004).

In Mexican higher education institutions research has been also subject of environmental focus. An example is the Center for Coastal Field Studies in the state of Baja California Sur. This center created a model that helps address the sustainability concerns through a five year research plan, case study projects and coursework (Ollervides, 2004). Another interesting case is the Manantlan Institute of Ecology of the University of Guadalajara. This institute has an undergraduate environmental education program which is linked to basic and applied research that develops and implements programs for strengthening social development and natural resources conservation of the Sierra de Manantlan region (Martínez, *et al.*, 2004).

Besides curricular contents and research, cleaner operations have also been a concern for Mexican Universities. Among the reported experiences in this field one of the most detailed experiences is the one from the Autonomous University of San Luis Potosi (UASLP). This university has an Environmental Agenda. One of the programs of this agenda is an environmental management system for the university. Several years ago the UASLP followed an ambitious program full of conceptual planning; faculty, students and administrators participation; communication; environmental audits and progress measurements. All these activities resulted in the EMS for the UASLP and a set of indicators of performance (Medellín-Milán, 2004). In this case a coordinator is in charge of the EMS. This coordinator is in direct line of authority with the Rector as part of the Environmental Agenda of UASLP. This close collaboration between the coordinator and the rector is one of the aspects that have helped the program to progress and get support (Medellin-Milán, personal communication, June 10th, 2004).

A similar scheme was put into practice at the University of Guanajuato (UG). This university also chose to follow an environmental management system model to operate its campuses in a cleaner way. The aim of the EMS in the UG is to transform it into an environmental model of education and behavior. For the coordination of the EMS, the rector of the UG requested the appointment of a coordinator for each academic and administrative unit (Súcar, *et al.*, 2004).

The published experiences are few that focus on waste management programs in Mexican universities. Among these are the Monterrey Tec, Campus Monterrey and the waste program of the University of Guanajuato. Other universities like the Autonomous Technology Institute of Mexico - ITAM, the Autonomous University of Mexico- UNAM, the Zaragoza School of Higher Studies, and

the Autonomous Metropolitan University Campus Azcapotzalco have waste management programs but no published information about them was found.

The Monterrey Tec Campus Monterrey has been operating a recycling committee since 1991. This committee is in charge of the activities of reduce, recycle and reusing of the solid wastes generated at campus. One of the reported strategies of this committee is the use of the Earth Day and the World Recycling Day as vehicles to involve younger students from K-12 local schools and campus community on reduce, reuse and recycle concepts (Díaz-Sanchez, 2004). No further information was found about this program.

The other documented and published waste program is the one from the University of Guanajuato (UG). The “total waste management” is one of the sub-programs of the EMS in place at UG. One of the first activities of the program was the acquisition of the containers for separating waste. Series of three containers properly labeled were located strategically for three categories of waste: organic, inorganic and paper and cardboard. These containers had lids of different colors and were adapted to the type of waste that must be placed in each. For the gathering of recyclables two areas were adapted. According to Súcar, *et al.* (2004) some of the phases of implementation of the program have been very difficult such as the adaptation of collection centers for waste. Other problem mentioned by Súcar, *et al.* (2004) is the lack of interest of students, faculty, administrative staff and custodial personnel. The information published about these programs doesn't include details about composition, volumes of potentially recyclable waste or any other more specific data.

3.3 Impact of external environment on the waste management program of the University of Baja California

What is the relationship between the external environment elements considered in this study (Mexican waste management system and sustainability trends in higher education) and the performance of UABCs' waste management program?

- What is the impact of the Mexican waste management system upon the waste management program of UABC?
- What is the impact of the sustainability trends in higher education upon the waste management program of UABC?
- What is UABC's approach to change when taking green initiatives like the waste management program?

3.3.1 Relationship between UABC's waste management program and the Mexican waste management system

When trying to identify the way the Mexican waste management system (MWMS) interact with the waste management program of the UABC it was difficult to isolate those from the interactions with the other elements of the external environment. The interrelationships between the various elements of the external environment and their impacts on MWMS are complex, Figure 11 shows the relationships found.

As it can be noted in Figure 11 there are various relationships between the different elements of the external environment that affect directly or indirectly the waste management program of the university. The program is also under the influence of these elements and its response to them also depends on the characteristics of the internal elements of the organization in combination with the external elements. Thus the diagram presented above could be even more complex if these combined elements were to be included.

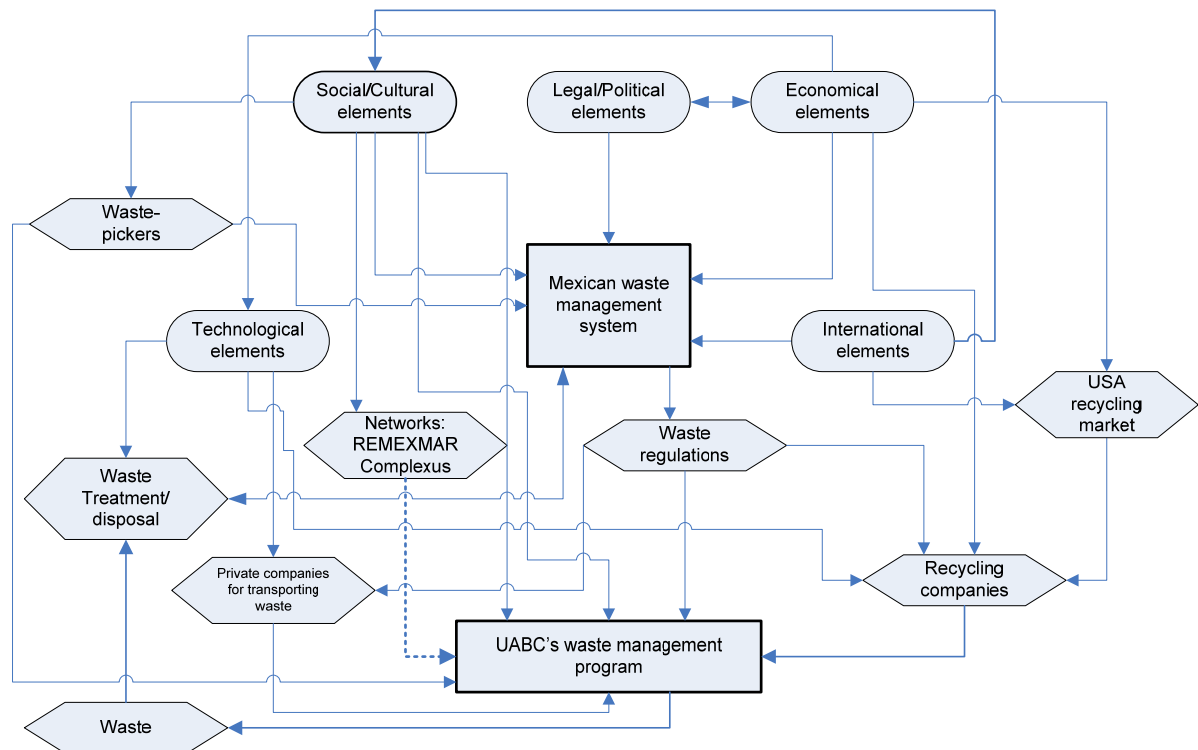


Figure 11. Relationships between the different elements of the external environment and the waste management program of UABC.

Despite these complex interactions we will focus below on how the Mexican waste management system interacted with the waste management program of UABC. Because MWMS was affected differently before and during the program, therefore an analysis of these relationships has been carried out throughout the whole period.

Before UABC's waste management program

How did the external environment impact the way that waste was being managed at UABC?

The Mexican Waste Management System had different impacts on the way waste was being managed at UABC, even though some of these impacts were not created by the direct influence of the Mexican waste system. Below the direct and indirect relationships or lack of there of is described from the initial introduction of the waste management program at UABC in 2001.

1. *Relationship with private companies for transporting and disposing waste to the landfill:* At the moment the waste management program started no municipality waste-pick-up service was available for universities. The institution had to look for a private service to pick-up, transport and dispose off its waste. This relationship was based on a transactional basis. The company collected the waste and the university paid for that service. Waste handling and disposal is just one of the many daily services that the university had to pay under a restricted budget. Thus the option was to look for the cheapest service (Landeros, personal communication, 2001). A cheap service is not necessarily a good service. The service provided by the private company created a bad image perception of UABC by the community. This relationship did not promote the link of the university with other elements of the Mexican waste system because to get rid of the waste generated at UABC the only thing to do was the weekly payment to the private company. No other type of interaction was needed that concerned non-hazardous solid waste issues.
2. *Relationship with SEMARNAT (federal hazardous waste regulator sector):* In general terms the relationship with SEMARNAT was good. On the one hand UABC was in compliance with bio-hazardous waste regulations; on the other hand SEMARNAT didn't have the mechanisms for auditing other hazardous waste like batteries, fluorescent lamps, ink cartridges, used oil, etc. Thus UABC was throwing away hazardous wastes (along with the non-hazardous waste). Nevertheless this practice never created conflict between the two sides.
3. *Relationship with municipal regulating sector:* The only contact that UABC had with municipal regulating sector was limited to the monthly payment for disposing waste in the

municipal landfill. Otherwise this relationship was lacking. There wasn't contact between municipality services and university personnel; this created a communication gap which in turn prevented each side from knowing the needs, expectations and plans of the other.

The Mexican waste system through the Municipal Cleaning Department did not exert any pressure or take any initiative that induced the university to start reducing the amount of waste produced or to change the quality of the waste. It is to be expected, however, that UABC would be interested in reducing its waste since this would reduce the daily fee payments to the private company. Yet, this was not the case. Also because no negative outcomes with the regulating sector occurred as a consequence of the quality of the waste composition, it wasn't an important issue. In this sense, even though regulations for hazardous waste existed, there were no municipal mechanisms to make the university comply with said regulations. Consequently, the absence of any legal enforcement on the operational performance of the university prevented a proper management of the hazardous wastes.

4. *The lack of support for initiating integral waste management programs:* Before the publication of the new law for waste management in Mexico in 2003, the creation of waste reduction and recycling programs were not an important issue for the government. Neither funds nor skills that could implement them were present as a way to support new and ongoing integral waste management programs. This simple fact hampered the start of a program since all the aspects related to money, skills and knowledge would have to be supplied by the institutions interested in these programs themselves. Again, the lack of boundary-spanning roles impeded the government from noticing the needs of these institutions involved in the proper waste handling alternatives.
5. *Lack of regulations for non-hazardous waste:* Because of the absence of non-hazardous waste regulations the amount and composition of the waste was not a problem for UABC as long as the institution could afford paying for the service. Thus, the search for reductions alternatives was not even in the mind of the people in charge of waste within the university.
6. *Lack of participation in the networks working on environmental initiatives: (COMPLEXUS and REMEXMAR):* The participation of members from UABC in COMPLEXUS and in REMEXMAR networks didn't produce any effect in proposing initiatives for reducing, reusing and recycling waste. The representative of UABC in REMEXMAR stated that he was working with the industrial sector because that sector needed advice for managing its

waste. Therefore he did not look at the possibilities inside the university (R. Ramos-Olmos, personal communication, March 14th, 2002). Thus, from a theoretical perspective the interpersonal networking did not lead to a stronger linkage of the university with the external environment. The members that belonged to COMPLEXUS and REMEXMAR didn't look at their own organization to improve them. They participated in those networks with no gain for UABC.

7. *Economic-Culture*: Cultural and economic factors favor activities like waste-picking. Waste-picking was present at UABC's temporary disposal site and their activities didn't seem to bother anyone. Actually their activities were the only effort towards recyclables separation at the institution. Nevertheless these activities didn't represent any kind of gain for the university. The waste-picking at UABC was a small scale copy of what is going on in the Mexican municipal landfills in general.

The practices of reducing, recycling and reusing waste weren't part of the Mexican culture. These activities haven't been promoted until recently and under very limited circumstances. Thus they have not become immersed in the culture yet.

After the launching of UABC's waste management program

After the integral waste management program was implemented at UABC in 2001 there were other evident impacts generated by the external environment. Below these impacts are described.

1. *Social/Cultural elements: Interest from different sectors of the community in the waste management program of the university*: The response to the program from the community showed that there was interest for this kind of programs in other sectors of the society. Each day more schools wanted to receive information, skills, education and support from UABC's waste management coordinator in order to start waste management programs in their institutions. This interest can be identified as a direct influence of the waste management program to the external environment of the university. Only the education sector approached UABC to assess how waste management programs could be set up. This may be due to the fact that the education sector could identify itself with the cognitive and normative systems within the education fields. According to Scott (1987) belief systems define the collective goals or values governing specific fields, values that provide the basis for domain definition (Scott, 1987).
2. *Legal/Political elements*: The lack of municipal regulations for non-hazardous waste also has an impact on waste management programs. Present day municipal regulations only pay

attention to the aspects related to street swiping and picking-up of the waste but don't pay attention to the creation of a preventive approach to waste that includes reduction and recycling as strategies. Because organizations must operate within a given legal framework it is more difficult for an organization to be proactive if no legal framework exists. In other words, if there was a municipal legal framework for the creation of waste management programs it would be easier to implement this kind of initiatives because different sectors of the society would be thriving for the same objective. In an interview with the Director of Ecology for the Mexicali municipality –the office in charge of municipal environmental issues including waste - stated that the first issue that his office was paying attention to was the collection system (Zatarain, personal communication, 2003). He also stated that once the municipality covered all the recollection areas they could start thinking about reduction and recycling programs (Zatarain, personal communication, 2003). He also said that it was too expensive to start municipal programs for the separation of waste. When the director of the ecology office was asked about their plans to respond to the new federal law for solid waste he mentioned that they had plans for modifying the municipal waste regulations but nothing has been done yet.

3. *Technological elements and economical elements:* Once the program started separating the recyclables like plastic, glass and aluminum from the university's main waste stream the municipal waste system was not prepared for receiving them, at least not all of them. The lack of local recycling industries made the recycling sector dependent on the USA recycling market. This in turn impacts initiatives like the UABC's waste management program because of the difficulty of delivering separated waste to recycling companies. Due to the reliance on the USA recyclable market, Baja California finds itself in a precarious position to manage its own recyclable waste. This is due to the fact that none of the opportunities offered by waste are being exploited by the local people and the dependency on the US market is even greater. Other alternative is to send the recyclables to other states of Mexico where recycling companies are established. Nevertheless this is not an attractive option for Baja California since it's very expensive to transport recyclables to distant locations.
4. *Social/Cultural elements, Waste-picking activities:* Waste-picking activities impact the waste management program since all the aluminum is sold by waste-pickers and not by the program. A way to stop waste-picking at the university should be found. Aluminum is the recyclable waste that have a higher price in the recyclable market, thus the selling of this product by the program would secure an income.

Up until recently, only the organizations that generated industrial and hazardous waste had been subjected to the pressure of waste management regulations. Now the action spectrum also reaches the large MSW generators, due to which many organizations will have to start integral solid waste management programs and emphasizing the minimization strategies. In order for this to happen, several changes will have to be made to the current municipal waste management systems, as well as to each organization's particular systems. At municipal level, Integral Waste Management Regulations in harmony with the spirit of the new law will be required. At an organizational level, the strategies will have to be planned through waste management schemes or programs, backed by management policies, technologies and procedures adaptation, together with educational and sensitizing strategies aimed at adequate waste management. In both cases the facts and peculiarities within each locality's context, will have to be addressed.

The Mexican waste management system can be considered part of the general environment of the university since it doesn't impose direct impact on the main functions or activities of the university (teaching and research). Nevertheless, after the analysis of the relationships found so far and when considering only the operational aspects of the institution, and specifically the solid waste issues, the Mexican waste management system could be considered a part of the task or technical environment, not to the university as an organization, but to the department of the university directly involved in waste handling, that is, the buildings and maintenance department. Considering the definition of institutional environment presented in the previous chapter, this would be the rules and requirements to which UABC must conform in order to receive legitimacy and support. But this would be more related to the educational set of activities of the university than to the operational set of activities like waste management. Despite this fact it would be fair to consider proper waste management as an indirect way to teach the university's community how to do it in an environmentally and socially sensitive way. This in turn could help the university to gain legitimacy for implementing sound alternatives for waste management.

3.3.2 Relationship between UABC's waste management program and the sustainability trends in higher education

Before the launch of the waste management program in 2001 no activities were present for impelling sustainability initiatives in the Mexican higher education system. Despite the international trends for including sustainability in higher education going on for many years, it wasn't until 2002 that Mexico formulated the Action Plan for Sustainable Development in Higher Education Institutions to drive the efforts of higher education institutions towards sustainability. UABC's

membership of COMPLEXUS (the Mexican Consortium of Universities' Environmental Programs for Sustainable Development) dates back to the creation of this network in September 2000. However, at the time of the launch of the waste management program no clear activities were defined to the members of COMPLEXUS. For these reasons the analysis of the relationships of the waste management program with the external element "sustainability trends in higher education" is to be done only for the moment after the program was launched.

In helping the detection of the relationships of the sustainability trends in higher education with the waste management program Figure 12 was constructed.

Figure 12 shows that the COMPLEXUS network is the link of sustainability trends in higher education, including the international trends, with Mexican universities, in this case UABC. As can be seen in this figure there is a simpler set of relationships between the sustainability trends in higher education and the waste management program than the ones of the former with the Mexican waste system. This is because UABC's waste management program has not been linked directly to the Mexican initiatives promoted by COMPLEXUS network. The initiatives of COMPLEXUS aren't limited to the curricular issues but to all the arenas and actions of universities including their operations, thus waste management alternatives are included as well. In spite of this, when reconstructing the history of the waste management program in Chapter II there were no links found of COMPLEXUS or any of its initiatives with the waste management program. This means that the external environment element "sustainability trends in higher education" wasn't posing any direct effect or impact upon UABC's waste management program.

A link of the international trends for sustainability in higher education with the faculty staff of UABC can be seen in Figure 12. This relationship is based on the knowledge, participation and communication that some members of the faculty staff of UABC have with members of international universities (again other knowledge networks). The waste management program however was managed by administrative staff. For this reason the input from faculty staff was difficult. The faculty staff did not participate in the program which created another missing link with that element of the external environment (dotted line between faculty staff and waste management program). This missing link prevents the possibility of sharing the knowledge acquired during the participation of faculty members in their respective knowledge networks. As a consequence this also prevented the following steps explained by Pumar (2005), namely to institutionalize and develop further policies related to the new idea introduced in the organization, in this case sustainability ideas in higher education institutions.

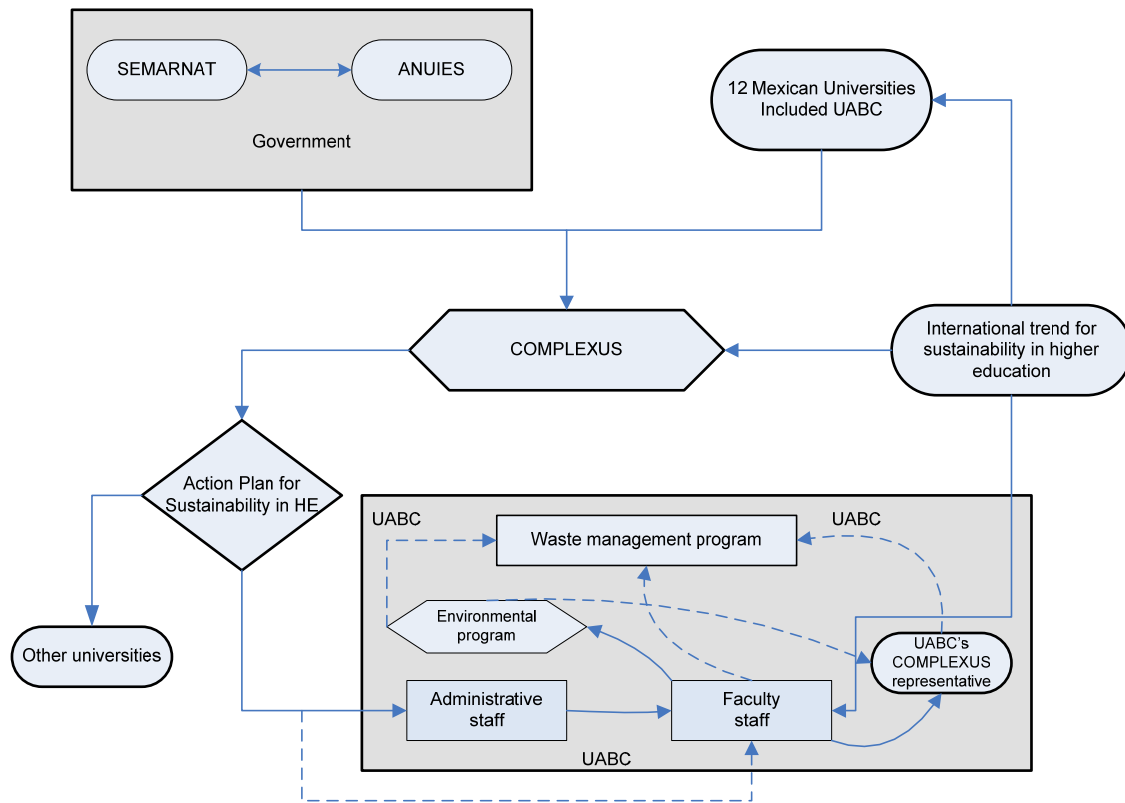


Figure 12. Diagram of the relationships found between the sustainability trends in higher education and the waste management program of UABC.

In principle, the Mexican Action Plan promoted by ANUIES/SEMARNAT and COMPLEXUS for including sustainability in higher education institutions is a promising initiative. However, for the case of UABC there wasn't a clear way to make it operational, at least not for the case of the waste management program. UABC's representative in COMPLEXUS hasn't communicated with the people in charge of the waste management program. In Figure 12 this missing link is the dotted line between these two elements.

Another missing link is taking place between the members of UABC's environmental program and the representative that UABC have in the COMPLEXUS network. Because sustainability includes environmental issues, these two elements should be connected. Here too however communication between the people working in the waste program and the ones in UABC's environmental program was limited. The line is dotted because, to date, the people in charge of the environmental program haven't contacted the people working in the waste management program, thus creating another missing link. All these missing links have prevented a relationship of the waste management program of UABC with the sustainability trends in higher education.

Three conclusions can be drawn from this analysis:

1. The boundary spanning roles that link UABC with the external environment element sustainability trends in higher education exists. Nevertheless elements of the internal environment of UABC seem to be preventing the linking of the waste management program with those external trends.
2. As long as these links continue to lack, the waste management program will not be seen as a part of an integral institutional program. This second conclusion could have other consequences as well, for instance lack of financial allocation of resources, lack of the required support from other departments of the institution, non-recognition of the waste management program as a valuable initiative, lack of internal regulations for waste management, etc. However if the program is considered part of the Institutional Environmental Plan and of the sustainability efforts promoted by the ANUIES-SEMARNAT Action Plan then the program could be seen as a part of an integral and stronger initiative with more possibilities of being supported and of being successful.
3. The role of knowledge networks did not play an important role for producing a paradigm change that helped the creation of successful sustainability initiatives.

3.4 UABC's approach to change in response to external influences

In Mexico, several efforts to face the generation, valuation and promotion of environmentally adequate waste management have taken place, and, in spite of this, its volume keeps increasing at a rate that surpasses the cleaning services' capacity as well as the infrastructure established for its utilization, treatment and final disposal. This leads to various environmental and social problems caused by its inadequate elimination.

A way to overcome these problems would be through the setting up of systems for integral waste management which combine forms of handling that include its reuse, recycling, treatment and adequate final disposal. Then waste can become an opportunity for business, income and jobs. Thus the setting up of waste management programs by any given organization could be seen as a sign of a preactivist style of responding to the waste problems. But the positioning of an organization within Ackoff's typology of institutional responses to environmental change (Ackoff, 1981) will depend on the time under analysis and the particular circumstances present in that time.

In this sense, when the Autonomous University of Baja California (UABC) created an integral waste management program it responded to its external environment behaving like what seemed to

be a “preactivist style” according to Ackoff’s classification (Ackoff, 1981). Based on the definition of what a preactivist organization is, UABC attempted to anticipate changes on the external environment related to waste and prepared for them. In this way two years before it was mandated by law, UABC had already created an integral waste management program aimed to reduce, reuse and recycle its waste. But looking at other moments in the history of the waste management program (Chapter IV) specially looking at the previous efforts towards waste separation, it becomes clear that the preactivist style is not the norm in UABC. The same occurred with other initiatives for protecting the environment that have taken place in UABC. Initiatives like the waste water treatment plant, energy saving air conditioning systems, and the bio-hazardous waste program have been implemented to comply with the legal framework. None of these initiatives have been the result of a planned effort to protect the environment or to teach the community (included the students) to take care of it, nor to anticipate changes in the regulatory framework. Thus, it is questionable whether UABC (through its waste management program) truly showed a real preactivist style to respond to its external environment.

3.5 Conclusion

The complex problems caused by waste generation and management, together with those derived from the creation and operation of service infrastructure for its handling, demand that numerous actors and sectors participate in the creation of policies, programs, legal and economic instruments, as well as in the administrative processes for integral waste management. This means that several different elements should converge to have environmental improvement and social acceptance while still financially feasible. In this sense the waste management program of the Autonomous University of Baja California is an example of the need to depend and interact with all the actors and sectors that influence Mexican waste system. At the same time, organizations such as UABC play a role within the waste system, affecting it and influencing it in different ways: for example, through the quantity and quality of the waste generated by the institution.

When analyzing the historical evolution of the services of recollection, transport and final disposal of MSW in Mexico, it is evident that there have been changes in the public cleaning system and that numerous attempts for the improvement of some of these activities have taken place. And yet public participation has been virtually null throughout the history of the waste management system in Mexico. Public participation is an essential ingredient when trying to solve a problem created by the whole community, as it is the case of waste generation. Taking all the above factors into consideration it can be said that UABC through its waste management program is participating in

the setting up of alternatives for diminishing waste problems in Mexico. However its real impact upon the system has been limited in part by the system itself.

When comparing Mexican waste management systems with the ones from other countries, mainly developed countries, the dearth of alternatives is evident, a little incineration and composting are taking place but mainly the waste is being disposed in landfills or in open air dumps. This is due in part because of the availability of great extensions of land that can be designated to landfill sites, which makes it a cheaper option that carries important environmental and social consequences. This economic fact alone renders other costly options unpragmatic.

Beginning with the approval of the General Law for Waste Prevention and Waste Integral Management in 2003, a new range of possibilities appeared regarding MSW management. One of the strong points of this Law is that it lays the basis for involving the citizens or interested parties directly in the formulation of proposals for options concerning waste management. This participation will allow the Law's goals to be achieved in an easier, simple, fast, financially viable, technologically feasible and socially acceptable way, with a focus based on the particular priorities and circumstances of each locality, entity or region as well as on the needs of the various sectors that generate waste within them. Organizations like UABC could take advantage of their unique position that the new law has made incumbent upon them which allows them to propose and demand services that waste management programs need to function adequately.

We could of course talk of an infinite range of possibilities that the new Law can offer to the solid waste management panorama in Mexico. However, it is important to mention, too, that the Law will be worthless in of itself, without the participation of the organizations, institutions of all sorts, including the community itself. It is also important to take advantage of the networks that are working towards a better waste management in Mexico like REMEXMAR and the networks like COMPLEXUS that are working towards sustainability in Mexican higher education system. The involvement of UABC in both networks could produce benefits to the waste program provided that UABC's representatives in each of the networks are included in the waste program as well. In this way the information gap that exists between the networks and the people working in the program would disappear and the flow of information would permit feedback. As a result of this new information wealth, the strategies used in other programs, the experiences from other institutions, the incentives of the governmental sectors involved, etc., could benefit UABC's waste management program. This, however, hardly took place in the current case study.

This chapter has focused on the relations between two elements of the external environment within UABC's waste management program. Although those elements did affect the program, some of the

encountered obstacles that prevented a stronger bonding with elements of the external environment actually have their origin from within the institution. In the next chapter the internal elements of the organization that affected the waste management program of UABC will be analyzed.

Chapter IV. The case study of UABC's waste management program

In order to be able to analyze how leadership, structure and culture (pro-environmental behavior) affected the waste management program, first it was necessary to construct the case. In other words, it was necessary to build the story of the waste management program to detect how the program performed over time, who were the actors involved and what were their roles in the program, how did these actors interact, what these actors thought about the program and what results did the program deliver. In this chapter the case of the waste management program is constructed which will subsequently be followed by an interrelation in theoretical terms in the next chapter (Chapter V).

4.1 Methodology used for analyzing the internal variables of the case

A brief institutional background is described as an introduction to the case with the purpose of helping in the understanding of the context in which the events of the waste management program took place. Moreover a brief description is made of the environmental awareness and of the previous efforts towards waste recovery at UABC. These descriptions as well as the story of the waste program were based on different sources of information: observations, written documents, meeting minutes, and interviews. In the case of culture (pro-environmental behavior) also a questionnaire was used.

The story of the waste management program is done on the basis of a narrative approach. Some parts of the story are abstracted from interviews with the actors that intervened in the program while other parts of the story are based on written documents and reports. Narratives to construct cases are widely used in different disciplines and used in both basic and applied research. As Lieblich, *et al.* (1998) states:

Because research methods should be always selected to best fit the research question, when researchers are asked by various social agencies to address real-life problems, to contribute their expertise to public debates or decisions, it may be advisable to approach people whose lives are relevant to the issue in an open manner, exploring their subjective, inner experience on the matter at hand. Narrative methods can be considered "real world measures" that are appropriate when "real life problems" are investigated. (p. 5)

While the terms narrative and narrative research appear often in qualitative studies, it is rare to find these terms defined (Lieblich, *et al.*, 1998; Riessman, 1993). According to Webster's Dictionary

(2002), a narrative is defined as a “discourse, or an example of it, designed to represent a connected succession of happenings” (p. 1503). Perhaps the most concise definition is that proposed by Smith (1981): Narratives are “verbal acts consisting of someone telling someone else that something happened” (Smith, 1981). Sarbin (1986) also stresses the organizational aspect of a narrative.

The narrative is a way of organizing episodes, actions, and accounts of actions; it is an achievement that brings together mundane facts and fantastic creations; time and place are incorporated. The narrative allows for the inclusion of actors' reasons for their acts, as well as the causes of happening (p. 9)

Bruner (1990) relates narrative analysis to “how protagonists interpret things” (p. 51), and Riessman (1993) adds that we can then go about systematically interpreting their interpretations (p. 5). Thus, for this work it was considered that the opinion of the actors involved in the waste management program of the Autonomous University of Baja California would be of great help in constructing the case under study.

The story of the waste management program is used as a time guide to detect how the sequence of events of the waste program influenced its performance and also to relate those events to the variables of interest in this study: leadership, structure and culture. To summarize the most important events of the waste program a table is constructed with an abstract of each phase of the program.

Because the objective of the story is to have a chronological description of the events that took place in the program, it is difficult to separate the aspects related to the three variables of interest for this study. Thus the results of the three variables are presented and analyzed separately. The different phases of the waste management program, as described in the story of the case, are used as a guiding framework for the analysis of leadership, structure and culture (pro-environmental behavior).

4.2 The case: Waste management program at UABC

The story of the waste management program can be divided into a number of phases. Each of these phases has a set of specific characteristics. In order to help understand the context in which the events took place, a short institutional background is presented first. The following sections of the story cover the descriptions of each of the phases of the waste management program.

The information used for this analysis comes from different sources: written reports and institutional documents, information published in the official Internet site of the Autonomous University of Baja California, interviews with key people (Table 9) and observations.

Table 9. Position in the organizational hierarchy of the people considered for constructing the story of the waste program

Name of key respondents	Position
A. Mungaray Lagarda	Rector
V. Beltrán-Corona	Former rector
G. Torres-Moye	Coordinator of postgraduate studies and research during both administrations
J. J. Sevilla	Coordinator of Institutional Planning
A. Jabalera	Coordinator of Administrative Services
R. Moreno	Chief of the maintenance office
V. Arroyo-Cardoso	Analyst of the office of maintenance
C. León-Diez	Former researcher at UABC
R. Gurrola	Janitor's supervisor
S. Romero	Professor, Faculty of Engineering
L. Gómez	Professor, Accounting Faculty
L. A. Velarde	Former janitor's supervisor
C. Landeros	Former chief of the maintenance office
M. Rivas	Director of the Engineering Institute
C. Rodríguez-Cadena	Former director of Works and Installations
N. López-Aguilar	Former Director of Student Welfare
L. Gómez, E.G. Carrillo, C. Castillo, D. Vásquez, G. C. Díaz, E.Leyva	Professors promoters of the waste program in different faculties
G. González, J.Martínez, M. Galván	Janitors
A. Mendoza	Manager, Paper recycling company
R. Bandrés	CEO, Waste and recycling company

This work also follows the Publication Manual of the American Psychological Association (APA, 2001) which indicates that personal interviews, memos, letters, telephone conversations, e-mail or messages from nonarchived discussion groups are considered personal communications. Thus,

whenever the “personal communication” quotation appears, it means that any of those communication means were the sources of the information presented.

In order to refer to the people quoted in the story Table 9 was constructed. This table allows relating the position (or the position on the organizational hierarchy within the university) to results and events of the program. It also allows to relate what has been stated in official documents to what has been said by the people interviewed or to what has been observed.

4.2.1 Institutional Background

The Autonomous University of Baja California (UABC) is located in the Mexican North-Western state of Baja California. It is the biggest university in the state with four main campuses located in the five state municipalities: Mexicali, Tijuana, Rosarito, Tecate and Ensenada. Together the five campuses bring services to more than 25,000 students.

UABC was created on February 28th, 1957 when its Procedural Law was published in the Official Bulletin of the Government of Baja California. Ever since its creation UABC has gone through different stages defining it. According to Piñera-Ramírez (1997), there are five main stages UABC has gone through since its establishment as a higher education institution. describes these stages while a sixth one is added. This last stage represented the time in which the university waste program was further developed.

The solid waste management program has been developed during the last two institutional stages appearing in. The first stage of the program took place at the end of the academic development and institutional stability stage, that is, between 2001 and 2002. The second stage of the program begins exactly with the University Reform in 2003. Both stages of the program were under the influence of different university environments: the first, a stable environment, where there were no changes either in academic or administrative sense. In contrast, the stage of university reform was filled with important changes both on the academic and administrative levels.

Table 10. UABC development stages.

Stage	Period	Characteristics
Gestation	1952 – 1957	The Baja California society's begun to express their wish to have a University. This ended with the proclamation of the University Charter in 1957 (Ley Orgánica de la Universidad).
Beginning of essential academic activities	1959 – 1966	The activities of teaching, research and cultural diffusion begun. The university branches were distributed in the four state municipalities.
Steps towards consolidation	1966 – 1971	The steps towards providing financial support to the University were taken, such as the State Government's decree which passed a tax in 1968 for middle and higher education, something that allowed the University to overcome some deficiencies and to plan its future.
Growth in the middle of turmoil	1971 – 1981	On the one hand the university received significant support from the federation, allowing accelerated growth. On the other hand it faced a number of problems which reflected the main student movements of the decade. Furthermore, the union organizations appeared which led to confrontations with employees, reaching a crisis towards the end of 1980 and beginning of 1981.
Academic development	1981 – 2002	This was a stage of stability with significant achievements in the teaching, research, outreach functions and outstanding scores at a national level in some areas.
University reform*	2003 – 2004	A decentralized administrative structure was organized from three vice-rectorships. The organizational scheme was changed to a scheme based on the educational process.

Set out following data presented by: Piñera-Ramírez, D. 1997. History of the Autonomous University of Baja California 1957-1997. UABC, Mexico. 630 pp. (In Spanish).

*Stage added by the author of this thesis.

The basic organizational structure changed six months after the last administration change.

According to the University reform the change in structure was supposed to bring a better service to the students (UABC, 2002). Through the organizational structural change many of the administrative activities that were done by the central administration would now have to be done by each faculty or institute. This would leave time to the central administration to make decisions in its areas of influence (UABC, 2002). The aim of the change was to have a flattened structure that facilitated the work between the directors of the academic departments and the rector and the other high rank people.

4.2.2. Environmental awareness at UABC

At the beginning of each UABC administration an Institutional Development Plan is issued. In this document the plans, policies, programs and actions are described that will be carried out during the administration. Before the Institutional Development Plan 1995-1998 (UABC, 1995) the “environmental dimension” was not even mentioned in the institutional development plan. It is in the 1995-1998 plan when for the first time this dimension is mentioned but the term used then was “ecological concern”. In this institutional development plan it was mentioned that ecological concern was one of the many variables that the external environment of the university was paying attention to. It is also mentioned that higher education system should impel the creation of academic programs that include ecological norms and values, research and development of low impact technologies, as well, as the dissemination of products offered by higher education institution relative to ecological issues (UABC, 1995). But looking further into the development plan the only strategy to cover these issues is the one created by the Research and Postgraduate Department (*Dirección General de Investigación y Posgrado*). In 1993 this department created an Environmental Research Program (ERP) (León, 1993) but the first time it was officially announced was in the 1995-1998 Institutional Development Plan (UABC, 1995). This program is described here with some detail because it can be used as an example of an interesting environmental initiative formulated at a decentralized level that had very good results during the time it was operating and cancelled later because of top management’s lack of vision (C. León-Diez, personal communication, March 7, 2005).

During the 1990’s Mexico was beginning to respond to the environmental concern that increased after the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. It was then when two faculty members that at that time worked at the UABC’s Research and Postgraduate Department, realized that UABC was not responding in an institutional way to the external needs such as the difficulties the state government had to face environmental problems and the industrial sector’s need for training in the environmental arena. Until that time there were only isolated projects that tended to just a few local problems. It was then that these two faculty members started working on the Environmental Research Program (ERP) of the Autonomous University of Baja California. This program would be the institutional reply to the external needs related to environmental issues.

ERP sought to integrate interdisciplinary research teams to consolidate and impel activities (research, teaching, outreach) oriented to solve the environmental problems of the region (León, 1993). The objective of the program was also to increase the skills of the research teams through

courses, conferences, and meetings with researchers from other universities of the region and from all around the world. ERP operated three years from 1993 to 1995. During this time the program allocated its own resources from different federal and international organizations, organized more than 20 different conferences, ten courses, and several meetings with researchers from different parts of the world. As a result of these meetings researchers from UABC started working on two Biosphere Reserves, and got involved in different priority environmental projects. Other achievement of ERP was the creation of an annual internal call for environmental research projects, and prioritizing the ones with interdisciplinary research teams. This initiative had an important response and functioned during three consecutive years.

Other very important achievement of ERP was the establishment of a direct communication channel between the coordinator of ERP and the Federal Secretary of the Environment (SEMARNAP), the National Institute of Ecology (INE) and the people working in the different levels of the government involved in environmental issues. After several meetings and talks with both the Secretary of SEMARNAP and the Secretary of INE it was accorded that UABC through the coordination of ERP was going to work on a project to propose a model for the involvement of Mexican higher education institutions in the search of solutions to the national environmental problems. In other words, this would be a translation of UABC's ERP model into a model that could work at a national level. Because of the relevance of this event it was the very Rector and the Director of Research and Postgraduate Studies who met with the Secretary of Environment to present the proposal. In the history of this project this was a crucial moment. It was the first time that the rector or the director of Research and Postgraduate Studies intervened in any of the activities of ERP.

Before the meeting with the secretary of SEMARNAP and without notifying ERP's coordinator the proposal was changed by the Director of Research and Postgraduate Studies. In doing so the main objectives of the proposal were reduced to his personal research interests. Not surprisingly, however, this proposal was rejected by SEMARNAP. For it wasn't what had been previously accorded with ERP's coordinator. After these events, and despite of the inclusion of ERP into the Institutional Development Plan 1995-1998 of the UABC (UABC, 1995), ERP disappeared (C. León-Diez, personal communication, March 7, 2005). This happened because ERP's coordinator left the university but his position was not filled to continue ERP's activities (C. León-Diez, personal communication, March 7, 2005). Did this imply that the environmental issue was taken out of the agenda?

The Institutional Development Plan of the Autonomous University of Baja California is the document in which the mission, vision, policies, programs and strategies are stated for each administrative period. The **institutional mission** is the element allowing the orientation of the university's efforts towards the fulfillment of its ultimate goals, modeling the academic and administrative processes with specific emphases which give a distinctive trademark to the university activities performed within and without the institution (UABC, 2003). Although the mission has kept its essence throughout the different institutional stages (UABC, 1988; UABC, 1991; UABC 1995) the inclusion of the environmental dimension within it, did not take place till 1999 in the Institutional Development Plan (*Plan de Desarrollo Institucional*) 1999 – 2002 (UABC, 1999). When the ERP was included in the previous institutional development plan the mission did not contain the environmental component.

According to UABC's rector for the period 1999-2002 the inclusion of the environmental dimension in this Institutional Development Plan was the result of two events: 1) he himself searched for the profiles and reports of rectors from the most prestigious universities in the world. In doing so, he found that the environmental dimension was always on their working agenda and 2) before his administrative period the priorities for learning were set for the next few years at one of the UNESCO's meetings in Paris. One of these educational priorities set in that meeting was that of respect for the environment (V.E. Beltrán-Corona, personal communication, March 7, 2005). Therefore he decided that with the support of the rest of the top management of the institution an environmental dimension in the institutional mission would be included. Nevertheless there wasn't a focus on waste management yet, implying that no policies and specific projects for waste management were written in that development plan.

UABC's mission as it stands in the Institutional Development Plan (*Plan de Desarrollo Institucional*) 2003 – 2006 (UABC, 2003) reads as follows:

*“Starting from its location in the border State of Baja California and in close collaboration with the different sectors surrounding it, the mission of the Autonomous University of Baja California (Universidad Autónoma de Baja California) is to contribute to reach a fairer, more democratic, egalitarian society and world, **respectful of its environment**, through:*

The forming, training and updating of quality, autonomous, critical and purposeful professionals, with a heightened sense of ethics and social responsibility, that will allow them to become fully accomplished citizens,

capable of facing and creatively solving, the challenges their current and future environment will pose them.

*The generation of scientific and humanistic knowledge, as well as of technological applications and developments pertaining to the **sustainable development** of Baja California and the world in general.*

The creation, development and spreading of cultural values and artistic expressions that will enrich life in Baja California, the country and the world in general.”

As it was stated in the Institutional Development Plan (PDI) 1999-2002 a Sustainable Development Program was supposed to cover the sustainability issues included in the mission. The aim of this program as stated in PDI 1999-2002 was to construct an institutional system to develop integral and coordinated actions that would lead to the adoption of a culture of respect for the environment. The second aim of this program was to generate internal dynamics oriented to the rational use of the university's resources (UABC, 1999). However, no program as such was created during said administration. According to two of the top management people at that time (UABC's former General Secretary and UABC's former Director of Research and Postgraduate Studies) the objective was too broad. After several meetings and discussions with people involved in environmental and sustainability issues the top management decided to focus on one or two specific programs that allowed them to have results and use them as pilot programs to later propose an integral sustainability program in a later stage (G. Torres-Moye, personal communication, April 8th, 2005). The two initiatives related to the environment that took place during that time were the solid waste management program and the responsible water consumption campaign. No educational programs specifically created to cover environmental issues were created. However some programs that already were in place covered some environmental aspects.

Both the former rector, the former General Secretary and the former Director of Research and Postgraduate Studies thought that institutional environmental or sustainability policies as described in Institutional Development Plan would be of much help to gain support for environmental programs and to allocate resources to these programs (V.E. Beltrán-Corona, personal communication, March 7, 2005; J.J. Sevilla and G. Torres-Moye, personal communication, April 8th, 2005).

4.2.3 History of previous efforts for waste recovery

Before that time several activities had already taken place in the area of waste separation, recycling and generation reduction activities despite of the lack of environmental policies at UABC.

Around 1994, the proposals were made for separating used paper to sell it for recycling. The first proposal appeared in the General Department of Works and Installations (*Dirección General de Obras e Instalaciones*) (V. Arroyo-Cardoso, personal communication, June 8, 2001). The initiative for the separation and sale of paper for recycling was presented informally, that is, by word, to the Director of Works and Installations at the time. This Director approved of the proposal and the Department of Works provided financial support to purchase bins for separating paper in the offices. This initiative lasted about six months and two tons of paper were sold in total (V. Arroyo-Cardoso, personal communication, November, 2003). According to Arroyo-Cardoso (personal communication November, 2003), the Director of Works and Installations (Architect Chan), was convinced of the need to have waste reduction strategies within the institution and felt that, because of her position in the institution, part of the responsibility was in her hands. The proposal for paper separation was accompanied by lectures given to the Heads of some of the faculties such as Engineering, Architecture and Accounting. The goal of these lectures was to make the Heads of the faculties spread the information to the administrative and teaching staff as well as to the students in their own faculties so that everyone would participate in the program of paper separation. These lectures were organized with the help of the Papelera San Francisco S.A. paper company, which would recycle paper and transform it into other paper products such as toilet paper, paper towels, and others. It was the personnel of this same company who was in charge of giving the lectures and providing informative material.

In these lectures, the environmental benefits of paper recycling were explained, as well as the opportunity for getting a financial benefit for selling paper to be recycled. Unfortunately, on the one hand the information provided in these lectures never reached the university community, that is, the people attending the lectures were the only ones who received the information. On the other hand, the bins for separating used paper were placed at various sites without proper information of how to use the bins. As a result students and professors placed all sorts of waste in them. This, together with the lack of information and training of janitors, caused the separated paper to be polluted, that is, mixed with other sorts of waste, which reduced the chance of selling it.

The lack of formality—the program was never institutionalized—of the paper separation initiative resulted in its not being taken seriously (V. Arroyo-Cardoso, personal communication, November, 2003). The bins for paper separation ended up in institutes and faculties where there had been no

lectures. Janitors saw the opportunity to make money selling used paper and they started fighting for that paper. The outcome of these quarrels was the decision to finish the paper separation program (R. Gurrola, personal communication, November, 2003).

During 1998, 1999 and 2000, other initiatives for separating paper for recycling took place in the Accounting and Engineering faculties of the UABC's Mexicali Campus. In both cases these initiatives were born out of the personal interest of the professor in charge of the groups and not due to the subject's curricular requirements.

In the case of the Engineering Faculty it was a professor who involved her students in campaigns for separating used paper and promoting the benefits of recycling. During the campaigns, the community at large was invited to take used paper to the university buildings and once the paper was received, they were given a printed informative package about the benefits of recycling, a tree, and a short explanation on the importance of the citizens' participation in these campaigns. The invitation to the community was made through the local communication media (television, radio and press). The trees were donated by the municipality who got involved in the campaign up to this level, in spite of the fact that the municipality itself didn't have its own paper recycling program at the time. There is no record of the amount of paper accumulated during the campaigns; the only thing known is that it was delivered to Papelera San Francisco S.A. de C.V. to be recycled (Socorro Romero, personal communication, June 12, 2002).

The Accounting Faculty also had a paper recycling mini-program. The campaigns for recovering recyclable paper were not addressed to the overall community but were focused on helping Social Security (Public Health Care Service) daycare centers. These daycare centers need paper and cardboard boxes of different sizes so that the children can perform various handcrafts such as drawing, cutting, coloring, etc. Since the budgets of these centers are always limited, they have chosen to employ used paper and boxes donated by several institutions. Upon perceiving this need of the daycare, the professor teaching "Ethics and Values" at the Accounting major, organized her students into brigades for collecting cardboard boxes and used paper to take to the daycare centers. This effort has taken place every time this professor teaches. As in the case of the effort by the Engineering Faculty, this effort however ended when another professor took over the subject. There are no statistics of the amounts of paper and cardboard that had been delivered to the daycare centers (Leticia Gómez, personal communication, February, 2004).

From the experiences described up to this point it can be concluded that these have been isolated efforts that have had no institutional support to drive them, make them grow and formalize them into events that are a part of an institutional strategy for waste management. This doesn't mean they

are not important initiatives, albeit with limited results. All were bottom-up initiatives and were led by the effort of active advocates convinced of the need for waste management strategies. This made these efforts work even without the institutional support. The advocates of the efforts described above were committed, aware of need and persevere in their efforts.

4.2.4 State of the art of waste management at UABC before the introduction of the waste management program

Before the introduction of the program, waste management at UABC was very simple. Waste was produced in classrooms, laboratories, halls, sports play-grounds and offices. The mixed waste was disposed-off in trash bins. Each shift of janitors (morning or evening shift) picked up the trash from the bins, transported and disposed it in the temporary disposal site for waste.

The temporary disposal site for waste was located in one of the few wooded areas in UABC known as the “little wood” which both West and North wards face two avenues with heavy traffic.

Therefore, any activity performed there was quite obviously visible. According one of the employees of the maintenance and buildings department, the location of the temporary disposal site was chosen because of the easy access of the garbage truck without disturbing the activities of students (Luis A. Velarde, personal communication, January, 2003). The temporary disposal site was built on a dirt floor in an area of about 40 square meters, surrounded by strong wire netting and covered with vinyl shade screen.

The temporary disposal site was an area for waste-pickers. Waste-pickers not affiliated to UABC in any way, went every day to the disposal site to pick-up metals, cardboard and sometimes glass. They sold these wastes to recycling companies.

A private company was hired to take the waste from the university’s temporary disposal site and transport it to the municipal landfill. Once a day, the private service, hired by UABC, showed up to collect and transport the waste generated at the institution, to the landfill. UABC had to pay the private waste transporting service for the number of waste-filled trucks that were necessary in order to get rid of solid waste (César Landeros, personal communication, November, 2002).

The collector truck of the private company was not a vehicle specifically designed for transporting waste; it was a one-ton capacity pick-up truck with an open container. The vehicle was loaded manually by two people; they picked the waste from the ground with shovels and placed it in the truck until it was full. The job of loading the truck would take from 2 ½ to 3 hours, or more in the hot season (from June to September) due to the need for rest and re-hydration of the people

involved in loading the truck, and who were working in the sun. The rendering of this service was very irregular, letting up to three days in a row go by during which the waste collection service would not show up. UABC had hired this same company for more than 20 years.

The municipality charged the private service for each full truck emptied out at the land-fill. There was no limit to the number of trucks that could be emptied each day. There were no records of the kind of waste UABC was disposing off. Mechanisms to know what the university was throwing away in the landfill were also missing. As a result UABC could dispose regulated hazardous waste like batteries, used car oils, fluorescent lamps, etc. in the landfill. An exception was the management of the bio-hazardous wastes generated at UABC which had their own management program.

4.2.5 Waste management program at UABC

4.2.5.1 Phase 1: Preparation for the launching (January 2001)

Besides the activities described in the previous section there were no other intentions to improve the waste management practices at UABC. It was until the year 2000 that the results of a research about the composition of the waste generated at UABC showed that more than 60% of the wastes was recyclable (Annex I presents the research report of that study). The researcher that conducted that study suggested to the Head of the Institute of Engineering to present these results to UABC's Rector. With his support a pilot program could be set in motion for an integral waste management at the Campus Mexicali I. The Head of the Institute of Engineering accepted her suggestion because he knew that the rector was in favor of environmental protection (Moisés Rivas, personal communication January, 2001). In January 2001, the researcher presented to the Rector and the Secretary General of the University, the results of the recycling potential of the waste on Campus. The General Director of Works and Facilities (DGOI) and the General Director of Student Welfare also attended the meeting. The first was in charge of the building and maintenance of the institution, whereas the latter was in charge of managing the programs for the community service all students must perform.

Once the information regarding the recovery and recycling potential of the university waste was known, the researcher got the unanimous support from the general directors who were present and of UABC's Rector, to create an Integral Solid Waste Management Program. At the end of that meeting, the Rector appointed the researcher as the Coordinator of the University Waste Management Program. The Rector asked the two general directors present to support the program. Verbally, each of them agreed to support the initiative to the extent their corresponding departments

would allow. The support of the Director of the Department of Works and Installations included the following:

1. Purchase and placing of containers for recyclable and non-recyclable waste in the places the coordinator should indicate,
2. Communication with the supervisors of the cleaning staff to make the program known and to explain how it would modify the waste management activities,
3. Get in touch with the companies who would purchase the recyclables for the sale and delivery of the materials separated as a consequence of the program, and
4. Constant communication with the program's coordinator to inform her about any setbacks which might turn up as a consequence of the program.

The Head of the General Department of Student Welfare expressed that his support would consist of setting up a community service program at an institutional level. In this way, the students would support the operation of the waste management program while fulfilling their mandatory community service.

Likewise, the responsibilities pertaining to the coordination of the waste management program were as follows:

1. Making the program known among the university community through the various communication media UABC has, and
2. Supervising the activities performed by the DGOI for the operation of the waste management program.

Several reasons can be given as to why the people present at that meeting were so supportive of the waste management program. The rector of the Autonomous University of Baja California at that time was concerned about the natural environment and was motivated to spread the word about the benefits of taking care for the environment (V. Beltrán- Corona, personal communication, March 8th, 2005). The former rector mentioned that waste related issues bring an opportunity to do things right and to teach others by example. He argued that a higher education institution should be congruent with what it is teaching inside the classrooms. This new waste management program would be the opportunity to show their concern for the environment (Beltrán-Corona, personal communication, March 8th, 2005). The Director of the Department of Works and Installations (DGOI) at that time had already thought about the need of a waste management program at UABC and had therefore requested funding for buying recycling bins (C. Rodríguez-Cadena, personal

communication, 2001). He also mentioned that the new waste program was in accordance with his plans and that therefore the coordination between the two could lead to better results (C. Rodríguez-Cadena, personal communication, 2001). In the words of the General Director of Student Welfare at that time, “this kind of programs cannot work without the support of the students, thus the creation of a community service program by his office, could involve students in the program and at the same time allow the students to fulfill their mandatory community service requirement” (N. López-Aguilar, personal communication, 2001).

Although the suggestion made by the coordinator was to start a pilot program in the Mexicali Campus, the Rector decided that the Waste Management Program should be implemented at the same time within all university Campuses, that is, in Tijuana, Mexicali, Ensenada, and Tecate. He also decided that the program should begin in February 2001 together with the beginning of the next school term. This decision was made because the rector wanted all the campuses to participate and that they all benefit of the program the same (Beltrán-Corona, personal communication March 8th, 2005).

The first activity of the coordinator was to visit all the facilities of the institution in order to get to know where would be the best location for the recycling bins. Based on her observations of the main flows of people and on the types of wastes generated in different places, the coordinator suggested the most appropriate locations for the recycling bins. Yet, in spite of her suggestions, janitors located the bins where they considered it to be the best place. This decision was made because the locations suggested by the coordinator would require more work for the janitors and this created problems (L. A. Velarde, personal communication, 2001).

During this first phase of the program financial resources were allocated to the coordinator. These were supposed to cover one year of activities of the program.

Summarizing this first phase of the waste management program it can be said this was a period of hope for the program because it received the support from the top management. Different tasks were appointed to different people and all the head of departments involved seemed willing to participate in the program. The recycling bins were acquired. The coordinator analyzed the best places to place them. This is when the first signs of resistance were apparent. Janitors were reluctant to comply with the recommendations made by the coordinator.

4.2.5.2 Phase 2: Launching of the program (February 2001)

The program was launched within the whole university system. However, the focus of the program was on the Mexicali campus because the coordinator was stationed there.

On February 13th, 2001 the Rector at the ceremony of the beginning of the new school term, publicly announced the program. From that moment on, the waste management program was officially initiated. The rector invited the community of the university to participate in the program by separating wastes into the corresponding recycling bins. The future of the program seemed promising at that time.

With the help of the Rector the next step was to create support in the organization. The most important people to mobilize were the heads of the departments. It was expected that once they were mobilized they could synergize the people at the various levels within their departments. Therefore, the Rector invited all the directors and heads of departments during the directors weekly breakfast to participate in the program. The coordinator was also present during the breakfast so she could describe the details of the program, answer questions and explain the different ways to participate in the program.

In order to get support, the directors of schools, faculties, institutes or administrative units were asked to appoint a person in each department to be in charge of supervising the program there. That person would be the program's promoter at his or her academic unit. In addition to the personal request made by the rector, a request was sent in written form to each of the deans of academic faculties and general directors of administrative departments. So the commitment of the rector was also translated in practical terms.

All of the promoters appointed at the academic units to support the waste management program were people sensitive in some way to the adequate management of waste, or who's academic or administrative work had some connection with this topic. Therefore, they were interested in participating in the program. Because of the awareness that this group of people was supposed to have towards the issue of waste, and because of their proximity to students and other faculty members, it was expected that they would be key actors in the program. It was also expected that they would be creative and active in the search for solutions when problems would arise.

For the sake of uniformity the operation at all the faculties and administrative offices, workshops were organized that covered the following elements:

1. Reasons for the program's existence,
2. Mission, objectives and goals of the program.
3. Students' participation in the activities of spreading and supervision of the program,
4. Strategies for a successful operation of the program,

5. Experiences of similar programs in other parts of Mexico and the world.

The workshops were held at various locations throughout all three campuses. There was financial support from the Rector's office to ensure the attendance of all promoters to these workshops. This support consisted of transportation to and from the host campus, as well as food and lodging, should it be necessary. In addition support was provided by supplying materials necessary for the workshop.

At the first two workshops, there were academic guests who shared their experiences with solid waste management at various institutions, both educational as well as in the industrial and the service sectors. The Master in Science, Paulino Luna, was invited to the first one from the Environmental Protection Agency (EPA) in California. The guest of the second workshop was Dr. Paul S. Phillips from Northampton University College, UK. Both accepted the invitation. No costs were involved for the UABC for their visit, since the guests charged no fees for the workshops given.

It seems that this is good place to question what were the real motives of these promoters for attending to these workshops? ³. Four of them declared that they were truly convinced of the need to have a waste management program at the university. According to them the feeling of doing the things right was greater than any economic incentive or other kind of reward (L. Gómez, E.G. Carrillo, C. Castillo, and D. Vásquez, personal communication, December 9th, 2004). Two other promoters recognized that they were expecting to have an incentive or some kind of reward (G. C. Díaz, personal communication, December 10th, 2004; E.Leyva, personal communication, December 10th, 2004). One of them mentioned that their effort would reward them with an extra academic activity. The six promoters interviewed admitted they would have dedicated more time to the program if they had been allocated more time to do so (L. Gómez, E.G. Carrillo, C. Castillo, D. Vásquez, G. C. Díaz, E.Leyva, personal communication, December 10th, 2004). This is because the tasks required for the waste management program were an added workload to their already filled work schedule.

The response of the promoters to the workshops was positive; there was 90 % attendance. The special opportunity that having this type of researcher offered was used to invite the whole university community to the workshops. All three events had the attendance of the academic, industrial and service sectors.

After the workshops, the change agent kept in touch with the promoters through e-mail and/or personally with those on the Mexicali campus, in order to follow up on their respective the activities and provide help, should it be necessary. Their task was to involve students, to disseminate the mission and objectives of the program and to create activities that would motivate the community to participate in the program. Because the activities of the waste management program were an extra load to their everyday activities, they didn't have much time for them (L. Gómez, E.G. Carrillo, C. Castillo, D. Vásquez, G. C. Díaz, E.Leyva, personal communication, December 10th, 2004). As a result their success was limited. Only three out of the fifteen promoters of the program reported several activities to the coordinator. Among these activities were participation in environmental events, involvement of students in waste separation practices, and training of students to spread the word about the program.

The janitors group was another group that was important to mobilize. Janitors are in charge of picking-up the trash bins and disposing-off the waste in the temporary disposal site. From the very onset of the program, they were also in charge of handling the recycling bins. It was truly important to get their support because of their role in the program. It was imperative they be informed about the way the recycling bins should be managed, the reason for the program and the channels of communications with the coordinator of the program. To do this, the coordinator had several meetings with janitors and their supervisors. Some of them were willing to cooperate and expressed some ideas that would help the coordination of activities. At the meeting it was generally agreed upon that the janitors' supervisors would be the link between the coordinator and the janitors.

4.2.5.3 Phase 3: Performance of the waste management program (from February 2001 to December, 2002- before the new administration).

Information and communication

The next activities carried out by the coordinator of the waste management program focused on spreading the new program both through the institution's media (university newsletter, University Radio station and, University TV Channel) and through classroom lectures, posters, stickers, banners, brochures and a Web page created specifically for the program

(<http://insting.mx/uabc.mx/reciclaje/reciclaje.html>).

³ Individual interviews were carried out. Because of the difficulty to find them all, interviews were only possible with six of the promoters.

The solid waste management program Website at UABC was specifically built to inform about the function, mission, objectives and goals of the program. This site also had a space for comments and suggestions regarding the program's function and for providing information on the progress and achievements of the program. Lastly, the program's Website contained information about the importance of the proper management of waste, the main processes involved in the transformation of waste to be recycled as well as links to other sites related to solid waste management.

The mission of the program was published in the University Newsletter (*Gaceta Universitaria*), together with its objectives and goals, encouraging the whole university community to participate and suggest ways to improve the program.

Another way to distribute the information within to the university community was through e-mail. Several messages containing the program's information were sent to all students, teaching and administrative staff at UABC. In addition to transmitting information, these messages were also used to remind the university community of the importance of all the university students' participation so that the solid waste program could be successful.

There were three types of information transmitted on the university television channel: 1) through interviews with the coordinator in which she explained the logistics of the waste management program, and the different ways that the community could participate; 2) taped programs with actors representing various waste management situations and explaining the new way of separating the recyclable waste and waste reduction strategies; and 3) informative spots in which, in a summarized way, information about the program was given and the community was encouraged to participate and visit the Website to get more information. Both the interviews and the taped programs were aired twice a week for 18 months with different schedules. The informative spots were aired daily, five times per day, during the commercial spaces on UABC's television channel.

There were two kinds of information transmitted on the radio: 1) interviews with the coordinator of the program and 2) informative spots. The format was similar to the one used on TV.

The posters and banners for the waste management program were put up in classrooms and hallways in most of UABC's buildings. In addition, banners were placed on the sports fields of the three main campuses.

Another strategy for spreading information about the program was through classroom short talks given by students. A group of 45 students was trained, all of them fulfilling their community service requirement. The training consisted of explaining to the students what the program was about, its objectives and goals, in such a way that the trained students could pass this information on

to the groups they would be visiting. In order to recognize the students presenting the lectures as members of the program, they were given t-shirts with the program's name and logo, in addition to a name tag signed by the coordinator of the solid waste management program. The stickers and informative brochures were handed out personally to the university students after the classroom talks about the program.

All these informative strategies were used simultaneously during the first 30 months of the program. All these informative actions seemed to lay a proper foundation for further implementation of the waste management program.

The main objective of the information campaign was to spread information about the program to the university's community, even though the information also reached the external environment. As a result after the first month of the campaign the coordinator of the program received several calls. The community, especially the principals of kinder-gardens, primary and secondary schools were interested in receiving advice about how to start waste management programs of their own. Principals from different schools also invited the coordinator of the program to give speeches to their students about the proper waste handling options.

In order to be informed about the way in which the banners, posters and recycling bins were being used and handled, the coordinator also asked the 45 social service students to fill-out reports once a week. These reports were checklists containing information about the cleanness of the bins, the frequency with which they empty them, and the location of the posters and banners or absence thereof. The report also contained a blank space in which the students could indicate observations that the coordinator should know about. Based on these reports the coordinator communicated with the janitors' supervisor to solve the problems detected by the students.

Negative results

In spite of the efforts to provide information about the program and train those involved in it, as described in the above sections, the expected results were not obtained in this phase of the program. Different factors prevented the program from functioning as was hoped. The events that most harmed the program were: the wrong location of the recycling bins, the negative attitude of the janitors, contamination of recyclables, the need for relocating the temporary disposal site for waste, and the bad service provided by the private company hired for transporting and disposing-off waste.

Location of recyclables containers – contamination of recyclables

In spite of the commitment of the Head of the General Department of Works and installations (DGOI) to check with the program coordinator for the location of the containers for separating recyclables, the janitors were the ones who made the decision concerning this location. In this way, some of the containers were placed in locations hardly visited by the students. The opposite also happened; some of the sites most frequently visited by the students had no bins for separating recyclables.

Another matter related to the location of containers is that no trash containers were placed beside the recyclables containers. As a result, non-recyclables were also placed in bins for recyclables. This led to the creation of a mixture of waste and pollution of the recyclables. Once again, the coordinator told the supervisor to place trash bins close to the recycling bins. Even though they agreed on this, the supervisor never did it.

Other problems arose when the coordinator suggested that the bins for separating paper should be placed at sites where more recyclable paper waste was generated, that is, in offices, near copy machines and near secretaries' desks. In spite of these recommendations, the DGOI staff placed the bins for used paper in hallways and courtyards, despite the fact that these locations did not generate paper with the necessary characteristics for being recycled. Therefore, these bins got filled with food wax paper, damp paper, and paper cups, as well as with other types of waste which are not recyclable.

All this began to upset the university community, who, rightly, began to criticize the way in which the program had been started. The coordinator received all sorts of complaints related to the location of containers (Social Service Student's reports 2001-2002). At a number of occasions, the coordinator asked the DGOI authorities to change the location of the recyclables containers. However, they never did in spite of agreeing to comply with the request. The order from the director of works and facilities to change the position of the bins was supposed to be passed on to the office of maintenance (C. Rodríguez-Cadena, personal communication, 2002). But that order was never received by said office (C. Landeros, personal communication, 2002). Therefore the message never reached the janitor's supervisors (R. Gurrola, personal communication, 2002) and consequently the janitors didn't either (G. González, J. Martínez, M. Galván, personal communication, 2002).

The above developments show that the coordinator had a total lack of power. Nothing of what she suggested or asked to be done had a positive effect. Why did the supervisors and janitors not

respond to the suggestions made by the coordinator? ⁴ The supervisor said that neither he nor the other janitors and supervisors believed in the program. He added that the coordinator was not their boss and therefore, they did not have to follow the coordinator's orders. Moreover he stressed that the female coordinator was not accepted by the janitors because waste was a men's job (Anonymous, personal communication, March 15th, 2005). The new routines and extra bins to be handled were not considered to be part of the job descriptions of janitors. This made it hard to involve janitors in the new procedures (G. González and J. Martínez, personal communication, August 20, 2004). In addition, janitors felt that they should have been heard during the planning phase of the new waste management program because they were in the end the ones that would be handling waste and recyclables (G. González, personal communication, August 20, 2004). Janitors also stated that their bosses never told them anything about the program, and that they didn't feel any commitment to these new activities from the top level administrators (Anonymous, personal communication, March 15th, 2005).

This negative attitude of janitors even escalated further more when trash was being placed in the recycling bins. The coordinator reported this situation to the corresponding supervisor hoping that corrective actions were put in place, however it was in vain.

Another problematic situation was the janitor's reluctance to handle more bins than they did before the program. Although it was explained to them that the new waste management system required extra bins and thus more work for the janitors. The janitors were not supportive (G. González and J. Martínez, personal communication, August 20, 2004). Despite the fact that this was reported to the maintenance supervisors, the janitors were never reprimanded. As a result these situations continued to exist in the months that followed. According to one of the supervisors it was not possible to make the janitors work more than it is specified in their job description, the activities that had to be carried out in the new waste management program weren't part of their job description (Anonymous, personal communication, March 15th, 2005).

Problems faced by UABC's community

The problems faced by students and faculty were in part the consequence of the situation described above. Due to the inconvenient locations the bins were placed at, students and faculty members used the recycling bins for disposing non-recyclable waste, thus creating a waste mixture that could not be sold. The attitude of the janitors also had an impact on the behavior of students. Several of the social service reports (Students reports 2001-2002) described how the students were

⁴ Five interviews were made for answering this question.

discouraged to place recyclables in the proper bins when they saw the janitors disposing all kinds of waste in them.

Another important fact that discouraged students and professors alike was the fact that janitors were mixing recyclables with non-recyclables at the temporary disposal site. This situation was also recorded in the student's reports (Students Reports 2001-2002).

Selling of recyclables

None of the two local private companies that usually bought recyclables were willing to receive mixed waste. Therefore, during the first 24 months not even one kilogram of recyclable materials generated in classrooms and halls could be sold. Although there were people that respected the separation of their waste, most of the university community did not.

In offices it was easier to separate some types of waste like paper or plastics but there were also problems in selling them. In the case of separated plastic bottles, the coordinator contacted the recycling companies when a considerable quantity of plastics at UABC had been collected, without any success however. The market for recyclable plastics was closed for the moment but the date for reopening was uncertain. As a result the plastics had to be deposited with the rest of the non-recyclable wastes and taken to the landfill. The same was the case for recyclable paper. Even though only two local companies for paper recycling existed, one of them had to close. It turn out not to be profitable to recycle paper in Baja California because of the poor quality of used paper (A. Mendoza, personal communication, 2003).

A problem that aggravated all this further was that generally speaking, the recycling market in the state of Baja California was almost non-existent. The so called "local recycling companies" were brokers of intermediaries that sold the recyclables to USA recycling companies (Bandrés, R. personal communication, February 12th, 2003). The Mexican brokers business was dependent on the health of the recycling markets in the USA.

Changing the location of the temporary waste disposal site

The temporary waste disposal site was only a few meters away from the Accounting and Business Administration Faculty and the Research and Postgraduate building. The proximity of the waste disposal site to those buildings had a series of negative effects on the university community, such as: bad smells due to the decay of organic waste, deterioration of the landscape, attraction of rodents, and proliferation of insects. In addition, the loading activities of the waste collector truck were performed at a time when lots of students were around and the traffic on the adjacent streets was busy. These problems were recorded in the student's reports (2001-2002) and confirmed by the

complaints reported to the maintenance department (V. Arroyo, personal communication, 2002). Also a note published in the local newspaper (Anonymous, 2002) reported the bad image of the UABC's temporary disposal site for waste.

Based on the student's reports and on the complaints reported to the maintenance department, the coordinator suggested to the DGOI authorities that an alternate site be found for the temporary disposal of that waste. The response to this suggestion was that the situation was not affecting anyone, besides there were no other spots available for it. A couple of months later, there were more complaints from professors and students at the Accounting and Business Administration Faculty due to the presence of rats in the building. In the face of such complaints, the DGOI laid a concrete floor at the site, thus preventing rats from burrowing there any further. Nevertheless, the temporary disposal site remained at the same place.

In addition to the above described problems, the process of waste collection was also problematic. The main problem was the lack of reliability for collecting the waste. This resulted in a constant accumulation of waste, the proliferation of insects and in a persistent bad smell. Based on these problems the coordinator of the program suggested to the authorities of the General Department of Works and Installations (DGOI) to find another company who could provide a cleaner and more trustworthy service. The reply to this suggestion was that they were not willing to find another company because they had always worked with this one and they could not find a better option for the same price. As a result the possibility of changing waste collection companies was not even considered during this stage. The coordinator of the waste management program did not accept this situation. Despite the resistance of the people at DGOI she decided to show the plausibility of hiring another company for the same price. To do this she needed the invoices of the actual service. However permission to access that information was denied as well.

In view of the problems described so far the coordinator followed another strategy. In order to have feedback and to try to understand why the people were reluctant to participate in the program, she constructed a questionnaire. A group of 30 social service students helped to get these questionnaires distributed and filled in by students, faculty members, administrative staff and janitors (Annex II).

The events of this phase evidenced two main characteristics: 1) the coordinator's lack of power and 2) the resistance showed by janitors, their supervisors and all the people involved in the program to make the changes required by the waste program. As a result of the former it was impossible for the coordinator to change the temporary disposal site for waste and the hiring of a new company to collect and transport the waste to the disposal site as well. As a consequence of the latter a series of related events took place: the recycling bins were placed in the wrong locations which promoted the

disposal of mixed waste that at the same time caused the impossibility to sell the recyclables. As a result of all these events the program acquired a bad reputation and image. In addition the UABC's community became reluctant to get involved. Despite of these negative results this phase the information and communication campaign was implemented without problems. Other result that can be considered positive is the response that the program had from outside the organization.

4.2.5.4 Phase 4: Performance of the WMP in a transition phase (January 2003 to August 2003)

Despite the results of the previous phase of the program, the possibility of a new administration, with new ideas and people brought hope for the program. The possibility to gain support from top management could synergize those at the lower levels of the institution. As a result, it was hoped the program could start having better results. This was a promising stage.

The renewed sense of hope was based on the change of administration. Every four years the administration of the University changes and is replaced by a new rector. Each new rector has the power to replace the heads of departments and the people inside the administrative departments according to his development plans for the institution. This was also the case when a new rector took position in December 2002. The new organizational structure he proposed offered a promising perspective for the waste management program as new people would be appointed in key positions. These people might be more willing to cooperate than the previous ones. The administration key positions that primarily affected the waste management program were: Director of the Department of Works and Installations (DGOI), the chief of the Maintenance Office, and the group of janitor's supervisors.

During the first six months of the new administration the organizational structure remained the same but the people inside the departments changed. This however, did not elicit a positive response to the waste management program. During this phase not only did the planning of the new organizational structure was taking place but, events such as the curricular reform, the planning of the process for downsizing the administrative and academic departments, and the fusion of diverse departments as well. There were too many changes going on in the university. The newly appointed people were so involved with all these changes and planning processes that the future of the waste management program became uncertain. Despite the fact the waste management program was left at the back burner, there was still hope that upon the conclusion of the restructuring phase, the program envision could still be viable. It was expected to take place during the second half of the year 2003. However in practice the situation didn't improve.

When the new rector took position, he visited each of the Faculties and Institutes of the University to invite the students and faculty members to work in coordination to the new Institutional Development Plan and with the ideals and mission of UABC. During his visit to the Institute of Engineering, the coordinator of the program asked the Rector what the future of the Waste Management Program at UABC would be. In reply to this question, the Rector said “I’m personally interested in protecting the environment”. He also admitted that he had felt very happy when the waste management program had started in 2001. He felt UABC would finally be doing something positive with its waste, which made him stop feeling guilty about tossing recyclable waste in the trashcan. He mentioned that “the faults that appeared in the program did not surprise me, since the planning had been carried out in a wrong way from the start. The main mistake had been to give the coordination of the program to an academic whose performance was being evaluated under different criteria” (Mungaray, personal communication, August, 2003). He further said “I’m convinced that the institutional waste should be managed and that, as an economist, I fully understand the impact of such a program on the institution” (Mungaray, personal communication, January, 2003). Lastly, the Rector asked the coordinator to turn in a report of the program’s activities performed to date, describing its achievements as well as the main obstacles the program had faced.

The coordinator of the program responded to his request and delivered the report to the new rector. Two weeks later the coordinator received a call from the new Director of the General Department of Works and Installations (DGOI) at UABC, Engineer Oscar A. Leppe Peralta, asking to arrange a meeting with him concerning the management of institutional solid waste.

The meeting was attended by the Head of the Department of Works and Installations, the new chief of the maintenance department at UABC’s Mexicali campus, an analyst from the DGOI, Architect Virginia Arroyo (mentioned in the second section of this chapter for having been the first person to propose a paper recycling program at UABC) and the waste program coordinator. At this meeting, the DGOI director told the coordinator that the Rector had assigned to the DGOI the coordination of the solid waste program. As a result the coordinator until that time had to resign, so that the job could be left to DGOI. In principle, this shift in responsibility could be seen as an improvement for the waste management program. The lead was put in the hands of a person with more power and authority. Moreover the rector instructed the director of DGOI to keep the former coordinator on board as an advisor so that she could stay involved in the program.

Once the director of DGOI was informed about the activities carried out by the former coordinator, the DGOI, under its new management, began the activities for the waste management program.

However, nobody took the position as coordinator of the waste management program because downsizing was taking place. It was an analyst of DGOI who inherited the job.

In spite of the downsizing, positive things did happen. Under the new administration some of the old problems were solved that couldn't be fixed during the previous administration. The first problem solved was the replacement of the current waste company for another one that collected the trash and transported it to the landfill.

The first activity of the DGOI was to seek potential companies to whom the separated recyclable waste could be delivered. To analyze the convenience for changing to a new waste company it was necessary to know how much UABC was spending on the issue of picking-up, transporting and disposing waste. The person in charge of the billing information was new in the position but wasn't reluctant to share the information with the analyst from DGOI. With the information obtained, it was possible to know the yearly expenditures of UABC's Mexicali campus for the collection, transportation and final disposal of solid waste. This information showed the financial viability of changing to another waste management company named Procesos de Reciclaje Industrial, S.A. de C.V. - PRISA.

Contact was made with the recycling company (PRISA), who immediately sent a representative over to talk with the DGOI director and the other people involved. After three more business meetings with the company representative, an agreement was finally reached concerning the periodicity and technical aspects of the collection system (V. Arroyo, personal communication, March 2003). PRISA would be in charge of collecting residual paper to be recycled. The terms and conditions of the contract had been agreed including the price per ton of paper delivered and for the transportation of the same. The contract for PRISA's services was ready. However, the company's legal representative never showed up to sign the contract, nor did he ever contact the DGOI or UABC's staff. As a result, the institution had to find a new company to take charge of the recyclable materials collection services. Without a contract no service could be hired to collect the waste from UABC.

A new company was approached named Professional Recycling, S.A. de C.V. – PROREC. As before, business meetings both with the two company representatives and its manager were held. This company turned out to be a more attractive option for the university, since it had recently merged with different companies, each of which worked with different types of recyclable waste. Furthermore, this company also offered the services of collection and transportation of the solid waste to the landfill. After several meetings, it was agreed to work with PROREC both for recyclable and solid waste.

According to the analyst of the DGOI working with PRO-REC provided certain advantages such as:

1. Dealing with a single company reduced the time to reach agreements and problem-solving, as opposed to working with many companies, each one dealing with separate types of waste. In the past, one company managed the trash and different companies would have to be hired for each type of waste streams (recyclables and non recyclables).
2. PRO-REC offered a better price for managing the non-recyclable solid waste, which would result in a \$122,000.00 pesos saving a year, signifying a 19% annual savings in waste disposal.
3. PRO-REC's collection system is cleaner and more efficient than the company UABC used before, and it would result in a better image for UABC, with less negative impacts during waste management.
4. PRO-REC would loan (for as long as the contract lasted with the company) the containers for the temporary waste disposal, thus the waste would no longer have to be piled on the ground. Consequently, UABC would save money by not having to invest in purchasing containers.
5. PRO-REC also supplied, on a loan basis, the containers for the temporary storing of recyclable waste separated at UABC.

For all these reasons, UABC decided to terminate the contract with the previous company and begin waste management with PRO-REC. "This new company is better organized and has more adequate and modern equipment; this will make the process more efficient", stated the person in charge of the office of maintenance and cleaning (R. Velarde, personal communication, April 2003), As has already been mentioned, PRO-REC would also be in charge of collecting and transporting the recyclable waste segregated from UABC's waste. The agreement with PRO-REC included that the company would not pay UABC for this waste; instead, it would give a discount for the amount equivalent to the recyclables obtained from the invoice for non-recyclable waste transportation and final disposal. In this way, the larger the amount of recyclable waste separated by UABC, the lower the cost for waste transportation and final disposal.

Another problem also solved under this new administration was the bad situation that the temporary disposal site for waste caused. The replacement of this site was triggered by a note in one of the most important local newspaper that helped as a catalyst for change of the waste disposal site. The note

was written by a very well known academic now working for the municipal government. He complained about the waste disposal site of the university, stating that the university was creating an image of an institution that didn't care about the community (El Mexicano, 5 de Febrero 2003). In face of this complaint, it was the UABC's Rector himself who asked the DGOI director to relocate of the temporary solid waste disposal site (R. Velarde, personal communication, May 8th, 2003).

The problem of the wrong location of the bins for recycled paper was solved during this administration as well. This time the analyst of the DGOI participating in the program asked for the relocation. But, it came to fruition only after convincing one of the janitor's supervisors to go along with the relocation (V. Arroyo, personal communication, April, 2003). During the relocation of the bins the analyst of the DGOI was also present to avoid a new bad location. She stated the task wasn't easy because of the reluctance of the janitors appointed to do the job (V. Arroyo, personal communication, April, 2003). The analyst also allocated funds to buy more bins for recycled paper being placed in the offices (V. Arroyo, personal communication, April, 2003)

In spite of all these good initiatives during the new administration the problem of the mixed waste continued to exist. This was due to the fact that the people (students, janitors, administrative staff and faculty staff) were still mixing the waste in the bins. According to the analyst of DGOI several bins for non-recyclables were still needed near the recycling bins (V. Arroyo, personal communication, April, 2003). Therefore it was impossible to sell the recyclables to the private company. Instead all the waste (including recyclables) was still being disposed in the municipal landfill.

Problems were not limited to the recycling bins. During this phase janitors were still reluctant to separate recyclables because this activity was not in their job description (R. Velarde, personal communication, April, 2003). The analyst from DGOI office along with the former coordinator reported this situation to the Director of the DGOI office. He told them that written rules, policies and procedures were needed to formalize the program. He believed that once the program was formalized and the activities related to the program were described, it would be easier to add these activities to the job description of janitors and all the people involved in the program (O. A. Leppe-Peralta, personal communication, April 2003). During the next month the former coordinator of the waste program along with the analyst worked on the draft paper for waste regulations at UABC. They reviewed environmental policies written for other universities and in particular special attention was paid to the policies for waste management. Based on these policies and in Mexican regulations for waste they wrote the environmental and waste policies for UABC. They also

worked on the description of the activities required by the waste program to be performed by students, faculty members, administrative staff and janitors. These documents included the description of objectives for the waste program, the reasons why UABC should be acting to prevent waste generation, the reason why recycling, reusing and reduction measures were good alternatives for waste, and the implications of this program for the community.

In May, 2003 they delivered the draft papers to different authorities of the institution. The authorities who were given the documents were: the Secretary General, the Attorney General, the DGOI director and the Head of Maintenance. The only authority that replied was the DGOI director, who made a couple of amendments to the documents and informed the former coordinator and the analyst that he would personally talk to the other authorities to hear their opinions on the paper.

A couple of weeks after having submitted the draft regulations, the analyst from DGOI was informed that the documents were being reviewed by the University's attorney. Once he approved of them, the Rector would have to authorize them. After that they could be published in the *Gaceta Universitaria* (University Newsletter), which is UABC's official communication medium. The university laws and regulations are enforced once they appear in the *Gaceta Universitaria* (University Newsletter). After several calls to know what was the status of the reviewing process, the attorney office answered that, in the face of all the changes taking place at UABC, it was difficult to pay any attention to waste management issues. Until January 2006 none of the regulations were published yet.

Summarizing the events that took place during this period it can be said that it was a roller coaster phase. At the beginning of this phase there was hope since new people took key positions. After that, there was a generalized feeling of uncertainty throughout the university resulting from the different changes that were taking place. This climate of uncertainty included the fact that the waste program coordination changed hands to the DGOI. Once there two of the old problems were solved: the relocation of the temporary disposal site for waste and the hiring of a more reliable company for waste collection. These events had brought new hope for the program again; after all these were signs that the waste program had taken a positive turn. Nevertheless this impression didn't last much. The lack of attention to the waste policies submitted to key people in the university was a clear indication that waste management issues were not important at UABC.

4.2.5.5 Phase 5. The implementation of the new organizational structure (August 2003 on).

What were the main changes in the organizational structure made? What impact did they have on the waste management program?

During the first semester of 2003, the previous organizational chart (Figure 13) was kept while the consensus for the University Reform was made. During the second semester of 2003, the university reform was set in motion with the corresponding changes to the organizational chart (Figure 14). This also influenced the waste management program. In the chart showed in Figure 13 the coordinator of the waste program is located as a faculty staff member (researcher) within a research institute. The department of works and facilities is located in the general directions' box. Both the position of the coordinator/researcher and the office of works and facilities are highlighted and shaded in Figure 13.

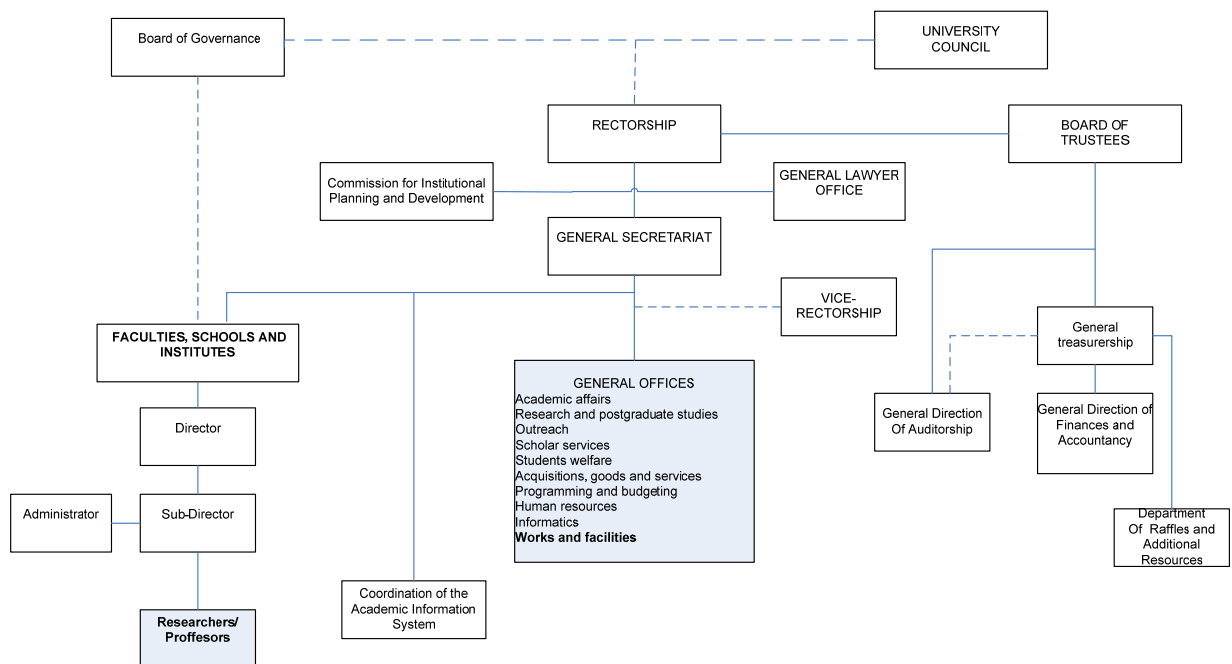


Figure 13. UABC's organizational chart before the institutional restructuring process

Within the decentralization of administrative activities considered by the University Reform, Vice-Rectors were appointed at each of the campuses, favoring the decentralization operation of the support services for the substantive activities which were now the responsibility of each Vice-Rectorship on the corresponding campus. With this change, the continuity of the waste management program at each campus now depended on one of the three Vice-Rectorships. In practical terms, this signified the disappearance of the program, unless the Vice-Rectors themselves decided to rescue it on any one of the campuses. This didn't happen in any of the campuses meaning that the waste management program stopped in the four campuses.

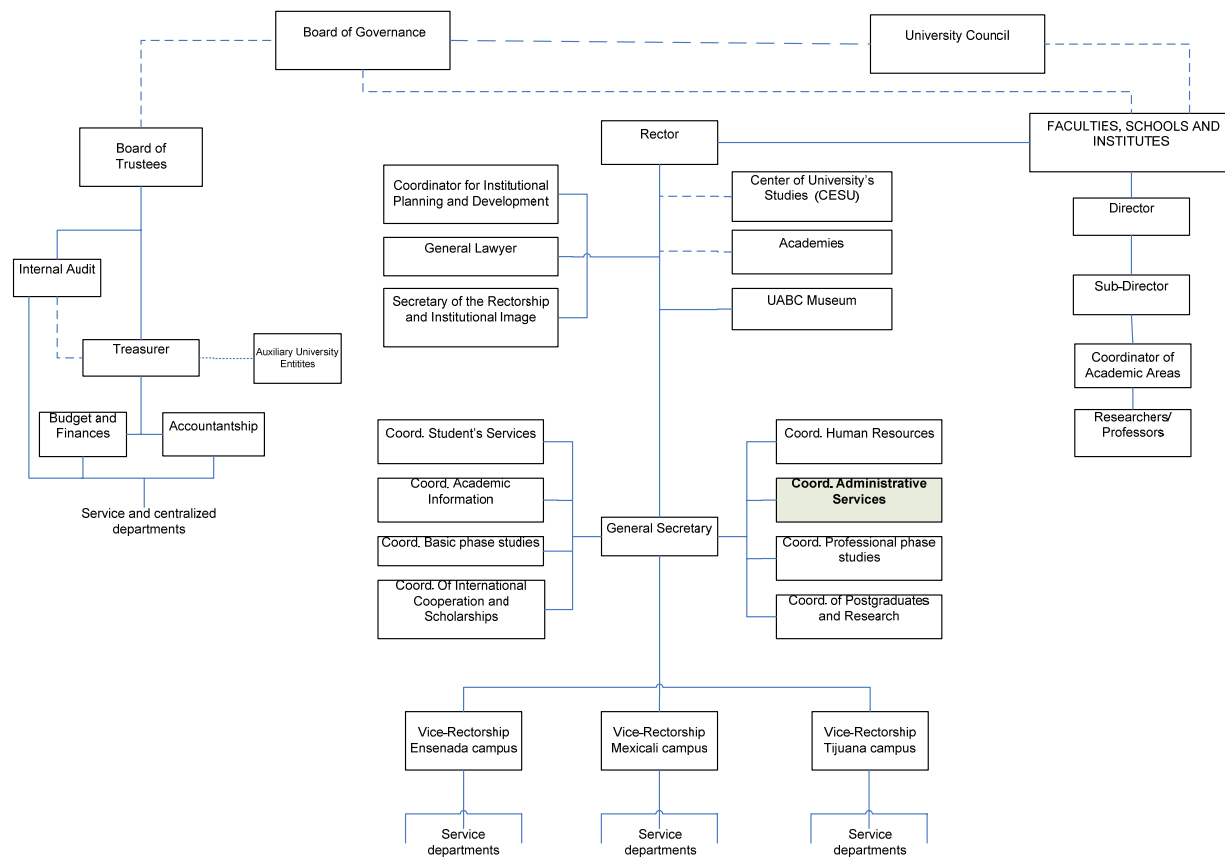


Figure 14. UABC's organizational chart after the institutional restructuring process.

The Office of Works and Facilities disappeared (Figure 14). Under this new organizational chart coordination offices were created instead of general offices. The head of each coordination office would dictate the general institutional guidelines within its duties but the acting entities would be under the supervision of each vice-rectorship. Under this new organizational scheme the cleaning and waste management activities should be carried out within the framework of the guidelines

dictated by the Coordination of Administrative Services (CAS). However the people in charge of the cleaning and waste management duties would work under the supervision of each vice-rectorship. This means that if CAS decided to support the waste management program, each office of maintenance under their respective vice-rectorship would have to follow the institutional waste management guidelines. Nevertheless CAS didn't support the program. The waste management program was not handed over from the former Office of Works and Facilities to the newly created Coordination of Administrative Services (A. Jabalera, personal communication, April 8th, 2005). This implied that no report or general information about the waste management program was provided to the new Coordinator of Administrative Services. In the words of the Coordinator of Administrative Services "...I didn't even know that such a program existed" (A. Jabalera, personal communication, April 8th, 2005). For the waste program this meant that any aim at reduction, recycling or reusing of waste would be isolated initiatives such as those that occurred before the program. In this respect the situation was quite comparable to the one before the replacement program.

As a consequence of the new organizational structure, personnel were relocated. The analyst who made the first efforts towards paper recycling at the University was placed in the Office of Maintenance under the Mexicali's Vice-Rectorship. For the waste management program this meant its survival, because this person was willing to look forward to its continuity at least in the Mexicali campus (V. Arroyo, personal communication, September, 2003). She requested an interview with the UABC Vice-Rector in Mexicali seeking to formalize the program and, through that, get the support the program needed to survive. The interview was held on October 14th, 2003. At this meeting the analyst related the history of the waste management program to the Vice-Rector, from its humble beginnings to the date of the interview. He was asked for support in continuing the program and the need for a specific budget, as well as for regulations and the appointment of a person who would be in charge of the program. The Vice-Rector responded positively to this request, but asked for an executive project proposal in which the financial needs as well as the objectives and goals for 2004 would be underpinned. The document had to be drafted and signed by the Head of Maintenance Department (Meeting Minute, October 14th, 2003).

The analyst from the Office of Maintenance reported to the Coordinator of Administrative Services at a University level and the Head of the Maintenance Department, to tell them what the Vice-Rector had asked to do. Together they agreed that the analyst would draft the project proposal and submit it to the Coordinator. He would review and modify the draft according to his own view. In October 20th, the draft document was sent to the Coordinator. Several times after that, she got in

touch with him in order to find out the progress of the document, or to know if it had already been delivered to the Vice-Rector. His response was that for the time being there were more important things to be done, due to which the waste program had to wait (V. Arroyo, personal communication, March 2004). Until the date of finishing this thesis (January, 2006) the executive project for the solid waste program was still not delivered to the Vice-Rector in Mexicali.

Summarizing the events described so far during this phase, it can be said that initially the support from the rector was there. He personally asked the director of Works and Facilities Office (DGOI) to continue the activities of the waste management program. He did so until he was substituted by the Coordinator of Administrative Services. From that point in time the waste management program was non-existent. In order to continue the activities of the program an executive project would have to be delivered to the vice-rector. This document would have to be approved by the Coordinator of Administrative Services, but this person never emitted any opinion about the executive project.

In spite of these facts the analyst from the Office of Maintenance continued working as an “un-official coordinator” for the waste management program. The waste management activities in the Mexicali campus then focused on the separation of used oil from kitchens, toner cartridges, and organic waste. These wastes were delivered to private recycling companies. In the case of the used oil from kitchens it was mixed with straw to feed animals. The selling of aluminum was problematic because of the presence of waste-pickers who took the aluminum from the recycling bins and sold it (V. Arroyo, personal communication, January 25th, 2005; R. Moreno, personal communication, April 8th, 2005).

The waste management program seemed hopeless. The only activities of the program that were carried out were done by the analyst from the Office of Maintenance and these activities were done without budget or any other support. But in December 2004 something happened. A series of public denunciations about the way UABC was managing its bio-infectious hazardous waste led to an audit from the government’s environmental authorities (A. Mungaray-Lagarda personal communication, April 5, 2005 and M. Rivas, personal communication, April 8th, 2005). As a result of government audits a series of fines were meted to UABC. These events were bad for UABC’s image and budget. The rector himself took action! He decided to improve the way in which bio-infectious waste was handled in the institution. The rector also decided to adhere to the concept of “clean industry” that the government was promoting within the industrial sector. He therefore announced his intention to become a “Clean University” (A. Mungaray-Lagarda, personal communication, April 5, 2005). To put this idea into practice a committee was formed, named “committee of environmental quality”. This committee was supposed to support all activities

performed at UABC that would lead to an improvement of the environmental performance. A Faculty director of each of the three main campuses was appointed as the coordinator of the environmental quality committee in their respective campus. After being formed, this committee acquired funds to build suitable temporary disposal sites for bio-infectious wastes, and to train the people inside the university that were in charge of handling and transporting this kind of waste within the university's boundaries (M. Rivas, personal communication, April 8th, 2005). According to one of the participants, who preferred to remain anonymous in this work, economic constraints were absent. The issue of bio-infectious waste was considered an "urgent program". "*As soon as we had an economic need to do our job the money got into our hands very quickly*", she stated (Anonymous informant, personal communication, April 9th, 2005).

As the events described above were taking place it was expected by the people working at the Office of Maintenance that the environmental quality committee would communicate with them to also include non-hazardous solid waste management in the so called "Clean University" (R. Moreno, personal communication, April 9, 2005). This however did not happen (V. Arroyo and R. Moreno, personal communication, April 8th, 2005).

Nevertheless the chief of the Office of Maintenance decided to continue their waste management activities in spite of the absence of communication with the Environmental Quality Committee. Due to the perseverance of the chief of the Office of Maintenance the program was kept alive (Arroyo, personal communication, January 10th, 2005). He had several ideas to make the waste program work and to involve students as well as heads of other departments within the university. Among his ideas were:

- A compost project: For this project he already had permission to use a piece of ground that belonged to the Veterinary Faculty. A caterpillar tractor was available to move the soil and also a vehicle to transport organic waste to that site. For this project the only thing needed was money to buy diesel and gasoline for the tractor and the vehicle.
- Special lids for recycling bins: Special lids were designed for the bins used to separate metal cans. This was done to avoid waste-picking activities at the University (especially for metal waste-picking). At the same time these lids only permit to dispose metal cans in these bins and no other types of waste.
- A waste compactor: To reduce the costs related to waste disposal and transportation; a compacting machine was needed. For compacted waste requires far less space to be stored when it is transported to the municipal landfill.

For all the activities mentioned above economical resources were needed. This was told to the Coordinator of Administrative Services but with negative results. He answered that those activities were no priority for the institution (R. Moreno, personal communication, April, 8th, 2005). In addition he stated that these activities would only be supported if they would gain big savings for the University. And should said measures yield any environmental benefits it would be a bonus, he stated (A. Jabalera, personal communication, April 9th, 2005).

The way in which the issue of waste management was treated was exemplary for the way in which decisions about environmental issues were taken in general at this institution. A good example is the water usage at UABC. According to the procedural rules for UABC the institution doesn't have to pay the government for the water it uses. Anyhow UABC was sued by the municipal agency in charge of water management, because this agency was forced by law to show the payments made by all the water users including UABC. UABC appealed seeking an injunction and won (A. Mungaray-Lagarda, April 5th, 2005). In other words, UABC could continue using potable water without paying for it. According to the rector, however, it didn't win in terms of developing a culture of consuming water in a sustainable way even though UABC won in legal terms. Thus the rector decided to voluntarily accept a series of per person (per student, per teachers, per employee) water-usage quotes in order to stimulate a disciplined water usage (A. Mungaray-Lagarda, April 5th, 2005). As result financial resources were allocated to diminish water consumption. The investment in these water-saving strategies cost the University between 25 to 30 million pesos. Among the strategies were the construction of water treatment plants, the change of washbasins, urinals and toilets for water-saving models and the change of the irrigation system for gardens to avoid water spills (A. Jabalera, personal communication, April 9th, 2005). According to the Coordinator of Administrative Services these decisions were taken for water saving reasons which implied the lowering of the costs for water consumption. The main reason was not to inculcate an environmental culture (A. Jabalera, personal communication, April 9th, 2005). According to the Rector none of the previous administrations had taken up the environmental themes for cost reasons when the institution's mission is to create a sustainability culture then someone has to accept these implied costs (A. Mungaray-Lagarda, personal communication, April 5th, 2005).

Up to this point it is difficult to discern if the rector was really in favor to promote a sustainability culture or if the initiatives for saving water and avoid fines for bio-hazardous waste management were image and financially motivated. The case of the Coordinator of Administrative Services was different. This person always accepted that the water and bio-hazardous waste initiatives were financially motivated. In this sense, the Coordinator of Administrative Services also mentioned that

they have other projects that would save money and at the same time lead to environmental benefits. However, he never called those projects environmental projects but as fiscally sensible-saving projects (A. Jabalera, personal communication, April 9th, 2005). He even mentioned that he was told by the rector to cut all the expenses that were not essential for the functioning of the university. In doing so the institution could use more economic resources in priority areas.

The above facts show that if there were any environmental initiatives –in the form of written policies and procedures- in the institution it wasn't quite clear to everybody. Some of the top leaders in this administration agreed that environmental policies would help to increase support for environmental programs like the waste management program. Moreover, such policies would also avoid the disappearance of those efforts in case of a change of administration. Policies would favor continuity (J.J. Sevilla, G. Torres-Moye, personal communication, April 8th, 2005; A. Mungaray, personal communication April, 5th, 2005). One of them even mentioned that if an environmental initiative wouldn't allocate resources it would soon disappear. If the initiative was serious it must have financial backing (G. Torres-Moye, personal communication, April 8th, 2005). The rector even mentioned “...*but policies aren't magic, change takes time, is a cultural process and you have to be very patient to see change taking place*” (A. Mungaray, personal communication, April 8th, 2005).

The events that took place during this phase can be summarized in the following. There were two main changes: 1) A decentralization process took place; Vice-rectorships would then lead the decisions in each of the campuses. For the waste management program this meant that it had to be approved by the vice-rector to continue operating. He was willing to support the program but the Coordinator of Administrative Services didn't cooperate. 2) A process of fusion among different departments took place. During this process general offices were replaced by coordination offices. As a result of these changes the waste management program wasn't appointed to any to the newly created coordination offices.

As a result the only efforts to keep the waste management program alive were performed by the analyst at the Office of Maintenance supported by her boss in the same office. Also during this phase three important events in the environmental arena happened at UABC: a) an “environmental quality committee” was created, b) the temporary disposal sites for bio-hazardous waste were built and the old ones were modified according to regulation, and c) an important investment in equipment for water saving was approved. Even though these events seemed promising the waste management program continued to be unrecognized by the administration. The environmental quality committee only undertook the environmental emergencies. An emergency during this time

was a costly event to the university. However, the rector argued that the water and the bio-hazardous waste projects were aimed to promote a sustainability culture while the Coordinator of Administrative Services argued that those actions were economically driven. The two arguments were incongruent.

4.2.6 Summary of the case

The Autonomous University of Baja California is the biggest in the state of Baja California and has been recognized as one of the best universities in Mexico for its academic performance and the quality of its programs. Nevertheless when considering the arena concerning to the environmental performance of the institution –including both the everyday operation of its facilities and the academic activities directed to research, teaching and outreach- formalization of the different environmental initiatives that have taken place, is lacking.

Originally UABC's waste management program was initiated in the Engineering Institute with the support of the top management. Despite this support different problems arose in the various phases of the waste management program that prevented it from becoming successful. Table 11 summarizes the main events that took place in each of the phases of the waste management program.

Table 11. Summary of the main events in each of the phases of the waste management program.

Program's Phase	Main events
1. Preparation for the launching	<p>Support for creating the program.</p> <p>Agreement upon the responsibilities of each university's department involved</p> <p>Allocation of economic resources for the first year of activities</p>
2. Launching	<p>Public announcement of the program's launching</p> <p>Request for support from the heads of departments of the organization</p> <p>Workshops for the training of the program's promoters</p> <p>Workshops with supervisors and janitors about the functioning of the program</p>
3. Performance of the WMP before the new administration	<p>Launching of the information and communication campaign</p> <p>Community shows interest in the program</p> <p>Coaching of social service students</p> <p><i>Negative results:</i></p> <p>Janitors reluctance to obey the recommendations made by coordinator</p> <p>Recyclables contamination</p> <p>Incongruent messages which caused mistrust in the program</p> <p>Bad location of the waste temporary disposal site</p> <p>Reluctance of the Director of General Department of Works and Installations, supervisors and janitors to attend the coordinator's recommendations</p>

Program's Phase	Main events
4. Performance of the WMP during the transition towards the new structure	<p>New rector asks for a report of the program</p> <p>The coordinator of the program steps back</p> <p>The rector requests the new director of the General Department of Works and Installations to take the responsibility for the program</p> <p>Different good measures are put in place (change waste company, change temporary disposal site)</p>
5. Performance of the WMP under the new organizational structure	<p>New organizational structure is implemented</p> <p>The General Department of Works and Installations disappears</p> <p>The waste management program disappears</p> <p>Different waste recovery and recycling activities continue as a personal conviction of some staff members</p> <p>Other environmental initiatives take place as a result of fines and suits to UABC</p>

From the events described in this chapter the following conclusions can be drawn:

- The events of the waste management program took place during two different institutional stages: 1) the stage of academic development and 2) the institutional reform (Table 10). Both stages had different characteristics the former had a stable environment, where there were no changes either in academic or administrative sense. The latter was filled with important changes both on the academic and administrative levels which led to a climate of uncertainty.
- The “environmental dimension” starts to appear in the UABC’s formal documents in the Institutional Development Plan 1995-1998 (UABC, 1995). In spite of the absence of environmental terms in the institutional development plans which could reflect the university’s intentions to work in favor of environmental issues, some efforts were carried out in the environmental arena. An example of these efforts was the Environmental Research Program (ERP) of the Autonomous University of Baja California. Even though this program was reporting good results and allocated its own resources during three consecutive years, it was terminated by the administration.

- The inclusion of the environmental dimension in the institutional mission took place for the first time in the Institutional Development Plan 1999-2002. However neither policies nor programs were developed to formally undertake environmental initiatives within an institutional framework. The two initiatives related to the environment that took place during that time were the solid waste management program and the responsible water consumption campaign. But these initiatives were not backed-up by any written document.
- Waste management efforts started long before the waste management program was launched. All were bottom-up initiatives and were led by the effort of active advocates convinced of the need for waste management strategies. However the success of these efforts relied on the individuals who proposed them. They lacked an institutional support and were never formalized.
- The first phase of the waste management program was a period of hope because it received the support from the top management. Different tasks were appointed to different people and all them seemed willing to participate in the program. The coordinator allocated funds for the first year of activities. The recycling bins were acquired and its location was decided by the coordinator, this is when the first signs of resistance were apparent. Janitors were reluctant to heed the recommendations made by the coordinator and they placed the recycling bins in places that implied less work for them,
- During the second phase the waste management program was launched and for the first time UABC had an environmental program aimed to encompass the main campuses of the university. The support from the heads of departments was requested by the rector. Promoters for the waste program were appointed in faculties and administrative departments. In order to have uniformity of the operations workshops were organized, which encompassed the participation of janitors, students, and promoters.
- The third phase of the program had both positive and negative results. Within the former are the launching of the information and communication campaign which included TV and radio spots, posters, a web site, banners and speeches. The community shows interest for UABC's waste management program and its coordinator is invited to give speeches to different schools. Social service student got involved in the program. The negative results were evident. These were marked by a constant reluctance of the janitors to move more trash bins than they were used to. The bad locations of the recycling bins along with the reluctance to separate the waste resulted in the contamination of the recyclables. Consequently it was impossible to sell recyclable waste. During this phase the reluctance

to support the coordinator of the waste program was also shown by the Director of the Department of works and Installations and the janitor's supervisors. The lack of power of the coordinator was evident. The program acquired a bad reputation and image as well as the reluctance of the UABC's community to get involved in it.

- The fourth phase was marked by uncertainty. A lot of changes were taking place in the university. The waste program coordination changed to the DGOI. During this period two of the old problems were solved: the relocation of the temporary disposal site for waste and the hiring of a more reliable company for waste collection. Despite of this good news the approval of the waste policies submitted to key people in the university didn't progress. Clear signs that waste management issues were not important at UABC are evidenced.
- The fifth phase of the waste program develops when the new organizational structure is implemented. The department that had the waste management program fuses with another department. In this process the waste management program disappears. The only waste management efforts were performed by an analyst at the Office of Maintenance and her boss. The support for the bio-hazardous waste program and for the water saving program were motivated by fiscal concerns (to avoid fines and a bad image) but not by environmental awareness.

Chapter V. Results of the internal environment

The results of the variables of the internal environment of the Autonomous University of Baja California (UABC) that affected the waste management program are presented in this chapter. The variables under analysis are leadership, structure and culture (pro-environmental behavior) (see Figure 15).

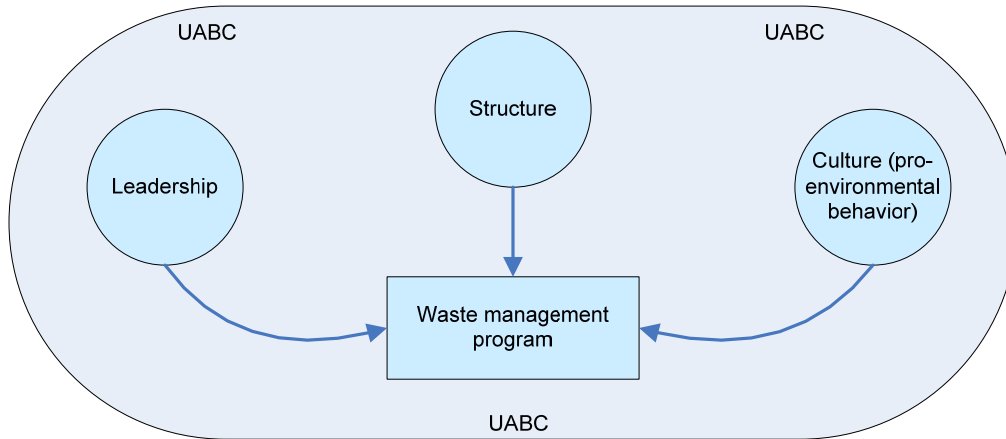


Figure 15. Internal elements of UABC considered for explaining the results of the waste management program.

In this chapter an empirical account is presented. In the next chapter (Ch. VI) this account will be interpreted in theoretical terms.

5.1 Introduction

The main events of the program described in the previous chapter will be analyzed separately based on the perspective of the variables selected to explain the difficulties in implementing a waste management program at UABC. The three variables considered in this study were leadership, structure and culture focused on pro-environmental behavior.

Because different theoretical approaches were used for each, at first these variables will be analyzed separately. However, the three variables are interlinked (Ogawa and Paredes-Scribner, 2002). For having a more comprehensive panorama of how these three variables interact with each other in the context of the waste management program of UABC an integrative analysis is made in the concluding Chapter (Chapter VI).

5.2 Leadership

In order to understand how leadership affected the waste management program of UABC the leadership styles of the key people involved in the program were analyzed. The interviews with the subordinates of the leaders as well as with the leaders themselves were incorporated into this analysis.

The central questions that must be posited are:

1. What was the relationship between the structure of the task and the results obtained?
2. What were the relationships between leader and followers and what role did these relationships played on the results of the waste management program?
3. What role did the power position of the leaders play in the results of the waste management program?
4. Did the leaders in place during each of the phases of the waste management program showed the characteristics of a transformational leader (vision with a moral purpose, relationship building, knowledge creation and sharing, and coherence making)? How did these characteristics affect the waste management program?

Leadership analyses were done at five levels within the institution: 1) at the highest level of the institution (rectors), 2) at the level of departments (coordination and general offices), 3) at the level of the offices of maintenance of buildings (chief of maintenance), 4) at the level of janitor's supervisors also belonging to the office of maintenance and 5) at the level of the coordinator of the waste management program.

In analyzing leadership within the case of UABC the five phases distinguished in the historical account (see chapter IV) were grouped into three main institutional stages. These three main stages of the institution were marked by the presence of different people in key positions at the five leadership levels analyzed.

The leadership styles were analyzed under the theoretical perspective of Fiedler's Contingency Model. According to Fiedler's model the performance of followers depends on the interaction between leadership style and the situational factors (showed in Table 3 page 39). The three situational factors (member-leader relationships, the structure of the task, and the power position within the organization) can be combined in order to describe different situations. These situations will change depending on the degree to which the factors favor the leader to influence his followers.

The three situational factors generate different situations, varying from 1, a very favorable situation for the leader, to 8 a very unfavorable situation for the leader.

Table 12 shows the results of the variables analyzed at each level of analysis. This table was constructed based on the data obtained from interviews with the people involved in the program and observations in the empirical story of the waste management program (Chapter IV). Eleven interviews were held to obtain the information needed to analyze the following variables: relationship leader/follower, structure of the task and power of position. The relevant information extracted from those interviews is presented in Annex III. The people interviewed were the same that appears in the first row of the table. In the case of the rectors, the former rector was interviewed to fill the information of the phase before the reform and the present rector to fill the information of the two other phases. In the case of the position of Director of Maintenance three different individuals were interviewed because different persons occupied that position during each of the phases. The same was the case for the position of chief of maintenance. In the case of janitor's supervisors three supervisors were interviewed and these were the same during the three phases analyzed because they kept their respective positions. For these interviews a semi-structured format was used. The results of the interviews are summarized in Annex III (this annex only includes the information useful for analyzing the three variables of Fiedler's model not the whole interviews).

The scores for filling Table 12 were based on the interviews summarized Annex III. The scores were obtained in the following way. The relationships leader/follower were scored as good (G) or bad (B) according to the answers obtained from the interviews sustained with the people involved in the program. The relationship was scored as good (G) if the interviewees expressed their relationship as trustful, respectful and if confidence between the leader and the subordinates were present. The relationship was scored as bad (B) if the opposite was the case. The structure of the task could be scored as low (L) or high (H). A low structure of the task was scored when the activities for the waste management program were not clearly defined or these were defined in vague terms, and when these were not verifiable. A high structure of the task (H) was scored when the opposite situation was present. The power position could be scored as strong (S) or weak (W). A strong power position (S) was scored when a leader was able to influence his followers to perform his orders; in doing so he could use rewards or punishments. On the contrary a weak power position (W) was scored when the leader wasn't able to influence his followers and he had no access to rewards or punishments.

According to Fiedler leaders can be effective if they fit the situation. Fiedler's model allows for predicting the characteristics of the appropriate situations for effectiveness. The three situational

components (relationship leader/follower, structure of the task and power position) determine the **favorableness** or situational control. Each type of situation depends on the combined scores of the variables. When there is a good leader-follower relation, a highly structured task, and high leader position power, the situation is considered the “most favorable situation” (Situation I). When there is a bad relationship leader-follower, an unstructured task and a weak position power, the situation is considered the “least favorable situation” (Situation VIII). The resulting leadership situations of this study are presented in the last row of Table 12. These situations resulted of the interaction of the scores obtained of three situational components in the rows above.

Table 12. Situations and leadership styles according to Fiedler’s Model encountered for the waste management program at UABC during the different institutional stages

Phases of the Waste Management Program during important Institutional Stages															
Levels/ Variables	Before the reform (Phases 1,2 and 3)					Transition stage (Phase 4)					After the reform (Phase 5)				
	Rector	Director of maintenance	Chief of maintenance	Janitor’s supervisors	Janitor’s	Rector	Director of maintenance	Chief of maintenance	Janitor’s supervisors	Janitors	Rector	Coor. of Administrativservices	Chief of maintenance	Janitor’s supervisors	Janitors
Relationship leader/follower	G	G	B	B	-	G	G	G	B	-	G	G	G	G	-
Structure of the task	L	L	L	L	-	H	H	L	L	-	L	L	H	L	-
Power of position	S	S	W	W	-	S	S	W	W	-	S	S	W	W	-
Situation	III	III	VIII	VIII	-	I	I	IV	VI	-	III	III	II	IV	-

L= low H= high B= Bad G=Good S=Strong W=Weak

In Table 12 “follower” should be understood as the immediate lower hierarchical level of the leader at each organizational level. For example, the follower of the “rector” is the “Director of Maintenance” or, under the new organizational chart, the “Coordinator of administrative services”. The “janitors” columns have hyphens underneath because there aren’t any lower hierarchical levels.

Table 12 was constructed using only the hierarchical levels of the organizational chart that were in some way involved in the waste management program. The analysis of this table is presented next and is done per institutional stage.

5.2.1 Before the reform:

As can be seen in Table 12 before the University's reform good relationships were present between the people in the higher positions of the organization's chart and bad relationships were present in the lower levels. The rector and the director of maintenance were in strong and powerful positions and the relationships with their immediate followers were good. The structure of the task was low in all cases. The low structure of the task in these two cases is due to the lack of definition of duties and expectations from the leader in relation to the waste management program. Neither the rector nor the director of maintenance asked their immediate follower to act upon the waste management program in a specific way. This is in spite of the hierarchical level of the leader that participated in the waste management program; none of them structured the activities of the waste program to be performed by their followers. In the case of the position power this variable scored "strong" in the first two cases and "weak" in the second two. The combination of these scores resulted in two situations during this stage: situation III and situation VIII. Interpreting these situations according to Fiedler's scale, it can be said that situations III were favorable for the leader. The position power (S) and the good relationships (G) that were present in the case of the rector and the director of maintenance put them in a good position despite the lack of structure of the task (L). In the case of the chief of maintenance and janitor's supervisors they scored a situation VIII. According to Fiedler's model Situations "VIII" are the worst or very unfavorable situations for the leader. In this case the followers (janitor's supervisors and janitors for each case) don't care much about what their bosses order to do because they are protected by the union. Anything that is not in their job description is harder to get done. This situation generates friction between the participants. As a result the leader-follower relationship was bad (B). This situation also reflects the lack of power (W) of the positions of the chief of maintenance and of the janitor's supervisors; what the union says and what is in the job description it is more important than what the bosses have to say. The low structure of the task (L) can be explained by the lack of the structure of the task in the higher hierarchical levels. When the top it is unclear about what it requires it is also difficult to ask the lower levels to help them to comply with such a task. This combination of variables –bad relationships leader-follower, unstructured tasks and weak position power resulted in situations VIII.

Because the level "Program Coordinator" is not in any of the two organizational charts this level was not included in Table 12, instead Table 13 was constructed for analyzing this level. The analysis of the program's coordinator was done based on Fiedler's variables but instead of analyzing two consecutive hierarchical levels the relationship of the coordinator with each of the

other levels were analyzed considering all the other levels as subordinates or followers of the coordinator. This was done because the program coordinator was supposed to be in charge of leading all the activities related to the program and the rest of the levels were supposed to support the coordinator.

Table 13 presents the results of the leadership style and the types of situation of the relationships that the program's coordinator had with the rest of the people involved in the waste program. These results only hold for the phases of the program before the institutional reform, when the position of program coordinator existed. Table 13 was constructed based on the information from the interviews, documents and observations presented previously in this chapter. As in the case of Table 12, in Table 13 the scores were obtained in the following way. The relationships leader/follower were scored as good (G) or bad (B) according to the answers obtained from the interviews sustained with the people involved in the program. The relationship was scored as good (G) if the interviewees expressed their relationship as trustful, respectful and if confidence between the leader and the subordinates were present. The relationship was scored as bad (B) if the opposite was the case. The structure of the task could be scored as low (L) or high (H). A low structure of the task was scored when the activities for the waste management program were not clearly defined or these were defined in vague terms, and when these were not verifiable. A high structure of the task (H) was scored when the opposite situation was present. The power position could be scored as strong (S) or weak (W). A strong power position (S) was scored when a leader was able to influence his followers to perform his orders; in doing so he could use rewards or punishments. On the contrary a weak power position (W) was scored when the leader wasn't able to influence his followers and he had no access to rewards or punishments.

Table 13. Situations and leadership styles according to Fiedler’s Model encountered for the waste management program coordinator.

Levels/ Variables	Before the reform (Phases 1,2 and 3)				
	Recto/r/ Coordinator	Director of maintenance/ Coordinator	Chief of maintenance/ Coordinator	Janitor’s supervisors/ Coordinator	Janitor/ Coordinator
Relationship leader/follower	B	B	B	B	B
Structure of the task	H	H	H	H	H
Power of position	W	W	W	W	W
Situation	VI	VI	VI	VI	VI

According to Fiedler’s model all of the identified situations between the coordinator and the other people involved in the program were unfavorable (situations VI) (Table 13). All the relationships leader/follower were evaluated bad (B). Since the creation of the program it was never possible for the coordinator to obtain from her followers what she needed for the program. There seemed to be a difference between the attitude of those involved in the program and their actual performance in it. At the start of the program, when in front of the rector, everybody seemed to agree on the terms and conditions for participating in the program. However, during the program the support was almost non-existent. According to the minutes, memos and responses from her followers in all these relationships the tasks were made clear that is why they were evaluated as having a high structure of the task (H). Nevertheless because the coordinator position wasn’t in the organizational chart, the coordinator wasn’t considered above any of the other levels that participated in the program. As a result she lacked the power (weak power position- W) to influence her followers.

It is interesting to note that all the activities that the coordinator was able to carry on were possible because those activities didn’t depend on anybody else but the very coordinator. This was the case for the information campaign, the organization of workshops for the training of the program promoters, the workshops with supervisors and janitors and the coaching of social service students.

5.2.2 Transition stage

During the transition stage of the institution (see Table 12) good relationships (G) were present between the people in the higher positions of the organization and a bad relationship (B) was present between janitor's supervisors and janitors. In relation to the structure of the task, only the rector and the director of maintenance scored high (H). The chief of maintenance and the janitor's supervisors scored low (L). This situation was present because the rector and the director of maintenance had a very clear idea of what they wanted to achieve for the waste management program and how they would achieve that. This was not the case for the chief of maintenance and janitor's supervisors.

The power positions remained the same as in the previous stage (before the reform), the rector and the director of maintenance hold powerful positions (S), while the chief of maintenance and janitor's supervisor hold weak positions (W). The combination of these variable resulted in situations I, IV and VI during the transition stage.

For the rector and the director of maintenance a situation I existed. Situation I is the most favorable situation for a leader, where good relationships leader/follower are present, tasks are highly structured and the power position is strong. In this case it was the very rector who asked the director of maintenance to take the waste management program and to make it work. It was then that the rector gave the waste management program report to the director of maintenance and asked him to correct what was reported as failure. The director of maintenance studied the report and asked his followers to have meetings and propose what should be done in order to make the program work. The chief of maintenance received specific instructions about what activities to carry on and how these should be done. The tasks were very structured.

A situation IV corresponds to the relationship chief of maintenance/janitor's supervisors. Here the relationship is good but a structure of the task is lacking and the power position is weak. Even though the chief of maintenance knew exactly what to do he didn't tell his subordinates how to proceed in order to make the program work.

The above mentioned situations worsen even more when the lower level in the hierarchy is analyzed. The janitor's supervisors/janitors relation fell in a situation VI. This is not a good situation for the leader. This is due to the bad relationship among the involved parties, the lack of structure of the task and a weak power (janitors are protected by the union and the only mandatory tasks to perform are the ones stated in their "job description book").

During the transition stage there was no coordinator since she had to give up the program and pass it to the Office of Maintenance.

During this stage the temporary disposal site moved to another place and the waste transporting company changed as well. Previously the former coordinator of the program had also tried to get these two activities off the ground, however without success. The difference could be that in the transition stage the director of maintenance was in a type I situation and that both activities did not depend on the lower levels -on the janitor's supervisors or on the janitors themselves.

5.2.3 After the reform stage

During the stage after the reform the first two relationships encountered scored situations III. Good personal relationships (G) and strong power positions (S) were scored but a structure of the task was lacking (L). Here the person immediately positioned in a higher hierarchy level did not even communicate with the Coordinator of Administrative Services or the chief of maintenance about the waste management program. Because of the fusion of two different administrative offices there was confusion about who should take responsibility for the waste program. As a result none took that responsibility.

The chief of maintenance/janitor's supervisors relation is under situation II, which was rather favorable. Despite a weaker position power, good relationships and a high structure of the task exist. A high structure of the task is present not because of an intention of the people in the higher hierarchy levels but because of the personal interest of the chief of maintenance and of the analyst working in his office on waste management issues. These two persons looked at the previous efforts towards waste management and decided to continue some of the activities of the program. They described the types of activities that needed to be carried out and how they would do them. When it was needed they had the support of the janitor's supervisors and of the janitors.

In sum the worst situation (situation VIII according to Fiedler) was encountered during phases 1, 2 and 3, which correspond to the stage before the institutional reform. This coincides with the lack of good results on the program except for the activities where no coordination between administrative offices was needed. This means that the activities of the program that depended on one person were possible but none of the activities that included the coordinated participation of different offices were feasible. Transition stages are considered uncertain but in spite of this the best situations were encountered during phase 4 that corresponds to the transition stage. It was also during this stage that good results of the waste management program were achieved. Remarkably the good situations were not along the whole leadership chain but only at the top. This situation was sufficient enough

to make things happen. This means that good leadership situations at all levels were not necessary to perform some of the tasks. But good leadership situation were needed to have all the activities of the program done. Situations II, III and IV (good leadership situations) were present during phase 5 that correspond to the stage after the reform. In this stage all the waste management activities aren't part of a program but isolated efforts towards sound waste management practices aroused from personal interest more than from an institutional program.

Based on the interviews used to construct the story of the waste management program it was possible to detect some of the characteristics of transformational leadership showed by the different leaders that participated in the program. Some of the questions during the interviews were specifically designed to obtain the perception the people have about the presence of transformational leadership characteristics in their bosses (Table 14).

During the **stage before the institutional reform** the rector showed some of the characteristics of a transformational leader. More than the vision of the program the rector explained its moral purpose, on different occasions, for example during the start of the new school class session, during the weekly breakfast with the people in top management positions of the university, and during different occasions in front of students and the faculty. The rector also contacted the people that he thought to be involved in order to make the program work. The rector delegated the responsibilities of the program to the people positioned in the lower hierarchical levels. The three hierarchical levels below the rector didn't show any of the characteristics of a transformational leader. These characteristics were partially shown by the coordinator of the program. She behaved differently towards the two main groups of people involved in the program. To the group of people of the office of maintenance (director of maintenance, chief of maintenance, janitor's supervisors, and janitors) she didn't show the characteristics of a transformational leader but she did to the faculty group and students that supported the program. The reason for the difference in the coordinator's leadership style could be on account of the receptiveness from the part of students and faculty. These two groups didn't reject the coordinator. This receptiveness could be the result of the perceived benefits that students and faculty found in the activities of the waste management program. The students could fulfill their social service requirements, and the faculty members that participated in the waste management program were conscious of the need to implement this kind of program in the university.

Table 14. Characteristics of a transformational leadership showed by the leaders involved in the program.

		Phases of the Waste Management Program during important Institutional Stages														
		Before the reform (Phases 1,2 and 3)					Transition stage (Phase 4)					After the reform (Phase 5)				
Levels/ Charact. of transformational leadership		Rector	Director of maintenance	Chief of maintenance	Janitor's supervisors	Program Coordinator	Rector	Director of maintenance	Chief of maintenance	Janitor's supervisors	Program Coordinator	Rector	Coor. of Administrativser vices	Chief of maintenance	Janitor's supervisors	Program Coordinator
	vision moral purpose		Y	N	N	N	Y/N	Y	Y	N	N	-	N	N	Y	N
relationship building		Y	N	N	N	Y/N	Y	N	N	N	-	N	N	Y	N	-
knowledge creation and sharing		N	N	N	N	Y/N	N	N	N	N	-	N	N	Y	N	-
coherence making		Y	N	N	N	Y/N	N	N	N	N	-	N	N	Y	N	-

Y= Yes

N = No

During the **transition stage** the rector and the director of maintenance showed “vision with moral purpose” but this characteristic was not shown by the rest of the people involved. The rector also showed “relationship building” intentions because he tried to put the former coordinator of the program into contact with the new director of works and installations (maintenance office). The rest of the people didn’t show any of the transformational leadership characteristics as evidenced by the results of the program and the statements of the people that were interviewed, which left much to be desired.

During the **stage after the reform**, the only person that showed transformational leadership characteristics was the chief of the maintenance office. This person was continually searching for alliances to make the waste management efforts work. For example through several meetings with the people of the Veterinary Faculty he finally obtained permission to use a space of land to implement the compost project. In these meetings the chief of maintenance explained the environmental and economic advantages of having a compost program and the benefits of involving

students in the project, among other things. He also explained the procedures for making a compost pile and trained two of the UABC janitors.

In general it can be said that the characteristics of a transformational leader were barely shown by the people involved in the waste program. The bottom line is that transformational leaders are individuals capable of motivating and inspiring followers by appealing to higher goals and the common good rather than to individual needs and self-interest. This was however not the case of the waste management program at UABC.

Summarizing the leadership results, it can be said that the waste management program of UABC was directly affected by the leadership styles that prevailed in the different institutional stages and the involved departments in each stage.

The good results of the waste management program at UABC emerged when at least one of the characteristic of a transformational leader was present combined with good leadership situations. For example during the stage before the reform the rector was in a situation III and he showed several of the characteristics of a transformational leader. In fact the creation of the program was the first good result of the program itself because before that there wasn't any declared institutional intention towards a sound waste management at UABC. However this event could take place because the rector was motivated to do so and was in a powerful position to create a waste management program. Although his power position was important, he was not able to impact on the lower positions in the organizational chart. Other variables seemed to have played a more dominating role. One of these variables was the lack of awareness of the people in key positions towards waste management issues. To help understand which variable played a major role in this situation it will help to look at the other phases of the program

During the transition stage the waste program had two important events: 1) the replacement of the waste transporting company and 2) the relocation of the temporary disposal site for waste. During this stage the rector and the director of maintenances were in a situation I (the best situation for a leader). These two leaders also showed some of the characteristics of a transformational leader. However these were fewer than those showed by the former rector in the previous stage. It is important to remember that the two events that took place during this stage relied only on the activities of two directly involved persons who were closely related to the top management. Thus here it is also difficult to identify if the two major events happened because of the power of the position of the leaders involved or because these leaders had some characteristics of a transformational leader.

In the stage “after the reform” the rector and his subordinates were not positive about the waste management program any more. During this stage there wasn't support from the top. The activities for sound waste management that took place were a consequence of the interest and work of two persons, the chief of maintenance and the analyst working with him. The difference between the chief of maintenance and the rectors and directors is that the former is a weak power position. The chief of maintenance showed many of the characteristics of a transformational leader but he lacked the power that the other two men had. Thus even though the chief of maintenance had many ideas, very well structured tasks and also maintained good relationships with his subordinates, he couldn't accomplish those tasks. He lacked the power to mobilize financial and human resources that were needed. Contrary to Fiedler's Model the chief of maintenance couldn't succeed in his attempt to make the program work even though he was in a situation II (very good situation).

The structure of the task alone didn't seem to play a major role. Instead it was the combination of this variable with the power position and the presence of transformational leader characteristics what made things work. In the case of the chief of maintenance the lack of power hampered the progress of the program, for he couldn't even convince his bosses to provide money for the activities of the waste management program.

In general, the above facts seem to point to the fact that the most dominant variable for leadership to be successful is the power position.

5.3 Structure

Which role did the structure of the university play in the results of the waste management program at UABC?

The story of the waste management program was developed during two different institutional structures. It is assumed here that these different structures affected the relations between the people involved in the program and the results of the program as well.

Figure 13 and Figure 14 show the two different organizational charts present during the phases of the program described in chapter IV. In each chart the departments involved in the program are highlighted in order to make it easier to understand the relationships among the participants. Comparing the two charts shows that the latest structure became even more vertical than the previous one, due to the increasing number of offices that were created.

The main change made by the new institutional structure was the creation of three vice-rectorships, one for each campus. The objective there was decentralization of the main decision making

processes, with the aim of speeding up academic processes. Nevertheless the general guiding framework for every process at the university continued to be dictated by the central coordination offices. The general treasurer office in charge of the financial issues of the institution, including the academic's financial issues, remained centralized as well. This could be considered a paradox – on the one hand it created a speeding up of processes while on the other it kept slowing down measures caused by the centralization of financial resources. This situation created confusion and lack of trust in the new administration and the measures taken by it. In so far as the waste management program the confusion became evident when the new structure was put into place. There was a champion for the waste program but none of the administrative offices were given responsibility for the program. In other words, no one was formally responsible for the waste management program. There was only a group of people interested in continuing the activities for sound waste management. Thus under the new institutional structure any kind of support for those interested in continuing the program, was lacking.

The situation before the institutional reform (phases 1, 2 and 3 of the waste program) seemed even more problematic. At first instance, an academic researcher was named coordinator of the waste management program. At the time nobody paid much attention to the implications of this situation. No link existed between faculty members (researcher or professor) and the staff of the maintenance office (see Figure 13). Thus relationships of any kind between academic related activities and cleaning-maintenance activities were nonexistent. Nevertheless it was expected that the academic researcher appointed as a coordinator for a waste program would be successful in aligning the participation of both actors: those belonging to the academic arena and those affiliated with the administrative and operations units of the institution. This turned out, however, to be impossible, which can easily be illustrated by the fact that the positive events that did take place were those that didn't require interdepartmental participation and could be carried out by administrative units alone. However, even within said administrative units, coordination among the different administrative departments proved to be impossible.

During these first phases of the program it was also evident how loosely organized UABC was. If we look at Birnbaum's (2001) which offered an analysis of actions of those at the top of educational organizations, here there was no direct link between the demands at the top and behavior by those further down in the organization. Although the rector had asked both the directors of academic, administrative units, the students and staff to support the program; the response was meager. And even worse, those departments that were supposed to directly support the program didn't get involved in its activities at all. In spite of the fact that in UABC the decision making structure is

very centralized, the situations described above showed that the rector had no power to make the lower hierarchical levels get involved in the program. One reason for this behavior could be that, by the time the waste management program was implemented, the yearly budgets were already delivered to the different departments. This situation could very realistically have created a lack of interest from the different offices. Since they could continue with business as usual, after all they had the money to do so, and there were no penalties for not getting involved in the waste management program. Another reason could be, simply that people did not see incentive for getting involved in the program.

During the transitional stage the organizational structure remained the same as before. The power and routines that were established during previous years continued to exist under the same old paradigms. In the case of the waste management program this can be exemplified by the two positive events taking place: the relocation of the temporary disposal site for waste and the hiring of a new waste company. Although both events depended on top management decision, nothing happened until external pressure accelerated the process. Complaint appeared in a local newspaper about the bad aspect of the UABC's waste disposal site. Before, the former coordinator of the waste program had suggested several times to change the waste disposal site, however without being heard by the authorities. This time the news spotted UABC as an educational institution bringing out a bad example for the community. Due to public complaints the rector himself now ordered the director of works and facilities to relocate the temporary disposal site for waste. This time the change was made immediately. These events show the difficulty within the organization to listen to each other. However, these events show that the rector wasn't really in favor of the waste management program. The real motivation to launch the waste management program could be an excuse to say that UABC was trying to operate in an environmentally sound way and in this way fulfilling UABC's mission. The rector had power and this was shown by the quick events that took place when UABC was put on the spot light by the public. Two other examples of this were given by the construction of the temporary disposal sites for bio-hazardous waste and the investment in water saving equipment. These events also demonstrated the power of the rector. Nevertheless this power was never used to support the waste management program.

The different units are not used to cooperating, communicating or supporting each other. The basic problem was that the operations unit functioned independently of the academic institutions. The operations department did not support the academic mission of UABC of being environmentally responsible and therefore had no desire to work on environmental issues. This was confirmed by the Coordinator of Administrative Services who claimed that finding the financial resources to run his

department was his highest priority. Evidently, doing the right thing was hardly valued. Thus the collaborative and ethical approach to decision making that is essential to sustainability was not present at UABC. This provides evidence for the assertion that if stakeholders do not find a collaborative atmosphere in the institution, environmental progress is difficult (Shriberg, 2002).

The events mentioned above also correspond with the theoretical notions of Mintzberg (1973). According to Mintzberg's classification of organizational structures the university is a "Professional Organization", but "support units" may be present in other forms. For example, support subunits that perform routine functions may have machine bureaucratic managements, but other subunits in a university may be administered as professional organizations or adhocracies. In the case study of this thesis the support unit would be the different departments involved in the program such as the Coordination of Administrative Services and the Office of Maintenance. The professional organizations subunits would be faculties and research institutes. As the university struggles to cope with new programs, its overall organizational form may tend towards adhocracy and this situation creates conflict. According to Mintzberg *et al.*, (1995) the waste management program needed the coordinated work of professionals with the support of "staffers" or support units. But professional organizations are defined by performance, designed to perfect standardized programs, not to invent new ones. To innovate means to break away from established patterns. Thus the innovative organization cannot rely on any form of standardization for coordination. It must remain flexible. This flexibility should allow to draw together different forms of expertise. This flexibility is found in adhocracies. Summing up these statements, it can be said that UABC's waste management program required an adhocracy type behavior with enough flexibility to cope with the required changes. Nevertheless the collective action required by the waste management program resulted in the reluctance of the staffers to cooperate with each other and the complexity of the collective process produced resistance to innovation. UABC was, after all, a professional bureaucracy where performance structures are designed to perfect given programs in stable environments, not problem solving structures to create new programs for unanticipated needs (Mintzberg, *et al.*, 1995). The stress of working in an adhocracy however puts pressure on the institution to organize subunits; this is also exemplified by the experiences explained below.

The waste management program within UABC can be considered as an innovation. Based on the innovation feasibility and organizational forms proposed by Lam (2000) the two organizational divisions involved in the waste management program responded differently to innovation. The academic division behaved more like a professional model and favored an individual approach to learning. This could be the reason why none of the previous environmental initiatives have left any

learning that could be used by other environmental advocates within UABC. The professional model generates a narrow approach to learning and inhibits innovation.

The operations side behaved like a machine bureaucracy rooted in an internal labor market and organized around narrowly defined jobs and tiered career hierarchy. This model seeks to control and eliminate tacit knowledge. It generates a superficial approach to learning and has little capacity to innovate. This could explain why it was very difficult for the people in the maintenance office to get involved in the new routines of the waste management program and/or to propose new ways of dealing with waste. Janitors for example are ruled by what is stated in their job description book. For them there is no other way to look at their work. They're also used to work in a predictable environment, any change in their routines is seen as an assault to certainty, thus making it more difficult to embrace new things and learn from new experiences like the waste management program.

Thus both divisions were not apt to innovate. Innovation was difficult for both. However the operations department was in a more problematic situation because innovation for them would mean a redefinition of their duties and their relationships at work. This would be a whole new way of getting things done.

5.4 Culture (Pro-Environmental Behavior)

Culture is an important mediator between behavior and the natural environment, and therefore has an impact on the way environmental initiatives are taken up. In the analysis below the theoretical focus will be the elements of culture related to pro-environmental behavior and specifically the ones related to waste management issues. The main question that guided this part of the study is: ***What is the relationship between the culture related to pro-environmental behavior and the performance of the waste management program at UABC?***

Specifically, the following questions will be addressed:

1. What is the **attitude** of the people at the university towards the waste management strategies (reduce, reuse and recycle) used in the waste management program?
2. What is the **attitude** required of people to actively participate in the waste management program?
3. Do the different groups of people (students, faculty, administrative staff and cleaning staff) differ in their **intention** to participate in the program?

4. What kind of relationship existed between the **information** disseminated about the waste program and the intention to participate in it?
5. What was the university's community preferred way of receiving **information** about the program?
6. What was the impact of the **location** chosen for the recycle bins on the people's willingness to use them?

The variables used to analyze culture, specifically pro-environmental behavior, were the **attitudes** towards the program, the **intention** to participate in the program, the influence of **information** about the program and the influence of the **location** of the recycling bins.

5.4.1 Attitude towards waste by different groups

Environmental culture specifically related to waste management issues was not homogeneous in UABC. According to the results of the interviews applied to top managers at UABC and the ones from the questionnaire (Annex II) applied to students, janitors, administrative and faculty staff, an environmentally sound waste management was perceived differently among these groups.

From the interviews with the former rector the drive to implement a waste management program at UABC could be derived. The former rector was the first one to put environmental concerns into the institutional mission. This was because he perceived environmental care as a personal and an institutional duty. He stressed for instance that he promoted this kind of practices among his family, friends and neighbors. Therefore, he also could not let the opportunity to do the same at the UABC go by. Specifically, as far as the issue of waste he was aware of the need of having environmentally sound waste management practices. Thus the personal awareness and knowledge was what moved the former rector to implement the waste management program at UABC. The same was also true for the water program of UABC. As a higher education leader, the former rector saw the opportunity to do something only a few universities in Mexico were doing, and to stand out doing something that he believed in. The former rector knew the importance of proper waste management, he also showed concern and the intentions to create a waste management program at UABC and he did it. Thus, his behavior was congruent with his intentions. This means his culture; specifically his pro-environmental behavior was evidenced. However these driving forces were not present among the other people in the top management positions at that time. For them the driving forces were

more related to comply with what the rector wanted than with personal commitment towards the environment.

During the transition stage the new rector didn't implement or propose any new environmental initiative for UABC. According to this rector he did not do that because he wanted to improve the initiatives that were already in place. Nevertheless he didn't support the participation of UABC in the COMPLEXUS network towards sustainability in Mexican higher education institutions. Neither did he support the continuation of the water program. His actions and attitudes did not evidence pro-environmental behavior. In spite of that lack of support for environmental initiatives at UABC some good results in the waste management program were present during the transition stage. Unfortunately, as discussed earlier, these good results seemed to be more related to the external pressure than to the rector's personal initiative. During the interview of the rector, he apparently had assumed that the positive results of the program during the transitional stage had more to do with the direct order he gave to the director of maintenance than with a personal commitment of this director to environmental issues. In his own words "*it's in the culture of the institution to comply with whatever is said by the boss. This is done in order to be a good employee in the eyes of the boss in spite of the employees own beliefs or values*". Nevertheless other interviewees mentioned that the director of maintenance showed environmental concerns in other jobs not directly related to the waste management program.

During the stage after the reform the environmental activities on the operation of UABC were supported by the rector but not in response to his personal commitment towards environmental protection. The fines, newspaper article and charges about the way UABC was handling bio-hazardous waste were the main catalyst to said action. The same held true for water usage. The investment in water saving equipment was a response to fines and water quotes imposed by the government and not so much because of the rector's environmental consciousness. During this stage the waste management program disappeared. Only a few advocates who were truly convinced of the benefits of waste reduction and recycling activities continued to carry out activities towards recycling.

Top managers like rectors and directors of the main offices were not the only stakeholders of a waste management program in a university. Students, administrative staff, faculty staff and cleaning staff were important as well since all of them generated, and handled waste in some way or another within the institution. For this reason the coordinator of the program during the second year of activities of the waste program sent out a questionnaire to know the perceptions of the University's community towards UABC's waste program. To cluster the answers to the questions, a five point

Likert scale was used going from “strongly agree” (5 points) to “strongly disagree” (1 point). An odd scale implied a neutral central point. The questionnaire also included questions with open ended answers and “yes” or “no” answers. The questionnaire was applied to 733 subjects composed of four strata: 1) students (488 individuals), 2) faculty staff (153 individuals), 3) administrative staff (58 individuals) and 4) janitors (34 individuals) (Table 15). In Annex II the questionnaire is presented. In the following paragraphs the most relevant results are presented.

Table 15. Number and percentages of subjects in each stratum that answered the questionnaire

Role in UABC	Count	%
Student	488	66.6%
Janitor	34	4.6%
Faculty staff	153	20.9%
Administrative staff	58	7.9%
Total	733	100.0%

In general terms (considering the four strata together) the UABC’s community agrees (99%) that waste poses a problem for the environment, 79% of them agree that once the waste is transported out of the university potential problems for the environment still exist. These results show an awareness of the consequences that waste poses to the environment (questions Q4 to Q5).

The answers of the three questions related to reduce, reuse and recycle (questions 6, 7 and 8) practices were analyzed for answering the first research question: **1) What is the attitude of the people at the university towards the waste management strategies (reduce, reuse and recycle) used in the waste management program?** In Table 16 the percentages of the four strata together are presented.

Table 16. Percentages of the attitude of the four strata together towards recycle, reduce and reuse strategies.

	Recycle		Reduce		Reuse	
	Count	%	Count	%	Count	%
Strongly disagree	4	0.5	8	1.1	5	0.7
Disagree	5	0.7	19	2.6	19	2.6
Neutral	12	1.6	93	12.7	58	7.9
Agree	272	37.1	340	46.4	336	45.8
Strongly agree	440	60.0	273	37.2	315	43.0
Total	733	100	733	100	733	100

From Table 16 it can be derived that UABC’s community generally accepts the strategies of reduce, reuse and recycle. The percentages of agreement (agree and strongly agree) for “recycle” are higher (97.1%) than the ones for “reduce” (83.6 %) and “reuse” (88.8%). Nevertheless these three agreement percentages were always higher than the ones of disagreement or neutrality. Table 17, Table 18, and Table 19 show the results of each one of these questions (Q6, Q7 and Q8) for each stratum.

From the three tables above a general pattern can be found by the different strata towards agreement of the strategies of reduce, reuse and recycle. However by looking only at the percentages one can not detect if there are any real difference among the answers of these four groups. For doing this an ANOVA, multiple comparison and a homogeneity test were applied. The results from this test indicate that there were no significant differences among the variances of these four groups nor within or between the groups for any of the three questions. The homogeneity tests didn’t show any kind of grouping either in the three strategies (reuse, reduce and recycle). Based on these results it is possible to say that the four groups of people perceive the three strategies for waste management at UABC in the same way, that is to say that there are no differences in the way these groups perceive these strategies.

Table 17. Percentages of the attitude of each stratum towards waste reduction.

	Role in UABC							
	Student		Janitor		Faculty staff		Administrative staff	
	Count	%	Count	%	Count	%	Count	%
Strongly disagree	5	1.0	1	2.9	2	1.3		
Disagree	12	2.5	1	2.9	4	2.6	2	3.4
Neutral	70	14.3	5	14.7	14	9.2	4	6.9
Agree	231	47.3	13	38.2	68	44.4	28	48.3
Strongly agree	170	34.8	14	41.2	65	42.5	24	41.4
Total	488	100	34	100	153	100	58	100

Table 18. Percentages of the attitude of each stratum towards waste reuse.

	Role in UABC							
	Student		Janitor		Faculty staff		Administrative staff	
	Count	%	Count	%	Count	%	Count	%
Strongly disagree	3	0.6			1	0.7	1	1.7
Disagree	12	2.5	1	2.9	3	2.0	3	5.2
Neutral	46	9.4	3	8.8	5	3.3	4	6.9
Agree	219	44.9	15	44.1	72	47.1	30	51.7
Strongly agree	208	42.6	15	44.1	72	47.1	20	34.5
Total	488	100	34	100	153	100	58	100

Table 19. Percentages of the attitude of each stratum towards waste recycling.

	Role in UABC							
	Student		Janitor		Faculty staff		Administrative staff	
	Count	%	Count	%	Count	%	Count	%
Strongly disagree	4	0.8	0		0		0	
Disagree	4	0.8	0		1	0.7	0	
Neutral	8	1.6	0		3	2.0	1	1.7
Agree	180	36.9	11	32.4	56	36.6	25	43.1
Strongly agree	292	59.8	23	67.6	93	60.8	32	55.2
Total	488	100	34	100	153	10	58	100

The second research question to answer is: 2) what is the attitude required of people to actively participate in the waste management program?

In order to answer this question the results for question 20 were analyzed. Question number 20 reads as follows: *I would like to participate in the UABC's waste management program.* The results for this question are presented in Figure 16.

As can be seen in Figure 16 the percentages of the people that were willing to participate in the waste management program are very low (25.2 %) compared to the ones in a neutral position (48.8%). These results teach that on the one hand the majority of the people agreed with the strategies (reduce, reuse and recycle) of the program while on the other hand just few individuals were willing to participate in it. To further understand the willingness to participate in the waste management program Table 20 presents the results by stratum.

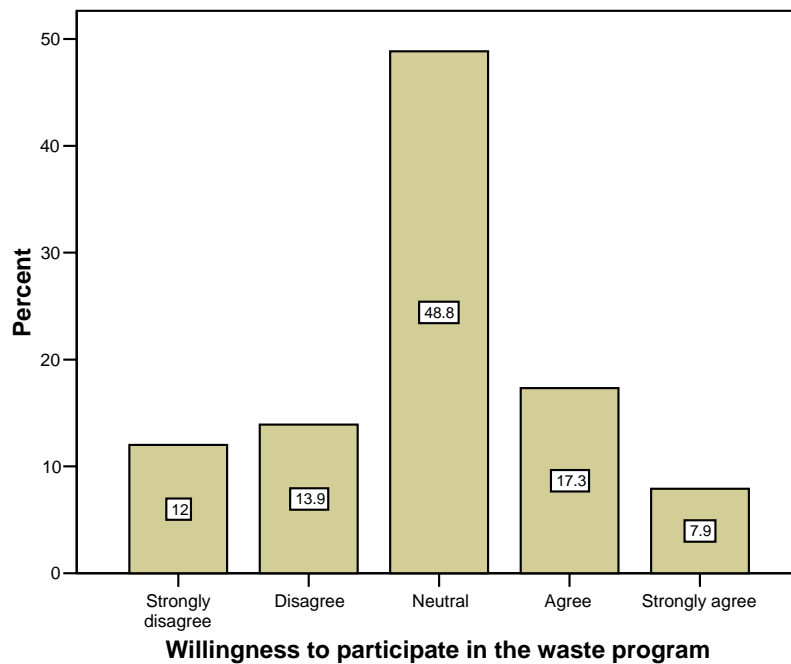


Figure 16. Percentages of the five possible answers for question 20

Table 20. Percentages by each stratum of the results to question 20 (I would like to participate in the UABC's waste management program).

	Role in UABC							
	Student		Janitor		Faculty staff		Administrative staff	
	Count	%	Count	%	Count	%	Count	%
Strongly disagree	57	11.7	4	11.8	14	9.2	13	22.4
Disagree	72	14.8	3	8.8	17	11.1	10	17.2
Neutral	244	50.0	17	50.0	68	44.4	29	50.0
Agree	82	16.8	4	11.8	37	24.2	4	6.9
Strongly agree	33	6.8	6	17.6	17	11.1	2	3.4
Total	488	100	34	100	153	100	58	100

From the data presented in Table 20 it is evident that the group of the administrative staff is the one with the lowest willingness to participate (10.3% resulting from adding the agreement percentages) in the waste management program, followed by janitors (29.4%), students (33.6%) and the faculty staff (35.3%) groups. In other words, the faculty staff is the group that showed a higher willingness to participate in the waste management program.

To know if the differences showed in Table 20 are significant it was necessary to answer the third question: 3) **Do the different groups of people (students, faculty, administrative staff and cleaning staff) differ in their intention to participate in the program?** To answer this question an ANOVA test was applied to the results of question 20 (Q20) of the questionnaire. Through this ANOVA test differences among groups or across can be identified (Fink and Kosecoff, 1998). ANOVA cannot directly prove that there are differences among groups but tests hypotheses about the sameness or equality of behavior and not the differences. Here ANOVA was used to test for equality of willingness to participate in the waste program among the four different strata (students, janitors, administrative staff, and faculty staff). The results are presented in Table 21.

Table 21. Results of the ANOVA test applied to the answers of Q 20 “Willingness to participate in the waste program”

		Sum of Squares	df	Mean Square	F	Sig.	
Between Groups	(Combined)	19.959	3	6.653	6.129	.000	
	Linear Term	Unweighted	6.778	1	6.778	6.244	.013
		Weighted	.007	1	.007	.007	.934
		Deviation	19.951	2	9.976	9.189	.000
Within Groups		791.370	729	1.086			
Total		811.329	732				

In Table 21 a small significance value (<0.05) indicate group differences. This means that at least one of the groups differs from the others. To determine which group(s) differ it was necessary to run a post hoc comparison. The test chosen for doing this multiple comparison was Tukey HSD. The results of this test are presented in Table 22.

Table 22 lists the pair wise comparisons of the group means for the Tukey post hoc procedure. *Sig* lists the probability that the population mean differences is zero. For this case the results were consistent in that administrative staff group was different from the rest when compared with each one of the other groups.

Table 22. Multiple comparisons of the mean for the variable “willingness to participate in the waste program” among the different groups.

						95% Confidence Interval	
	(I) Q2 Role in UABC	(J) Q2 Role in UABC	Mean Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
Tukey HSD	Student	Janitor	-0.225	0.185	0.616	-0.70	0.25
		Faculty staff	-0.248	0.097	0.051	-0.50	0.00
		Administrative staff	0.405(*)	0.145	0.027	0.03	0.78
	Janitor	Student	0.225	0.185	0.616	-0.25	0.70
		Faculty staff	-0.023	0.198	0.999	-0.53	0.49
		Administrative staff	0.63(*)	0.225	0.027	0.05	1.21
	Faculty staff	Student	0.248	0.097	0.051	0.00	0.50
		Janitor	0.023	0.198	0.999	-0.49	0.53
		Administrative staff	0.653(*)	0.161	0.000	0.24	1.07
	Administrative staff	Student	-0.405(*)	0.145	0.027	-0.78	-0.03
		Janitor	-0.630(*)	0.225	0.027	-1.21	-0.05
		Faculty staff	-0.653(*)	0.161	0.000	-1.07	-0.24

* The mean difference is significant at the .05 level.

For all selected post hoc procedures, homogeneous groups are defined; each homogeneous group corresponds to a column of the table. In this case, two homogeneous groups were defined Table 23.

Table 23. Tukey HSD and Duncan tests for homogenous groups

		Subset for alpha = .05			
		Q2 Role in UABC	N	1	2
Tukey HSD(a,b)	Administrative staff		58	2.52	
	Student		488	2.92	2.92
	Janitor		34		3.15
	Faculty staff		153		3.17
	Sig.			0.090	0.480
Duncan(a,b)	Administrative staff		58	2.52	
	Student		488		2.92
	Janitor		34		3.15
	Faculty staff		153		3.17
	Sig.			1.000	0.179

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 72.414.

b The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

Both tests (Tukey and Duncan) defined two homogenous groups. Even though Tukey HSD test grouped “students” and “administrative staff” in one homogenous group both tests are consistent in that the administrative staff group cannot be grouped with the other groups. This means that the administrative staff group differs from the other three in its willingness to participate in UABC’s waste management program.

5.4.2 Information about the waste management program

The fourth question to be answered was: 4) **what kind of relationship existed between the information disseminated about the waste program and the intention to participate in it?** For answering this question a Spearman *rho* correlation between the answers of two questions were done.

Spearman's *rho* is a rank-order correlation coefficient which measures association at the ordinal level. The absolute value of the correlation coefficient indicates the strength, with larger absolute values indicating stronger relationships. The results of this analysis are presented in Table 24.

Table 24. Results of the Spearman rho correlation analysis.

			Q13 Knowledge about the waste program	Q20 Willingness to participate in the waste program
Spearman's rho	Q13 Knowledge about the waste program	Correlation Coefficient	1.000	0.128(**)
		Sig. (2-tailed)	.	0.001
		N	733	733
	Q20 Willingness to participate in the waste program	Correlation Coefficient	0.128(**)	1.000
		Sig. (2-tailed)	0.001	.
		N	733	733

** Correlation is significant at the 0.01 level (2-tailed).

Table 24 shows a correlation coefficient score of 0.128 which is relatively far from 1. This indicates that knowledge about the program and the willingness to participate in it are positively but weakly correlated. In other words these results show some relationship between the two variables but this doesn't necessarily mean that information about the program influences the willingness to participate in it.

To further understand the role information about the program played the preferences for receiving information were analyzed. The fifth question therefore was: 5) **what was the university's community preferred way of receiving information about the program?**

Using the answers from question 17 (Q17) Table 25 was constructed. As can be seen in Table 25 the most preferable way for receiving information about the program was through posters and fliers. This depicts a very traditional preference for receiving information. Television, video and a WEB page were the second most preferred ways for receiving information. These results show that the waste management program used the most appropriate means to distribute information. The most preferred and the second most preferred ways for receiving information were also used in the waste management program along with other of the options.

Table 25. Percentages and frequencies for the most preferred forms of information distribution

	Frequency	Percentage (%)
Video	212	12.16
Posters and fliers	426	24.44
Multimedia material	57	3.27
University bulletin	184	10.56
WEB Page	210	12.05
E-mail	185	10.61
On-line course	51	2.93
University's radios station	168	9.64
Television	226	12.97
Other	24	1.38

5.4.3. Location of the recycling bins

Some authors mention that the perception the people have about the location of the recycling bins is an important variable that influence their willingness to use them (See Chapter II). Thus the sixth question was: **What was the impact of the location chosen for the recycle bins on the people’s willingness to use them?** This question is answered using the results from Q15 of the questionnaire. Table 26 shows the percentages and frequencies of the answers to the statement “The location (situation) of the recycling bins is adequate”.

As can be noted in Table 26 the majority of the people (67.5%) in the sample agrees or strongly agrees that the location of the recycling bins is correct. Nevertheless the people refuse to use them. According to the reports of the social service students (students’ reports, 2003) the people refuse to use the recycle bins because they don’t want to walk to the place where the recycle bins were. These reports also mention that the people don’t pay attention to the signs on the bins indicating the type of waste contained. Therefore many people discarded the waste in the wrong bin.

Table 26. Percentages and frequencies of the answers to the statement “The location (situation) of the recycling bins is adequate

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	14	1.9	1.9	1.9
	Disagree	60	8.2	8.2	10.1
	Neutral	164	22.4	22.4	32.5
	Agree	344	46.9	46.9	79.4
	Strongly agree	151	20.6	20.6	100.0
Total		733	100.0	100.0	

5.5 Summary

This chapter presented the most relevant results of the three most important variables influencing the development of the UABC’s waste management program: leadership, structure and culture focused on pro-environmental behavior. The results were interpreted here at the light of three different institutional stages: before the reform, transition stage and the stage after the reform. The waste management program produced different results in each of the three stages. In the next paragraph are presented the summary of the results for each of the variables.

5.5.1 Leadership

Leadership results showed that the leadership situations during the whole program were often not favorable. In are summarized the main results of leadership for each stage.

The leadership results contained in show that different leadership situations –according to Fiedler’s model- prevailed during the different stages of the waste management program.

Table 27. Summary of the results of the three variables during three institutional stages.

Variables	Institutional stages		
	Before the reform	Transition	After the reform
Leadership results according to Fiedler's model	Fairly good situations (III) were present for leaders in the higher hierarchical positions The worst situations (VIII) were present for the lower hierarchical positions Bad situations (VI) were always present for the position of WMP coordinator	The best situations (I) were present for leaders in the higher hierarchical positions Bad situations (IV) were present for the lower hierarchical positions	Fairly good situations (III) were present for leaders in the higher hierarchical positions A very good situation (II) was present in one of the low hierarchical positions. The other low hierarchical position presented a bad leadership situation (IV)
Transformational leadership characteristics	Showed partially by the rector and the coordinator of the program	Showed partially by the rector and the Director of Maintenance	Showed only by the chief of maintenance.

During the three stages of the waste management program better leadership situations were present for the leaders in higher hierarchical positions. This situation seemed to be the result of the strong position power and good relationships that these leaders had. Under these situations the lack structure of the task wasn't important enough to put these leaders in an unfavorable position. Nevertheless these good positions (situations III) of the rector and the Director of Maintenance were not used in favor of the waste management program during the stage before the reform. In the case of the rector he supported the launching of the program but no support was given after that. In the case of the Director of Maintenance in front of the rector agreed to cooperate but no support was given after that agreement. The best of situations (I) for these leaders were reached during the transition stage. Under this situation was that the temporary disposal site for waste moved to another place and the waste transport company changed as well. During the stage after the reform an interesting situation presented for the chief of maintenance, despite that this position lacked power he had a very good leadership situation (situation II); this was the result of good relationships

and very structured tasks. Nevertheless he could use this situation in favor of the waste program because he lacked the power to do so.

The worst of the situations that a leader can have – situation VIII According to Fiedler's model- were present in the lower hierarchical levels. The leader in these positions faced bad relationships with their subordinates, low structure of the task for the activities related with the waste management program and weak power positions. The combination of these variables brought about a very bad situation for these leaders. As a result the waste management program did not receive support from said leaders.

Also the coordinator of the waste program faced a bad situation -a situation VI according to Fiedler's model. This situation was the result of bad relationships with her followers and a weak power position.

During the three institutional stages it was evidenced that power of the position is a variable that played a major role for the performance of the leaders involved in the waste management program. It was not enough to structure their tasks or to maintain good relationships, if these variables were not combined with strong power positions the waste program didn't produce good results.

Transformational leadership characteristics were often lacking among most of the leaders that participated in the program. During the stage before the reform the only two persons that showed some of these characteristics were the rector and the coordinator of the waste management program but these were scarce in both cases. During the transitional stage some of the transformational leadership characteristics were shown by the rector and the Director of Maintenance but this stage lasted only six months. In the stage after the reform the only person that showed these characteristics was the Chief of Maintenance, anyway this person lacked the power to benefit the program. In all these cases the transformational leadership characteristics were linked to good results for the waste management program. When the former rector showed these characteristics he launched the program. When the coordinator of the waste program showed these characteristics she trained students, organized workshops for the promoters of the programs and launched the information campaign. And when the chief of maintenance showed the transformational leadership characteristics he started activities for the waste program without the support from higher or lower hierarchical levels.

5.5.2 Structure

The change of organizational structure during the execution of the waste management program didn't improve the results of the program. Similar problems continued to exist even though new people occupied key positions in the program.

During the stage before the reform the activities of the waste program were difficult to coordinate because different institutional departments had to be involved. Frictional relationships aroused as a result and the coordinated activities that required this participation couldn't get done.

During the transition stage the organizational structure remained the same as before. The power and routines that were established during previous years continued to exist under the same old paradigms. The good results for the waste management program that were present during this stage were accelerated by external pressure.

The transition stage and the stage after the reform were characterized by confusion. This was the result of the processed of downsizing, the fusion of different departments and the creation of vice-rectorships. These events were not favorable for the waste management program because resulted in the lost of the responsibility for the program. After these events took place no one was formally responsible for the waste management program.

During the three institutional stages the most prominent structural problems were: 1) the difficult cooperation between faculty and the maintenance office staff, and 2) the lack of support to the coordinator whose position was not formally recognized in the organizational chart. The first problem evidenced the lack of a collaborative atmosphere in the institution. The second problem evidenced that the attachment to formal positions is stronger than the intrinsic moral purpose that this position was created for. Both problems were the result of the difficulty to cope with innovation.

Innovation resulted more difficult to the administrative staff people than to the faculty staff and students. The explanation for this was found in Mintzberg's (1995) and Lam's (2000) theoretical notions. Both authors agree in those professional organizations like universities might be composed of subunits that behave differently. In the case of UABC administrative staff behaved more like a machine bureaucracy and the faculty staffs more like adhocracies or professional models and both models respond differently to innovation. In the former case was more difficult to cope with innovations like the waste management program because machine bureaucracies are organized around narrowly defined jobs and have little capacity to innovate. In the latter, the professional

model favored an individual approach to learning and responded in a more flexible way to innovation.

5.5.3 Culture (pro-environmental behavior)

Environmental culture related to waste management issues was not homogeneous in UABC. For the case of the two rectors that were present during the different stages of the program this was also true. The former rector showed higher pro-environmental behavior. He included sustainability aspects in the institutional mission, created the waste management program and the water program. The last rector didn't implement or propose any new environmental initiative for UABC and suspended some of the environmental activities that were carried out during the former administration. This was the case of the participation in COPLEXUS network and the water program. After the reform stage the environmental activities supported by the rector were the direct result of external pressures.

As far as the university's community the results showed that pro-environmental behavior was lacking. In spite of the acknowledgement that the strategies used by the program were necessary, people didn't show intentions to actively participate in it. The group with the lowest willingness to participate in the program was the administrative staff and the group with the higher was the faculty staff. It is interesting to note that these results also support the explanations given above for the barriers to cope with innovation from two different groups within UABC.

5.5.4 Other variables used to explain pro-environmental behavior

In relation to the other two variables analyzed -information distribution and the location of the recycling bins- the results were not conclusive. In the case of the information campaign the results showed that the waste management program used the most appropriate ways for distribution of information about the program. This statement was based on the results of the most preferable ways for receiving information that the UABC's community had. Nevertheless the information about the program didn't seem to influence the willingness to participate in the program. In the case of the location of the recycling bins although the community considered it was appropriate, the people refused to use them.

Chapter VI. Conclusion and recommendations

Various authors have stated that higher education institutions can play a very important role in promoting sustainable development (UNESCO, 2004; Schriberg, 2002; Wright, 2002; Bekessy, et. al, 2001; Leal-Filho, 2000; Clugston and Calder, 1999; Orr, 1994; Eagan, 1992). Through their practices universities can set an example for communities and other organizations. Nevertheless it has also been recognized by several authors that there is still a long road to go before universities really exploit the potential they have for influencing the community towards these ends. Various reasons are mentioned. One of these reasons is the lack of a system orientation when trying to introduce new environmental activities (see Chapter I). In this sense Schriberg, 2002c; Orr, 1996; and Clugston and Calder, 1999 agree in that the reductionist approach (see Chapter I) employed when trying to implement green initiatives is one of the reasons why this process is so difficult. This reductionist thinking blurs the possibility to detect the links between the related parts involved to solve the problem. The Autonomous University of Baja California (UABC) has passed through the same kind of problem. The main research question of this thesis was as follows: how can we explain the difficulty of implementing waste management programs within universities from a systems oriented perspective? To answer this question two sets of variables that might have influenced the results showed by the waste management program were analyzed: a) external variables (waste management system in Mexico and sustainability trends in higher education), and b) internal variables (leadership, structure, and pro-environmental behavior). In Figure 17 is a summary of the variables analyzed in this study.

Below the reflection is presented upon both groups of variables. First the two elements from the external environment – sustainability trends in higher education and the Mexican waste management system- are discussed. Afterwards are discussed the three elements of the internal environment: leadership, structure and culture focused on pro-environmental behavior.

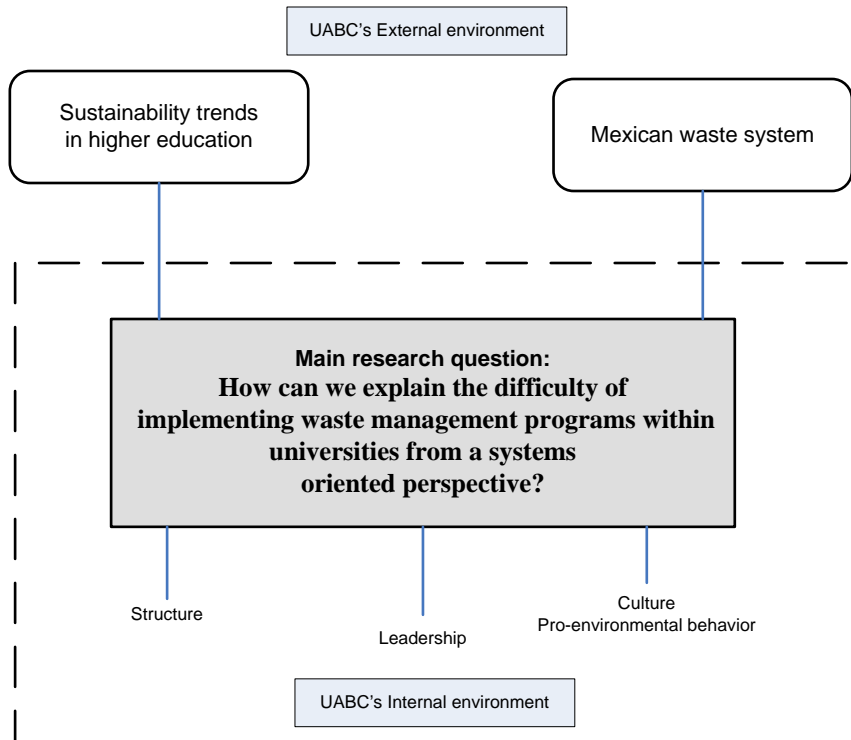


Figure 17. Variables analyzed in this study.

6.1 Impact of the external environment

The two factors of the external environment analyzed in this study were: 1) the Mexican waste management system, and 2) the sustainability trends in higher education. The first factor was chosen for three reasons: a) once waste is generated at UABC it has to be managed according to the policies and regulations imposed by the governmental authorities (part of the Mexican waste system); b) the waste generated at UABC has to enter into the municipal waste stream, and therefore has to be managed according to the municipal technological possibilities; and c) the way in which the waste from UABC leaves the institution and enters into the municipal waste stream depends on the private companies that brings that service as part of the Mexican waste system. Because of the above reasons it is to be expected that the Mexican waste system influenced the way in which UABC handled and disposed-off its waste. The second factor of the external environment - sustainability trends in higher education- was chosen because, among other issues, these international and national trends directly invite universities to start strategies to diminish their environmental impact. At a national level, a document was issued by governmental agencies - the Action Plan for Sustainability in Higher Education (ANUIES-SEMARNAT, 2002) - that set different strategies for Mexican universities to implement initiatives towards sustainable

development. Among these strategies the action plan asks universities to start environmental management systems to operate in a cleaner fashion. Because UABC had a representative involved in the process of formulating the action plan, it was expected that the institution responded according to these strategies, especially when dealing with issues related to UABC's operations.

Based on these two elements of the external environment, the specific research questions raised in this part of the study were:

- What is the impact of the **waste management system** upon the waste management program of UABC?
- What is the impact of the **sustainability trends in higher education** upon the waste management program of UABC?

Generally speaking the two variables of the external environment analyzed in this research showed little impact on the waste management program.

Mexican waste system

Let us first look at the way in which various factors related to waste management practices and policies influenced the waste management program of UABC.

Before the start of the waste management program no interaction existed between UABC's personnel in charge of the waste management issues and the different key actors from different sectors of the external environment that had something to do with waste, such as private companies, other universities, or municipal and federal authorities. In theoretical terms this means that boundary-spanning roles, which promote communication and relationships with people and organizations of the external environment, were absent. This in turn explains why UABC's waste management personnel wasn't aware of the different benefits (economic, social and environmental) that a proper waste management could bring if implemented properly. Also this lack of interaction prevented UABC from knowing that waste management alternatives existed and that, internationally, many universities have improved their waste management practices.

Secondly, before the start of the waste management program no regulations for non-hazardous waste were in place. The history of the waste management program showed that regulations can influence for example the establishment of the waste treatment plant and the bio-hazardous waste program at UABC. These were the results of the enforcement of the regulations for waste water and hazardous waste. Thus UABC responded to the fines and inspections made by the federal authorities. The fact that waste management policies existed, would generally make people (and

institutions like UABC) aware of the problem. However the history of the waste management program also made it clear that even if UABC started a program for non-hazardous waste as a direct result of laws, regulations and inspections, they were not always effective in assuring the management of its waste in a proper way. For example, during the existence of the program (in the transitional stage) new regulations for non-hazardous waste were issued that promoted waste management alternatives (strategies for waste prevention, reduction and recycling). Nevertheless these new policies didn't prevent the program from disappearing. In other words, while new regulations for non-hazardous waste were being issued by the Federal government, the waste management program was being dissolved at UABC. This showed that regulations in this case were not as effective as in the other examples. But the reason for this could be that the regulations for non-hazardous waste were new and no mechanisms to guarantee compliance were in effect. As a result no fines were issued to UABC for the way it mishandled its waste.

Thirdly, the role played by recycling market did have an important negative impact. The lack of local recycling industries hampered initiatives like UABC's waste management program because of the dependency of the program on said companies to handle and transport its separated waste. The dependency of the Mexican region that is near the United States border on the USA recycling market created uncertainty as to an effective reliable channel for the handling of separated recyclables.

Finally, the presence of waste-pickers in the institution also inhibited progress in the waste management program. Notwithstanding that, before the program, waste-picking could be considered beneficial from a social and environmental perspective for it represented the only source of income for the people who recover and sell the recyclables, while at the same time it was the only way to prevent recyclables to end in the landfill. Once the waste program began waste-picking activities became a hurdle because it led to a lack of income from selling recyclables which was intrinsic to the very success of the program.

This study allowed the detection of an impact in the opposite direction as well. That is from UABC to the external environment. In this case a positive impact from UABC's waste management program to the external environment was the enthusiastic response from the educational sector of Mexicali. Different schools' administrators wanted to receive information, skills, education and support from UABC's waste coordinator in order to start waste management programs in their own institutions.

Sustainability trends in higher education

Let us now look at the way in which the sustainability trends in higher education, internationally and at a national level- influenced the waste management program at UABC.

The Mexican Consortium of Universities' Environmental Programs for Sustainable Development (COMPLEXUS) was created by the Federal government to stimulate the improvement of academic processes in environmental issues. COMPLEXUS network was the only formal link of the sustainability trends in higher education, including the international trends, with UABC. Even though UABC had an active representative in COMPLEXUS he didn't provide feedback to the waste program participants. This meant that the external environment element "sustainability trends in higher education" didn't pose any effect on the institution. The waste management program coordinator knew about the international sustainability trends and was also aware of the existence of COMPLEXUS and the aims of this network. However she was not authorized to participate in the network because UABC had already a representative there. The representative was in the position to advise UABC's top management people about the priority actions relevant to UABC with respect to environmental issues. However his recommendations never impacted on UABC's waste management program. The lack of connectedness and communication between faculty activities and administrative activities prevented other possible ways to link the national and international trends of sustainability in higher education to the UABC waste program.

From the above paragraph it can be concluded that UABC had a diffuse influence of the existence of national and international networks working on sustainability in higher education. This situation was similar to the one presented on the waste management policy. But in this case the external variable did not have any specific impact.

The above means that the boundary spanning roles that link UABC with the external environment element sustainability trends in higher education were present. However, elements of the internal environment of UABC seemed to prevent the linking of the waste management program with those external trends. If links continue to be lacking a waste management program or any other environmental care program, will not be seen as part of an integral institutional program. It can be concluded that the role of knowledge networks did not play an important role for producing a paradigm change that could help the creation of successful environmental initiatives at UABC.

How can the conclusions mentioned above be interpreted theoretically based on Chapter II?

A plausible explanation comes from **networks theory** (e.g. Laumann, Galajliwicz and Marsden, 1978). In the case of the waste management program of UABC networks existed but did not impact

the program or its other environmental initiatives in any way. The detected networks related to the variables of the external environment considered in this study were REMEXMAR (for linking the Mexican waste system and UABC) and COMPLEXUS (for linking the sustainability trends in higher education and UABC). None of these networks seemed to exert any impact upon the waste management program. This could be explained by the process of knowledge exchange that must follow the participation into networks (Pumar, 2005). In the case of the participation of faculty members into COMPLEXUS or REMEXMAR networks the knowledge exchange was limited. The information or knowledge conceptualized into the network never permeated into the institution nor was it promoted by a public intellectual (public intellectuals move easily between the academic and public policy communities and are well qualified to translate academic arguments into policy objectives). Thus paradigmatic knowledge about how UABC could perform their everyday activities did not emerge.

The institution couldn't understand how to do it. The institution didn't know how to perform the same old activities in a different way. Paradigmatic knowledge here must be understood as a world view which gives meaning to individual perceptions of the environment, and in turn shapes observations and social institutions (Kakkuri-Knuuttila, Lukka, and Kuorikoskim, 2004). This situation can also be explained by Cox (1996) who mentions that institutionalization of knowledge goes hand-in-hand with its diffusion. Institutionalization must be understood as a practice that has been incorporated into a structured and usually well-established system. This means that an innovation or a new practice like the waste management program would not be institutionalized until its diffusion is taking place. Only then paradigmatic knowledge is given a name that has meaning in the policy realm. For the case of the waste management program the knowledge about waste management did not turn into paradigmatic knowledge, thus neither into an activity with policy meaning. These findings imply that it is not enough to participate in different networks. It is necessary to incorporate the information acquired through those networks through a process of diffusion, assimilation and finally institutionalization of the new ideas.

Thus at this point it is possible to assert that the lack of connectedness between the external sectors –in this case the Mexican waste management system and the education system- missed the opportunity to create joint strategies that could bring benefits for both.

6.1.1. Reflections on the Mexican waste system and UABC's waste program

Besides the above general explanation a number of more specific explanations can be provided to understand why the influence of the Mexican waste management system (including its policies) hardly had an impact on UABC's waste management program. A first plausible explanation might be that the Mexican waste management system is not considered part of the task environment of the university (Dill, 1958; Hall, 1991; Scott, 1987; and Gibson, Ivancevich and Donnelly, 2001). This implies that attention is paid to the aspects directly related to the educational processes such as curricula development, educational model, professor's skills, etc. and hardly to waste issues. As UABC does not receive support and legitimacy for having environmental programs such as the waste management program, the issue does not get priority. This is in line with Scott (1987) who argues that organizations act according to the rules and requirements to which they should conform. In the case of UABC waste management is not part of these rules and requirements. First of all this seems to be due to the standards on which the education authorities of the Mexican education systems evaluate universities. These standards don't include environmental care aspects. In other words, even if a public university has made much effort to have cleaner operations this doesn't count for receiving financial support and prestige.

A second reason may be that the Mexican waste management system doesn't exert any kind of influence upon higher education institutions to foster better waste practices. It doesn't have any mechanism to link its policies to the final users or actors affected by its policies.

The sum of the above problems leads to a vicious cycle (see Figure 18). Thus, if these two branches of the problem are observed as a whole it appears to be a vicious cycle. No one takes action to embrace universities to help solve the waste problem. Moreover, no use is made of the opportunity to include the higher education sector as one of the key players for promoting sustainable practices. This latter effort even exceeds waste issues because sustainability implies much more than proper waste management. It would provide the opportunity to promote waste management under the broader umbrella of striving for sustainable practices in different areas.

A third explanation comes from the fact that agencies mostly serve political and symbolic functions (Bolman and Deal, 1997). For the Mexican situation this means that the SEMARNAT (Mexican agency for the environment) and ANUIES (National Association of Mexican Higher Education Institutions) exert a type of symbolic control expressing the belief in the virtues of planning and the value of an integrated program of action. However the agencies are not given formal authority over the organizations whose services they are supposed to control. Hardly any incentive is used to

stimulate the cooperation of those organizations (Scott, 1983). It would have been a powerful stimulus if government had exerted more pressure on the verification of environmentally sound waste management practices. This can be illustrated by the fast response of UABC to the environment agency requirements when the institution was fined for improper management of bio-hazardous waste and water usage. Therefore, rigorous ways for verifying waste management aspects within universities –through inspections and fining systems- would probably have been an effective strategy to stimulate waste management at UABC.

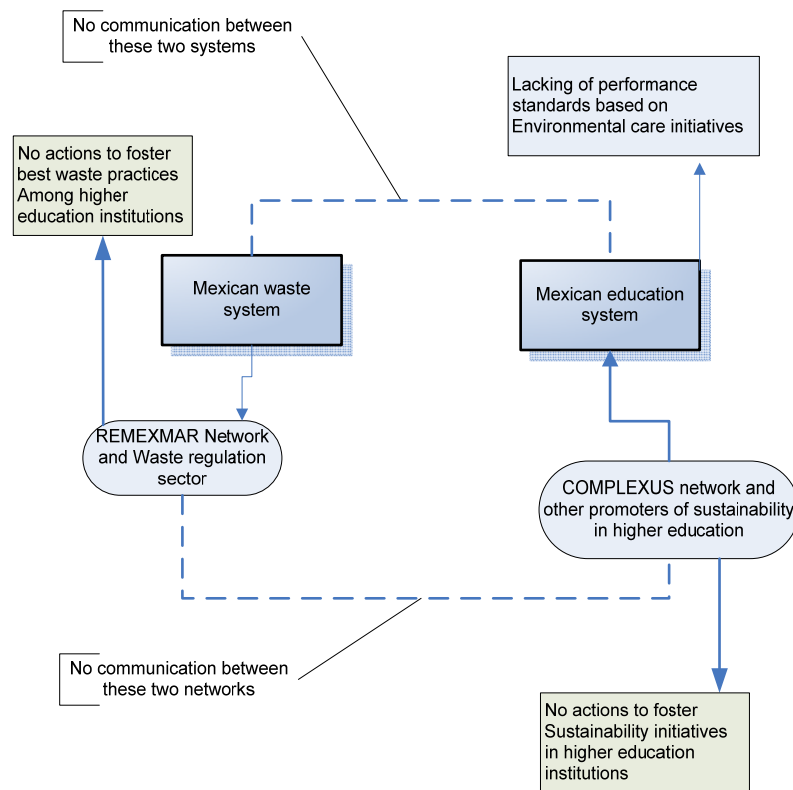


Figure 18. Disconnecting among the Mexican waste system, the promoters of sustainability in higher education and the Mexican education system.

Two additional explanations for the slow progress in the waste management at UABC can be mentioned related to the financial and cultural aspects of the external environment. Both aspects didn't act in favor of any waste strategy in Mexico, including UABC's waste program.

If financial incentives such as tax and financial mechanisms in favor of waste business would have been implemented, other alternatives, aside of land-filling might have been developed in Mexico. This in turn might have brought a synergetic effect towards the creation of jobs related to waste, such as buy-and-sell business for recyclables or recycling industries. These could have decreased the dependency of Mexico on the external markets for recyclables leading to certainty for the integral waste management programs such as UABC's.

Culturally speaking the Mexican government has always taken the entire responsibility for managing waste. The principle of shared responsibility was only introduced in 2003 by the new law for waste management. This means that until then no tradition existed of taking care of the waste produced, not in the families, not in the organizations, and not in the institutions like higher education institutions. Thus it is not surprising that the kind of waste management programs like at UABC failed to work when the tradition of participating as an institution in such programs was non existent. In more general terms this is also expressed by Laumann, Galajliewicz and Marsden (1978). They argue that if the cognitive and normative systems to which an organization (such as UABC) is subject don't include a cognitive and normative system for a desired change (such as proper waste management) it will be very difficult to change towards that end.

6.1.2 Reflections about sustainability trends in higher education and UABC's waste program

Which specific explanations can be given as to why the sustainability trends in Mexican higher education hardly had a positive impact on the waste management program at UABC, even though these trends are specifically intended for the higher education sector?

At a national level different efforts have been carried out to promote sustainability at higher education institutions, like the COMPLEXUS network and the Action Plan for Sustainability in Higher Education. However no specific strategy has been put into practice to follow up on the strategies set by COMPLEXUS and the action plan. The lack of incentives and implementation agendas impedes actual progress at universities.

A plausible explanation for not considering sustainable development initiatives (including environmental care initiatives) at Mexican universities is the lack of connectedness between the various external elements. This can be understood by what Scott (1987) calls "the historical elements". Historically no communication channel existed in Mexico between the education system and the other systems ruled by government. In the environmental arena, this kind of interaction between the environmental agency and the education system only started in the late 1980s through

promoting environmental education at primary schools. Then, in 2001 the Action Plan for Sustainability in Higher Education was issued. Even though this was a joint effort between the environmental agency and the higher education system, it hasn't brought about any tangible results yet because the mechanisms for working together have not been established yet. Since "historical elements" of cooperation between different systems are lacking, the implementation of new ways of doing things together is hard to effectuate as well.

Continuing this line of reasoning, it is imperative to mention the impact that the UABC's waste management campaign had on its environment; specifically on the lower educational levels such as kinder-garden, basic education and high school. After the first weeks from the starting of the information campaign a lot of feedback from the principals of different schools was received. This showed the great interest that existed about the issue of waste management programs in basic and middle level educational institutions. In this case these institutions identified more with UABC (a higher education institution) than with the government. The reason for this could be the historical elements of cooperation between similar systems.

History has also shown that Mexican higher education institutions respond to external stimuli when the financial support is available or when they are penalized for doing things wrong. It is therefore plausible to assume that the information brought in by the networks would be taken seriously and the institution would be more responsive to what is taking place outside of the organization, had the waste management initiative been introduced with the appropriate incentives, namely financial.

The above analysis teaches us that government mandatory measures are crucial when all public universities were forced to operate in the cleaner way, then UABC started to listen to the external environment variables studied here. Or, like the example published by Mata-Sagreda, (2002), it will take years before the university responds to those external variables.

Despite the above constraints there were also signs of willingness to take the waste management issue (and sustainable development in general) seriously at UABC. For instance:

- UABC is member of COMPLEXUS (the network for environmental care and sustainability in Mexican higher education institutions),
- UABC top management people were familiar with the Action Plan for Sustainability in Higher Education issued by the federal government,
- through the COMPLEXUS network UABC was aware of the national and international trends of environmental care in higher education,

- UABC had capable people that could start acting according to the Action Plan.

In spite of this fertile ground present at UABC it proved to not be enough to start acting according to the Action Plan. Internal factors seemed to have prevented UABC to take proper action. How and why these internal factors determined the development progress, will be discussed next.

6.2 Variables of the internal environment

The three elements of the internal environment of UABC that were analyzed in relation to the waste program were leadership, structure and pro-environmental behavior. These elements were chosen because these were mentioned most frequently as being crucial in the literature about implementation of environmental care practices.

The analysis of these three variables was made during different institutional stages. A summary of the results of each of these three elements is presented and then reflected upon in the next paragraphs.

6.2.1 Leadership

Different authors (Doppelt, 2003; Scott, 1987; Bolman and Deal, 1997; Kotter, 1996; Kotter, 1990) have stressed the importance of leadership for implementing a change effort. In this study the intention was to investigate the relationship between leadership and the results during the implementation of the waste management program. The research question that guided this part of the study was: **what is the relationship between the role of leadership and the results obtained during the implementation of the waste management program at UABC?**

The results of the analysis showed that the waste management program of UABC was directly affected by the leadership styles that prevailed in the different institutional stages and in the departments that were involved in the program during each stage. Positive results came to the fore when at least one of the characteristics of a transformational leader was present combined with a good leadership situation. The power position was important as well but it didn't exert much influence on the lower positions in the organizational chart because of other variables present. One of these variables was the lack of awareness for waste management issues of the people in key positions.

During the stage before the reform the rector in place at that time played a major leadership role. His commitment to the inclusion of the sustainability aspects into the institutional mission and his awareness of appropriate waste management practices made possible the implementation of the

waste management program. However, during that same stage leadership at the lower hierarchical levels was in a bad position according to Fiedler's model. This situation was the result of the combination of three variables: bad relationships between leader and followers, weak power positions of these leaders and the low structure of the tasks of the waste management program. This made it difficult to perform the different activities required by the program.

During the transitional stage (between one administration and the other) two important events took place in the waste management program: 1) the replacement of the waste transporting company and 2) the relocation of the temporary disposal site for waste. These events were linked to the best situation that a leader could have (according to Fiedler's model situation I) and to the presence of transformational leadership characteristics showed by the rector and the director of maintenance; both in influential power positions. Nevertheless here was also difficult to identify if these events happened because of the power of the position of the leaders involved or because these leaders had some characteristics of a transformational leader.

In the stage "after the reform" the activities for sound waste management taking place were primarily initiated as a result of the interest and work of two persons: the chief of maintenance and the analyst working with him. The chief of maintenance had a weak power position but showed many of the characteristics of a transformational leader. He had many ideas, very well structured tasks and maintained good relationships with his subordinates. Nevertheless he couldn't accomplish these tasks because of lack of power in terms of financial and human resources. Here Fiedler's Model can't explain why even though the chief of maintenance was in a situation II (very good situation) he couldn't succeed in his intents to make the program work.

The structure of the task alone didn't seem to play a major role; it was the combination of this variable with the power position and the presence of transformational leader characteristics that made some progress in the program. The above facts indicate that the variable that was more powerful for leadership to be successful was the power position combined with transformational leadership characteristics.

The existence or not of the waste program at UABC turned out to depend largely on the willingness of only one person, the rector. However his effectiveness related to many different coordinated activities from different departments of the university.

The two rectors in charge during the waste management program differed in their view of waste management and therefore set other priorities. During the administration of the former rector the terms "sustainable development and environmental care" were included in the mission of the

University. The present rector didn't propose something new in the environmental field. The emphasis of his administration was on the university's reform and other changes directed to academic curricula. Despite this difference in situation, the former rector was more concerned with the environment than the present one⁵. This concern was manifested in the different environmental programs the former rector supported (waste management, water and energy). In contrast, the present rector cut down the resources to support the participation in the COMPLEXUS network. In this sense the former rector was a better leader for environmental initiatives than the latter. In fact it was during the administration of the former rector that the waste program was launched and during the administration of the second that the program was eliminated.

6.2.1.1 Reflections about leadership and UABC's waste program

How can the above analysis about leadership be interpreted theoretically?

Different leadership situations were present during the three stages of the UABC reorganization. These situations generated few positive results for UABC's waste program. The good leadership situations were mainly present at the higher power positions weren't enough to generate positive results in the waste program. Positive results of the waste program emerged when at least one of the characteristics of a transformational leader (vision sharing, moral purpose, relationship building, knowledge creation and sharing, coherence making) was present combined with good leadership situations (understood as the leadership situations of Fiedler's model (see Chapter II). This was the case in the three organizational stages. In other words, good leadership situations alone did not produce good results for the waste program and transformational leadership characteristics alone didn't either. This situation could be explained by Avolio and Bass (1988). These authors state that without the capacity of inspiring and motivating the followers to reach certain results it is very difficult to achieve an objective. Then the power of the position by itself is not enough to attain the desired results. The inspiration and motivation are the result of the transformational leadership style. This is also in accord with Bass and Steidlmeier (1999) who claim that transformational leaders orient organizational systems toward a higher ethical purpose, thus inspiring their followers to act upon a desired objective. This was evinced in the transitional stage when the Director of maintenance, who was in a good leadership situation and showed transformational leadership characteristics, was able to change the private waste company for transporting waste to the landfill. Other example is given by the Chief of Maintenance in the stage after the reform, which also showed transformational leadership characteristics. Despite of the lack of support and the

⁵ Based on interviews with both.

disappearance of the program, he continued proposing waste management alternatives, however with limited success due to the lack of resources.

The waste program of UABC required the participation of people at all levels of the organization because each hierarchical level of the university work for specific purposes under specific rules and norms. Based on Zaccaro and Kimoski (2003) and on Doppelt (2003), to achieve a goal through a change process an organization requires leadership at different levels. Leadership not only pervades to management – it is found throughout the organization. Therefore leadership at different levels of UABC was analyzed.

In implementing a program such as the waste management program it is desirable that at each organizational level the leaders show the characteristics of a transformational leader (Lussier and Achua, 2002; Gibson, Ivancevich and Donnelly, 2001; Bass, 1998; O’Toole, 1995; and Bennis, 2003). The understanding of the program should then start with a vision and communication tailored to each type of audience. By doing this the message of the waste program and the activities associated with it will be especially relevant and meaningful for each type of audience within the university. This is also in accordance with Senge (1990) who mentions that many well-intentioned efforts often fail because the leaders forget that people learn what they need to learn not what others think they ought to learn. This means that if leaders get the people to see the need for the desired change they might be willing to learn how to do it.

The explanations above are contrary to the approach adopted in the waste program. It was assumed by the coordinator of the program and by the rector himself that the call of the rector to support the program would create the willingness of the people to participate in it; for he was in the power position to do so. This related to the notion of Scott (1987). He argues that most organizations are designed in such a manner that hierarchy of positions is created: one position is defined as controlling another. In this sense the position of the rector within UABC is the highest position in the organization. For that simple reason it was expected that his influence on the institution would be enough to create support for the waste program. This expectation was in accordance with Tannenbaum *et al.* (1974) who supplied evidence for the general expectation that the amount of control or influence is positively associated with the position in the formal hierarchy. In practice, however, this was not the case for the waste management program. In spite of the power and hierarchical position of the rector the desired impacts on the rest of the organization were not attained.

Thus it can be stated that for the initiation of the program the support from top management (the rector) was necessary but this support was not enough to make the program work. Support from the

lower levels in the hierarchy was also needed. This support could only be achieved if the characteristics of transformational leadership were shown by the different leaders that participated in the waste program regardless of the power position. The case of the waste management program showed that transformational leadership was often absent. Moreover, the leadership situation was not favorable especially not for the lower hierarchical positions during the three phases. This also hampered a successful implementation of the waste management program.

6.2.2. Structure

Also the organizational structure of UABC did not facilitate the success of the waste management program. Historically, no relationship existed within UABC between the academic sector and the administrative sector in charge of cleaning-maintenance activities. As the waste management program had an academic based coordination it was very difficult to align the participation of different actors belonging to the administrative and operations units of the institution as well.

Because the power position is linked to the structure of the organization, for explaining these findings it is important to look at leadership in relation to structure. Considering these variables together, the results of this work agree with Ogawa and Paredes-Scribner (2002) in that leadership and organizational structure are deeply interrelated and that structure can both facilitate and constrain leadership. In this sense the leadership power position was given by the verticality of the organizational structure that prevailed during the three stages of the program that were analyzed. Also the organizational structure affected leadership by determining the access to resources that leaders can use to exert influence over others. In this sense, the main responsibilities of the waste program were under the leadership of low power positions within the organizational structure thus exerting little influence over followers because of the lack of means for giving rewards, punishments and authority.

Moreover different units of the university were not used to cooperate, communicate and support each other. This was the case between the academic sector and the operations sector. For instance, the experiences gained in the waste program suggest that UABC's infrastructure operates independently of the academic activities and of the mission of the institution.

During the course of the waste management program a reorganization of the UABC took place. However, under this new organizational structure the traditional way of working within the institution remained the same. The new structure didn't by itself promote new behaviors. The structure became even more vertical because new hierarchical levels were created and the power remained centralized. For the special case of the waste management program the changes in

organizational structure were negative because the program itself disappeared at the same time that the office in charge of waste was merged into another administrative office. This meant that under the new institutional structure there wasn't any kind of support for those interested in continuing the waste management program.

6.2.2.1 Reflections about structure and UABC's waste program

The research questions that guided this part of the thesis were:

- Which type of structure best describes UABC's?
- What was the relationship between the organizational structure at UABC and the performance of the new waste management program?

Many of the problems that were present in UABC's waste program arose as a consequence of its organizational structure. Although universities are generally organized as professional bureaucracies based on a high degree of specialization of knowledge, this was partially true here. The operations side (administrative staff) of UABC behaved like a machine bureaucracy which was rooted in an internal labor market organized around narrowly defined jobs and tiered career hierarchy; in contrast, the academic sector behaved more like a professional bureaucracy (Mintzberg, 1995). In addition to the administrative sector, the academic departments of the university had to be involved as well. While the people in the academic departments of the university were asked to be highly prepared, specialized and creative to face the demand of increasing number of students, higher standards for research, and a better approach when responding to the community demands, the administrative departments were composed of people whose only requirement was to follow the organizational rules and regulations. This situation created confrontation between the creative-innovative side of the university (academic activities) and the machine-like side of the university (people in the administration). The former demanding new procedures for their ideas while the latter being unable to respond because of the absence of flexibility to change old procedures or to create new ways for responding to new demands. These two different parts of the university resemble two different structures: the academic sector resembles Mintzberg's professional bureaucracy while the administrative sector fits better Mintzberg's machine-bureaucracy behavior. This difference explains UABC's waste program experience. On the one hand the waste program idea sprouted from a research (academic) experience that was adopted by top management. On the other hand, the participation and involvement of the administrative departments of the university were required to get the waste

program off the ground. This raised problems because the administration had to respond to a program that was not in any of their previously established procedures.

The situation described above can be explained by Morgan (1997). He states that mechanistically structured organizations have great difficulty of adapting to changing circumstances because they have been designed to achieve predetermined goals and not to innovate. At universities the administrative job positions are particularly oriented to do specific things in clearly defined ways. Problems arise when the academic part of the institution proposes an innovation which requires participation of other departments of the institution. In the case of the waste management program these two approaches conflict: 1) a faculty member proposing a waste management program and, 2) the administrative people rejecting, opposing, delaying the program and finally sticking to the *status quo*. These results also coincide with Lam's (2000) institutional configurations and their ability to learn. Translating the UABC's waste management case to the Lam's configurations the bureaucratic model would be UABC's administrative departments. When they were asked to participate in the program they didn't know how to do that because no written documents were available to tell them how to proceed. The people in the administrative departments needed narrowly defined tasks to be able to work in the waste program. Because the waste program in UABC was new there weren't formal positions. Therefore it was confusing who was the boss and to whom they were supposed to report. Why did the people in this confusing situation not ask how to proceed or why didn't they look for options to act? Lam (2000) can be used again for explaining this situation. This author mentions that bureaucracies seek to control and eliminate tacit knowledge. They generate a superficial approach to learning and have little capacity to innovate. This could explain the difficulty to mobilize the administrative departments to learn new ways of dealing with waste and make them participate in the waste program.

When the two different approaches mentioned above try to work together, tension often rise. These circumstances hamper the openness and flexibility required to accept new ways of doing old duties. In the case at hand it was difficult to introduce, new ways for dealing with the same old problem of waste generation and disposal. Generally speaking, changing circumstances call for different kinds of action and response. In the case of UABC the standardized procedures of each department and the lack of communication channels made it hard to deal effectively with new circumstances. Since environmental issues bridges multiple departments and stakeholders, they may only become priority when cross-functional and interdisciplinary decision making prevails (Schriberg, 2002c). The top-down and siloed approach followed within UABC, was not favoring cross-functional activities like the waste program.

The way that UABC responded to the demands of the external environment was also related to the structure of the institution. In the case of the waste program the boundary spanning roles were played by faculty members. They were in contact with the networks related to waste management issues and sustainability trends in higher education. The information gathered through these networks couldn't be applied into UABC because the machine-bureaucracy impeded this for the same reasons as explained above.

In the case of UABC analyzed here, it was expected that the two different administrative periods would produce different results for the waste program because of a reengineering of the organizational structure that was done during the second administration. However, even when structural changes took place no positive results for the waste program were gained. New hierarchies were created while the old ones were fused and renamed. This produced an even more complicated organizational structure. Under these new circumstances the waste management program was left unnoticed by all the newly created coordination offices. The more complex structure even worked against the requirements for responding to a new idea. According to Doppelt (2003) sustainability initiatives require horizontal relationships as well as a seamless integration of all units and functions in planning and decision-making. This didn't happen at UABC since the activities of each unit is completely disconnected from the rest of the units. As an example there is the moment when the coordinator of the program (a faculty member) tried to coordinate janitor's activities (staff members of an administrative unit). These different units of the same organization have never worked together. Even though their activities could have mutual benefit they haven't been conceived in that way. This situation could be explained by Oakley & Krug (1991), who state that the power/control-based structures create separation between organizational functions dependent on each other. They create and perpetuate the barriers that limit the ability to work well together across departmental lines (Oakley & Krug, 1991).

Schriberg (2002) adds to this that departmental and disciplinary boundaries form barriers to sustainability initiatives. Moreover he argues that "turf battles" and "internal competition" can hamper the support and credit for environmental initiatives. The same situation occurred in the case of UABC's waste program, for instance at the moment of buying and placing the recycling bins, during the meetings and talks for the relocation of the temporary disposal site for waste, and during the proposal for changing the company that collects and disposes-off the waste in the landfill.

Another explanation for the failure of the waste program at UABC is the assertion of various authors (Doppelt, 2003; Fullan, 2001; Birnbaum, 2001; Hall and Hord, 2001) that the better positioning of an innovation over an old practice is a consequence of the application of power by

various interest groups at numerous levels within an existing organizational system. As this situation did not exist in the case of the UABC it was very difficult to successfully implement any environmental innovation. The most influential positions were not interested in such an initiative. One interviewee stated “if the rector is not truly convinced, he will not provide the financial or human resources to support the environmental initiatives”. Thus UABC members appear to behave according to the wishes and plans of the top level. Stakeholders have faith in their leaders- particularly the rector- in terms of taking on reasonable risks and providing a vision and action plan for the future. However, UABC operates largely as a bureaucratic, hierarchical organization that is structured in a top-down manner. In top-down decision making processes people placed in lower levels of the organization are used to receive orders from the higher positions. In the case of the UABC waste management program there was hierarchical leadership without positive results. Although this assertion might sound contradictory due to the difficulty of collaborating between the various departments it was not.

Another aspect related to the organizational structure is the lack of power of the coordinator of the waste program. The people that were supposed to help her didn't do this because they didn't see her as their boss. This situation was a consequence of the lack of power her position as coordinator carried within the organizational chart of the university. According to Scott (1987) power in formal organizations is determined at least in part by design. Most organizations have been designed in such a manner that a hierarchy of positions is created: the one position can control another. In the case of the waste management program the position of “coordinator of the waste program” was non-existent. Thus, how much power could that position possibly have? If Scott's (1987) vision is considered, who is to be controlled, punished or rewarded? A second way to explain the lack of power of the coordinator can be based on Hatch (1997) quoting Pfeffer (1978). According to Pfeffer through structural arrangements, communication is prescribed, reporting requirements are made apparent, and information networks are forged. It is through this structuring of communication, relationship, and information that top management is provided with the legitimate authority to use organizational power to set goals, make decisions, and direct activities. In other words, authority is derived from individual's structural position in the hierarchy. In this sense, the UABC's waste program coordinator lacked authority and power as well.

Finally, the other environmental efforts that have aroused in UABC from bottom up have also had limited success because of the lack of human and financial resources and because of the lack of policies to guide these efforts with the institutional backup. Those efforts like the Environmental Research Program (ERP) that lasted three years was functioning until it fell into the hands of

administration leaders. The people in the administration didn't notice the benefits that ERP would bring to the institution nor saw the benefits for the faculty members that were already involved in environmental care projects and research.

These findings lead to the conclusion that under the mechanical top-down structure of UABC, innovation is very difficult to implement. An indirect consequence of this is that people in the organization don't consider innovation as desirable, which leads to apathy among its members. This is in agreement with Shriberg (2002c) who states that collaborative structures if present (as opposed to "top-down" processes) favor an environment in which environmental care programs are welcomed.

6.2.3 Culture (Pro-Environmental behavior)

In the analysis of the waste management program at UABC it was assumed that pro-environmental behavior might play a role in successful implementation of the program. This pro-environmental behavior focused here on the behavior showed by the people at the university towards the waste management program. A distinction was made between pro-environmental behaviors: 1) at the level of the rectors and 2) at the level of the rest of the UABC's community analyzed by groups (students, faculty staff, administrative staff and janitors).

The results showed that the two rectors in office during this study had different attitudes towards waste issues at UABC. During the stage before the reform the former rector was motivated to start a waste management program because of his personal awareness and knowledge about adequate waste practices. He was also aware of the international trends of universities in the environmental arena. This knowledge motivated him to implement the waste management program at UABC.

During the transitional stage the new rector didn't implement or propose any new environmental initiative for UABC. During the stage after the reform the rector supported environmental activities at UABC. However, this was not in response to a personal commitment towards environmental protection but because of the fines and newspaper charges about the way UABC was handling bio-hazardous waste. This created only a sense of urgency to appease the authorities thus, the new rector did not show a favorable attitude towards environmental care initiatives at UABC.

The results concerning the rest of the UABC's community showed that pro-environmental behavior is lacking here. In spite of the recognition that the strategies used by the program (reduce, reuse, recycle) were necessary, people didn't demonstrate the will to actively participate in the program. Generally speaking just few individuals wanted to participate in the waste program. The

administrative staff was the one which had the lowest willingness to participate in the waste management program.

The results also showed a weak relationship between the information about the program and the willingness to participate in it. Posters and flyers were the preferred way for receiving information about the program. The majority of the people agreed that the location of the recycling bins was proper. Nevertheless, people refused to use them.

6.2.3.1 Reflections about pro-environmental behavior and UABC's waste program

Relying on the results of the above paragraphs is difficult to point at specific reasons for the lack of pro-environmental behavior. Plausible explanations might be the following three: 1) the structural problems mentioned before; 2) the notion of Azjen's Theory of Planned Behavior and 3) the influence of other variables such as the information about the program and the specific context variables such as the location of the recycling bins.

1. According to Lam (2000), Morgan (1997), and Bolman and Deal (1997), the bureaucratic mechanic behavior of the administrative staff limits flexibility and openness to perform and experience new behaviors, attitudes and activities. The reason for this is that once a situation is defined the course of action is clear, straightforward, and almost automatic. But if new situations appear –like the new waste program- nobody knows what to do because there aren't written rules for this new situation and there isn't an established chain of command to shape and direct the behavior of those lower levels of the organization. This lack of a culture to face new procedures lowered the willingness of the administrative staff to actively participate in the waste program.
2. Azjen's (1991) Theory of Planned Behavior (TPB) aims to determine behavioral intentions. According to this theory intentions to perform behaviors of different kinds can be predicted with high accuracy from attitudes toward the behavior, subjective norms, and perceived behavioral control (Azjen, 1991). According to this theory UABC's community might recognize the value of the recycling, reduction and reusing strategies but not see any personal advantage for behaving according to them. If individuals don't see a personal gain in the proposed behavior (in this case recycling, reducing and reusing waste) they might not consider it worth to make any extra effort towards the proposed activities. Another explanation derived from TPB might be that people at UABC do not perceive that what others think about their waste practices is important. Subjective norms could be working

against the waste program. Finally, it might be that the people at UABC don't have the feeling that they can control the performance of the new behavior. This perception hinders their participation in the program. The results of the questionnaire used in this research don't permit further analysis based on TPB.

3. Other variables that might play a role in the lack of pro-environmental behavior are for instance the availability of knowledge and information. According to Kreft-Burnman (2002) and Garcés *et al.* (2002) deficient knowledge and information may leave many doubts about the way the people could participate in a program. However the weak relationship between the willingness to participate in the waste management program and the information received didn't confirm this. Moreover, the program's coordinator used the preferred forms for receiving information. Therefore, the possibility of having used channels of information that the community disliked should be rejected. McKenzie –Mohr & Smith (1999) also recognized the importance of information and knowledge in creating public awareness and in changing attitudes. However, these authors also state that behavioral change rarely occurs as a result of simply providing information. Instead these authors advocate community initiatives which focus on removing barriers to an activity while simultaneously enhancing the activities benefits.

Other plausible explanation may be that no proper incentives were applied. As mentioned in Chapter II *motivators* behind recycling behavior are important variables to be considered when analyzing participation in recycling. For the case of UABC's waste program monetary motivators weren't part of the strategy. The importance of these incentives is in agreement with McGuire, Hughes, and Rathje (1982). They state that money has proved to be the most powerful incentive toward household recycling. However, the implementation of monetary incentives could be difficult at universities due to the varied composition of its community. Considering this, different strategies and rewards could have been planned for each of the groups. For example at the University of Colorado in Boulder, USA, students are involved in recycling activities. They get paid for this work while at the same time they fulfill a community service program (Keniry, 1995). With this double incentive students are eager to participate in the program. The University of Colorado has also used incentives to keep janitors (custodian staff) involved in the waste program (Keniry, 1995). This example shows that incentives can have a substantial impact in a variety of sustainable activities including waste reduction and recycling. They are particularly useful when the motivation to engage in action is low, or people are not doing the activity as effectively as they could (McKenzie-Mohr and Smith, 1999). There are, however, authors who argue that effectiveness is a greater motivator

than money (Davio, 2001; Gamba & Oskamp, 1994; Oskamp, *et. al.* 1991; Simmons and Widmar, 1990). These authors suggest that the more people see recycling as being effective, the more likely they are to participate, or to participate more fully. Thus the perceived effectiveness of recycling is a strong motivator. The results of the study presented here confirm the latter. In several of the students' reports it was mentioned that it was not worthy to separate the recyclables because janitors mixed all the waste from the recycling bins with non recyclable waste. This type of incidents discouraged the participation in the program.

Another explanation for the UABC's community lack of engagement in the waste program is given by other *specific context variables* such as the location of the recycling bins and the existence of a waste policy. The results concerning the location of the recycling bins seem contradictory. On the one hand the results of the questionnaire showed that the people agree that the location of the bins were proper. On the other hand several of the students' reports mentioned that people complained about the location of the recycling bins. The incongruence of the results could be due to the way the information was conducted. The questionnaires were applied in classrooms and in offices far from the recycling bins, while the students' reports were written in front of the recycling bins after a short conversation with the people that used them in an improper way. The second way of obtaining information could have been more prone to use excuses for not using the bins properly. It should be noted that from the very beginning the location of the recycling bins was a problem and the janitor's will prevailed over the objectives of the program. These results are in agreement with Williams (1991) and Ludwig *et al.* (1998). These authors argue that the location of the recycling bins affects recycling programs. A bad location of the bins will bring negative results and apathy for its usage. Another reason using the bins in an improper way can be explained by habits (see below).

The lack of environmental and waste *policies* might also help explain the bad results of the program. Garcés *et al.* (2002) mentions that when a recycling program is supported by sound environmental *policies* and is felt to be organized and controlled by good management, it has a positive influence on individual recycling behavior. Considering this, UABC's waste program was in a bad position because it was never supported by policies. Moreover, the administration gave clear signs of a lack of control. These facts might have discouraged people from participating in the program. The UABC policy issues are also related to structural issues. The lack of policies for waste management is a consequence of the structural procedures to formulate policies. In the case under study here a waste policy proposal was made from the bottom up. Nevertheless no progress was visible because, based on the structural procedures of UABC, such policies should have been formulated at the top-level.

Finally *habit* might also play a role in the lack of pro-environmental behavior. According to Klöckner & Matthies, (2004) most of people's behavior is habitual. The association between cues and patterns of behavior is learned by repeating the same behavior under the same circumstances over and over again. This implies that the old habits of throwing away all types of waste together are strong. It will take time before people get used to the recycling bins and use them properly. Thus in spite of the agreement that the recycling, reusing and reducing were perceived as good waste management strategies and that the recycling bins were considered to be in the right locations, people still struggled against participating because of habitual behavior.

6.3. General lessons learned

From the case of waste management program studied in this thesis four different groups of lessons can be derived: 1) the lessons derived from the understanding of the Mexican waste management system. These lessons could be applicable not only to any other education institution but also to other kinds of institutions like industries, commercial establishments, health and government institutions, etc. 2) The lessons derived from the understanding of the international and national sustainability trends in higher education institutions. These lessons are not only applicable to UABC but to any other public Mexican university as well. 3) The lessons derived from the understanding of some of the internal variables of UABC. These lessons are mainly applicable to UABC but could be applicable to any other public institution with similar structural characteristics. And finally 4) the lessons derived from the methodology and theoretical approach followed in this study. These lessons can help improve future research in the same field of study within UABC as well as in other institutions. Below these four lessons will be further elaborated.

The lessons learned from the understanding of the Mexican waste system allowed seeing how this system largely determines the institutionalization pattern of waste management programs. A certain degree of dependency exists between UABC's program and the external waste system. This dependency became manifest in the way that there was lack of local recyclable markets, incentives for implementing waste alternatives, connectedness between the educational sector and the waste sector, and the lack of supervision of waste managements in educational institutions, etc. All these aspects affected the UABC's waste program. The main lesson learned here is that a waste program should not be envisioned in an isolated manner. A waste program should be planned taking in consideration the external waste management conditions (opportunities and limitations). In this respect the future of waste management in Mexico seems more promising. The recent Mexican regulations for waste are more comprehensive and include social, commercial and cultural aspects that were not part of previous regulations. Present day federal, state and municipal governmental

initiatives regarding waste management are more supporting as they offer opportunities for the development of different methods of handling waste including recycling initiatives. Nevertheless a systemic approach should be considered when applying the new regulations or when the old scheme of isolated efforts towards proper waste management will continue to be present. This means that many different actors should be active in pursuing the objectives established by governmental authorities. Now the responsibility relies more on the community and less on governments. Thus initiatives like the UABC's waste program are more pertinent than ever.

The lessons learned from viewing the case of the waste program in the context of sustainability in higher education are illuminating as well. It showed that even though the actual trend was to include sustainability initiatives within all activities of higher education institutions, it did not permeate in Mexican universities by itself. When institutions like UABC gave high importance to environmental activities they were receptive to learn from other institutions that have already implemented such initiatives. In UABC's case for example for environmental initiatives to be considered seriously they must be written in the Institutional Development Plan. In this way, environmental initiatives would be followed through and policies for its implementation would be created.

From the leadership analysis it was learned that it is not enough to have the support of top management for the implementation of a waste management program. Support and leadership from the top of the institution was essential for the launching of the initiative. Next, the support of the lower levels of the institution was needed to make the program work. Leadership at the lower levels of the institution is also necessary since these leaders are the ones who will actually need to carry out the activities of the program. More attention should have been paid to these levels in the case of UABC. It was evident that besides the transformational characteristics, the leaders at lower hierarchical levels also needed power in the form of authority and financial resources to perform their activities. Consequently the leaders at the lower hierarchical levels could have the means to induce their followers to show concern to the new program and not just their ordinary daily routine.

From the analysis of the impact of the structure of UABC on the waste management program it was learned that the present day structural configuration of the Autonomous University of Baja California gives high importance to the formal positions in the hierarchy. Under the actual structural conditions of UABC a formal position of a waste program coordinator is therefore needed in order to take the waste management seriously. Otherwise "fanthom" positions –like the one of the waste program coordinator- will lack the power and resources needed to make the program work. The case of UABC also evidenced the lack of connectedness between departments. This connectedness

was needed in the waste program to facilitate the activities that required the coordination of two or more departments within the institution. As a result tensions arose between different sectors of the university that historically had not worked together. This situation in turn created bad conditions for the proper development of the waste program or any other environmental initiative that required the cooperation between departments.

From the analysis of pro-environmental behavior it was learned that it was hard to relate this aspect to a single and specific causing variable. In other words, pro-environmental behavior is the consequence of the interaction of many variables. Some of them are difficult to detect such as subjective norms or perceived behavioral control. However, other variables influencing pro-environmental behavior are more easily to detect such as the way the information is delivered, the inclusion of motivators or incentives to foster the intended behavior, the creation of policies to backup the waste initiatives, the elimination of barriers to perform the intended activity, and the creation of activities that help the community to change their waste disposal habits by repetitive action. It was also learned that it is not enough that people show concern for waste issues and they consider waste problems important. What really matters is to find ways to make people get involved and engage in the relevant activities. It was also revealed that different groups within the institution showed different willingness to participate in the program. This implies that different approaches might be useful when inviting the community to participate in environmental initiatives like the waste program.

Finally the case of the waste management program was studied under a systemic approach that considered variables from the external as well as variables from the internal environment of the institution. Even though the variables considered in this study were carefully selected, other variables turned out to play a role as well. This means that there is room for other explanations if other variables were to be considered. Generally speaking the case evinced that the different variables analyzed were not acting independently from each other. The interplay between these different variables led to the results described herein.

The most influential factor in the case study here seemed to be the organizational structure. The structure of UABC turned out to affect many other variables that were in play during the launching and implementation of UABC's waste program. As stated by Senge (1990) it is important to look beyond personalities and facts. One should start to look at the structures that mold the individual behaviors and create the conditions that facilitate certain types of happenings. The case showed that different structural barriers worked against the waste program. Structures define the desirable characteristics of a leader, how a leader becomes a leader, where the power is located, and what

kind of incentives are acceptable and permissible, what kind of relationships are needed and desirable between people in different departments, etc. All these issues can change when structures change, and a new vision becomes attainable. As mentioned by Doppelt (2003) “*effective structures are vision-and strategy-driven*”. High performance organizations devise structures that allow them to achieve their ideal visions in the most efficient and effective means possible. Many of the organizations that are leading the way towards sustainability are consequently moving away from tradition hierarchical models towards flatter structures arranged more by process rather than function (Doppelt, 2003).

Any other organization that fits the description of hierarchical structure such as that found at UABC can identify itself with the case of the waste program analyzed in this thesis. Nevertheless the problems encountered and the steps for getting a waste management or any other environmental program in place might not be the same as that in UABC. The reason is simple: no two organizations are alike. They might share some characteristics but the contexts in which they perform are different. Therefore in line with Wheatley (1999), the author of this thesis doesn't believe that organizations are ever changed by imposing a model or a recipe developed elsewhere. In every organization it is important to look internally, to search for the resources available for learning new ways of doing things and to engage in a creative process. Literally quoting Wheatley (1999) “*if context is as crucial as the science explains, then nothing really transfers; everything is always new and different and unique to each of us...*”

The problems faced by the UABC's waste program in relation to the Mexican waste system will be encountered by any other Mexican organization trying to implement a waste program that includes reduction and recycling strategies. Organizations under these circumstances would not be limited to the education institutions but to any kind of organization. The way each organization responds to this external variable will depend on the structural dynamics within the organization. The same holds for the sustainability trends in higher education. The sustainability trends are evolving and increasing as time goes by. It's the functioning of each educational institution that will create the responses to that international and national sustainability trends.

6.4 Similarities of the findings of this study and other studies

Some of the conclusions reported in this work are similar to those reported by other authors.

In this study it was reported that there was a coordinator for the waste program but without the power needed - a situation which is similar to not having a coordinator at all. It was also reported that this coordinator didn't have a formal position within the structure of the organization.

Moreover, no general environmental coordinator was appointed within the institution in order to follow-up not only the waste program but any other environmental initiative in UABC. Allen (1999), Schriberg (2002c), and Ching & Gogan (1992) also found that the lack of an institutionalized leader dedicated to coordinate environmental issues hampers the communication between academics, staff and students resulting in misunderstandings, unnecessary duplication of work and general bad relations between key stakeholders in campus environmental issues. Moreover, the difficulty was emphasized of coordinating two or more university departments having different types of activities such as the administrative vs. the academic units. Similar conclusions were reported by Armijo, *et al*, (2003) and Schriberg (2002c).

The case reported here also mentioned that the support from the top management of the institution was only present during the start of implementing the waste program. After that there was barely support from the administration, finally resulting in the disappearance of the waste program. Similar conclusions were obtained by Allen (1999), Creighton (1999), and Bowers (1997). They claimed that without continuous administrative support and commitment environmental efforts fade away and eventually disappear.

The need of environmental and particularly of waste policies was crucial for the initiative to have impact within the institution. The same conclusion was drawn by Allen (1999); Bowers (1997) and Hamburg & Ask (1992).

In this study it was also concluded that institutional priorities at UABC were linked to the standards set by the government to support higher education institutions. Until December 2005, these standards didn't include environmental performance. As a consequence UABC did not consider environmental issues as a priority. Competing priorities have also been reported by other authors such as Dahle and Neumayer (2001) as barriers towards the support of environmental programs within higher education institutions.

When pro-environmental behavior was discussed above it turned out to not be enough that the community shows environmental concern toward appropriate waste management issues. This variable alone did not promote pro-environmental behavior. For people are reluctant to change their behavior. Similar conclusions were reported by Dale & Neumayer (2001) and by Bowers (1997). They stated that often the most resistant aspects to change are those which lie below the surface level of awareness.

Finally one of the major problems detected in this study was the structural problem of talking about the different approaches to embrace environmental initiatives. This result resembles the conclusions

drawn by Orr (1996); Clugston & Calder (1999), and Schriberg (2002c) who concluded that when trying to make a change towards a “green operation” of the campus the reductionist thinking encouraged by universities blurs the possibility to detect the links between the related parts involved in helping solve the problem. Through the analysis of industries and different types of corporations Doppelt (2003) reached the same conclusion. He found that organizations that have made the most progress towards sustainability understand that the shift towards that aim requires the full involvement of all their internal members, as well as external stakeholders. In practical terms, this means that if UABC or any other institution aims to put into practice environmental initiatives, they should consider a systemic approach. Under such approach, the institution would try to avoid a very local and punctual focus; instead they would try detecting relationships between the different offices and stakeholders involved in the initiative. By doing so, the key elements of the external environment as well as the elements of the internal environment of the institution would be considered. As a consequence a more integrative planning and implementation would result, which would give the initiative more chances to succeed.

6.4.1 Additional theoretical insights

Although many studies about environmental performance in universities have been performed the majority of those have focused on one or two variables. For instance some have only looked at the internal factors influencing environmental performance at universities leaving out external aspects. Other studies have paid attention to the process of implementing ISO 14000 and environmental management systems. This study aimed to include both internal and external explanatory factors and adopted a systemic approach. This systemic approach sets the framework upon which future work can be based. Under this framework, which included internal and external factors, and on the basis of relevant theories, it was possible to understand that the events of the waste program aren't the result of a single variable. Instead the integrated framework of this thesis showed that it was the interplay of several variables what produced the results of the waste program. In other words, it was shown that a single phenomenon can have more than one origin and various sets of players. The main theoretical contribution of this thesis was the finding that, despite of the interplay of the various factors analyzed, the variable that played a more important role was organizational structure. The importance of this variable resides in that organizational structure influenced leadership, culture and the way the organization responds to the factors of the external environment. This was evinced more clearly under transitional stages when the organizational leaders changed but the organizational structure remained almost the same and the results of the waste program didn't improve. The organizational structure in this case shaped the way the UABC's members

interacted with each other, performed their tasks and interacted with the external environment. Other important theoretical contribution of this thesis is that in order to have environmentally sound practices in the Mexican higher education sector, it would be also necessary to align the vision and scope of the official-governmental sectors related to environment and to education.

This thesis was the convergence of results and complimentary findings from different theoretical perspectives. It is complimentary in that overlapping and different facets of a single phenomenon emerged. This added scope and breadth to the study. At the same time the original framework of this thesis should be revised in different aspects, especially for obtaining more insights about:

- The role played by external networks such as COMPLEXUS and REMEXMAR in Mexican universities that have advanced on their environmental agendas.
- The motivators to engage UABC's community in environmental initiatives
- The “environmental background” of the leaders involved in environmental initiatives to see if it influences their success on the initiative.
- A benchmarking study in order to grasp the types of strategies used by other Mexican public universities that have advanced environmental agendas.
- Demographic factors that might influence the willingness of the people to engage in environmental initiatives.

The analysis presented here does not resolve all issues regarding how and why universities implement environmental programs, particularly given that the study was based on a single case. Rather the research raises questions and left space for alternative interpretations and the generation of future hypotheses.

This study highlights the importance of the organizational conditions in the external and internal environment of universities. Emphasis was put on the particular elements that impose limitations to create conditions for the specific environmental program at stake. The analysis shows that multiple variables –from inside and outside the institution- must be taken into account for an environmental program to be successful. Specifically, the study reveals that external influences will not permeate into the organization if the internal elements are not ready to let them enter the institution. This was particularly the case for the sustainability trends in higher education. This research also claims that unless the governmental standards for supporting higher education institutions include environmental performance standards UABC's top leaders will not be pro-active in pursuing green

operations of the campus. In addition the study shows that other variables of the external environment negatively influence the environmental initiative by not imposing any kind of pressure. This was particularly the case for the Mexican waste system. These findings create a fertile soil for future research focused on the types of relationships and ways to overcome the gaps in information and relationship between external elements of the institutions and the internal elements that should respond. This study also reveals the importance of the interrelationship among those external elements that could work together to attain the desired results. In this context the interaction of the Mexican education system and the Mexican environmental agency is proposed in promoting coordinated actions that could help higher education institutions to attain greener operations.

This study also contributes to the field of higher education management. Particularly this research supports the assertion that the type of leader involved in environmental advocacy as well as the approaches that leaders adopt in promoting the environmental initiative can significantly impact the results. In addition, transformational leadership characteristics alone don't create the results pursued by the leader. Instead it is the combination of power and transformational characteristics what is more effective at UABC. This is linked to the other research finding that structure is a powerful force against leader's efforts. Namely, the structure sets the formal chains of power within the institution. It is demonstrated that at the Autonomous University of Baja California the waste program was not integrated across functional areas which made the interdepartmental collaboration difficult. These findings are likely to be applicable to other institutions and types of organizations as well.

The results of this study are particularly interesting since it was made under transition phases – change of administration and organizational structure. For this reason it opens the door to the formulation of new questions such as: How influential are the transitional phases on the leadership style? Would an environmentally knowledgeable and concerned leader change his priorities once he/she reaches top management positions? Is the structure itself dictating the leaders how to proceed?

In the field of pro-environmental behavior the research showed that environmental concern does not promote pro-environmental behavior by itself. Particularly it was shown that the community's agreement on the strategies promoted by the waste program and the recognition that waste poses a problem to the environment did not create a willingness to participate. These findings leave room for further research to explore the mechanisms of engaging people in environmental programs in such a way that a change of behavior occurs. This study also reveals that different perceptions of the waste program are present at UABC. This implies that different approaches should be explored in

order to get participation of the community in the waste program. These findings are likely to be applicable to other environmental initiatives at UABC or any other organization where differences of perceptions exist.

In general terms the integrated approach reported in this work offers the opportunity to pay attention to variables that could be overlooked. This could happen because no obvious relationship is seen among the desired change attempts and those variables. Under certain circumstances it might be easier to analyze only one group of variables –for example the internal variables of the organization. But under this approach the researcher might miss the opportunity to give a more complete explanation of the events under study or even to detect variables playing key roles. Finally, environmental programs at universities are intended not only to improve the environmental performance of the institutions but also to show students and the community in general that taking care of the environment is important. These programs also exemplify how to organize and put into practice environmental care initiatives. This is and should be the main objective of environmental programs. In this sense systemic approach to analyze and solve the problems of environmental programs in universities would bring more information to reach target audiences.

6.5 Recommendations

The recommendations described below could be applicable to any other organization, but as stated previously, context-specific variables should be taken into account as well. For example, in organizations with flatter structures and less bureaucracy it would be easier to have a single leader of a waste program to coordinate the activities from different departments. If the organization is a university or a college in this case, this leader might even be in an academic position because no inter-departmental barriers might be present or if present they might be easier to overcome.

It would be naïve to recommend an entire structural change of the University with more horizontal and less bureaucratic structures. With this in mind the following more realistic scenario is recommended.

6.5.1 Leadership

Who should be considered a leader for an environmental care program like the UABC's waste program? In this thesis different levels of leadership were considered because the waste program worked at different levels of the organization. But should a unique person lead the activities of such a program? Are there needed more leaders? Based on the results of this thesis the author of this work believes that different levels of leadership are required for different purposes:

- the top management of the university (rector),
- the director of the maintenance department,
- janitors' supervisors, and
- a “waste program coordinator” only in the case that this position could be formally created into the organizational chart.

If the Autonomous University of Baja California is to begin a serious waste program or any other environmental care program, these initiatives must be supported by top-management leaders, in this case the rector himself. This support can't just be in the form of verbal commitment but must be formally supported in the same way that the other serious institutional initiatives are undertaken; this is through written statements and commitments in the development institutional plans. This way the mechanisms and strategies for following –up those written initiatives would start. There would also start the creation of the requisite **policies** and **allocation of financial** resources for the new initiatives.

The leadership of the director of maintenance department will serve to bridge the activities required by his/her subordinates and the institutional initiatives for waste management. Thus it will be his/her leadership responsibility to find the mechanisms to train personnel, allocate a reward system, and motivate his subordinates to participate in the program. The janitor's supervisor's leadership will have to be designed and supported by the strategies of the director of maintenance. These lower leadership levels should be acknowledged in the eyes of the entire institution that they are the “people in charge of the waste program”. In this way the university's community will know where to go when something related to waste and recycling comes up.

6.5.2 Structure

A waste program coordinator position should be created only if it is formally integrated into the organizational chart, thereby giving the coordinator the support and formality needed at UABC to be considered a leader. Preferably this leader must be somebody already in the administrative staff. So, the coordination activities demanded by the program won't interfere with the academic activities that are evaluated with different reputation measures. For an academic staff an administrative position –even if temporary- is not convenient because (s)he loses the opportunity to comply with academic evaluation standards.

The waste program coordinator should be advised by a group of people already involved in waste management research. This way the coordinator is supported with up-to-date information about waste policies, technology and waste management trends. This advisory group should also involve students and representatives of the administrative staff and the cleaning staff in order to consider all the views present within that the different UABC's community about the waste program. This strategy will avoid excluding someone from the decision making process.

Job descriptions for the janitors and the rest of the cleaning staff should be modified. The new job descriptions must consider the activities demanded by the waste program. In this way the complaints about duties out of the list of regular activities would be avoided. For this, negotiations with the labor union representatives are needed.

6.5.3 Pro-Environmental behavior

Based on Schein (1992) learning experiences of group members and new belief, values and assumptions of new leaders and members can be used to create or change organizational cultures. According to this, different mechanisms must be used to promote a more environmentally conscious culture. These mechanisms must be aimed to create common understanding, beliefs, assumptions, and shared values of the need to take care of the environment and to act accordingly. For doing this, different approaches will be required:

- Communication:
 - A permanent campaign must be kept in all the communication media of the university. For example at UABC's TV channel, UABC's radio station and university's newsletter. Through such campaign messages explaining the importance of the environmental care programs, procedures and concrete activities to be performed by the university's community will be delivered along with the need, vision and mission for achieving a successful waste program. To be effective all the messages delivered through these media would have to include the elements suggested by McKenzie-Mohr and Smith (1999): use captive information, know your audience, use credible sources, frame your messages, make the messages easy to remember, provide personal or community goals, emphasize personal contact and provide feedback.
 - Personal messages from the rector where he reveals the vision of a university that is environmentally conscious. These messages from the rector should also include

exemplary practices that the very rector is performing to support the program. In the words of Schein (1992) “leaders of organizations generally seem to know that their own visible behavior has great value for communicating assumptions and values to other members”. Schein also says that informal messages are the more powerful teaching and coaching mechanism (Schein, 1992).

- Messages from the program’s coordinators towards the general community
- Learning experiences of group members:
 - Create opportunities for the different groups of people to get involved in activities that promote learning, in this case learning related to environmental care issues. According to Senge (1990) if people learn in groups or teams they transform themselves into a micro cosmos for learning through the organization. New concepts are taken into practice. New attitudes can be communicated to other individuals and other teams. Teams’ achievements can set the tone and establish the norm for learning altogether for the organization (Senge, 1990).
- A reward system for exemplary pro-environmental behavior
 - Because some cleaning staff employees may see waste reduction efforts as threats to their job security or view recycling as an increased workload (Creighton, 1997) it is important to find the reward mechanisms to compensate for their extra effort. According to Doppelt (2003) one of the key levers of change held in the human resources systems is the organization’s system of rewards. The employee reward systems should be consistent with the organization’s environmental care vision, goals and strategies. This agrees with Schein (1992) who says that if leaders are trying to ensure that their values and assumptions will be learned, they must create reward, promotion, and a status system that is consistent with those assumptions.
 - Make the incentive or reward visible. According to McKenzie-Mohr and Smith (1999) for incentives to be effective it is needed to draw people’s attention to them. Incentives can be more visible by closely associating them with the behavior they are meant to achieve.

- The program considering the use of non-monetary incentives such as social approval can also exert a strong influence upon behavior (McKenzie-Mohr and Smith (1999).

Use must be made of the groups of people willing to participate and get involved in environmental programs. In different universities students have proved (Keniry & Trelstad, 1992; Ching & Gogan, 1992; Hammond-Creighton, 1997) to be a powerful and successful group capable of creating synergies to engage the rest of the community into the environmental initiatives. Hence, it would be wise to consider, pay attention and support students initiatives, ideas and strategies. After all, as stated by Hammond-Creighton (1997) students are the university's customers, and their education is the primary reason that most colleges and universities exist.

6.6 An integrated approach

Specific recommendations were done separately for each of the three variables. But, is an integrated approach possible? The creation of an academic center in charge of environmental research, teaching, outreach, and audit could bond several aspects of environmental programs. This center could agglutinate the current environmental initiatives and researchers to form a body of knowledgeable and experienced academic staff capable to propose and guide the institutional environmental initiatives. This academic unit wouldn't necessarily imply the need of a different building to move the environmental researchers together but a linking between them based on research projects, teaching and institutional initiatives. This center should also include the participation of the people in administrative positions involved in the desired initiative. This type of arrangement would allow the participation of different branches of knowledge such as engineering, biology, oceanography, business administration, sociology, among others, to participate and bring input into the environmental initiatives. In general the advantages of a center of this type are:

- No need to invest in new buildings for the center because each researcher would continue working for their respective faculties,
- Feedback from different knowledge branches since any faculty member could participate and be a member of the environmental center. This would allow the articulation of multidisciplinary work amongst academic bodies.
- An independent board of management. This would allow the continuation of the center's initiatives and programs in spite of the changes in the top management or in spite of the priorities of the new administrations.

- Permanent offer to students to get involved in the research projects and in the institution's environmental programs. Offers to involve students could include modalities such as social service, scholarships, and teaching support. This way more students could participate in environmental initiatives,
- A non-centralized audit body. Supported by the authority of their academic background, the members of the center would evaluate the performance of the institution's environmental initiatives and suggest the necessary improvements to them.
- Real boundary spanning roles would be played by the group of faculty members since their research demand to be linked to the external environment. This would allow the introduction of the state of the art trends on environmental issues that could be incorporated into the institutional environmental agendas.

Besides environmental programs and research other activities the members of the center could also participate in curricular changes to include the environmental perspective in the education programs, formation and updating of professors, and business advice on environmental issues. An initiative of this type could help to overcome the structural and leadership problems manifested in the waste management program of UABC. It could also help to develop a culture of collaboration that would set the ground for a more participative community towards the solving of environmental problems within and outside the campus.

Change towards environmentally sound operations in any organization is not an easy task. It would take flexible structures, committed leadership and coordinated efforts to make it possible. Nevertheless this objective is attainable. As it was stated by Doppelt (2003), persistent environmental problems are sure indicators of poor leadership, management and governance in an organization. Factors that while difficult to overcome, are not insurmountable.

Literature References

- Ackerman, F. (1997). *Why do we recycle?: Markets Values and Public Policy*. Washington, D.C.: Island Press.
- Ackoff, R. L. (1981). *Creating the corporate future*. New York: Wiley.
- Acurio, G., Rossin, A., Teixeira, P. F. & Zepeda, F. (1997). *Situation of the municipal solid waste management in Latin America and the Caribbean*. Banco Interamericano de Desarrollo – No.ENV.97-107. Washington, D.C: Organización Panamericana. (In Spanish).
- Aguilar-Juárez, O., Coffie, R., & D'Urquiza-Díaz, A. (2004). Sustainability audit as a first step towards the design of the sustainability program for the Tecnológico de Monterrey, Campus Guadalajara. In *Environmental Management for Sustainable Universities -EMSU 2004*.
- AICPA-American Institute of Certified Public Accountants (1998). *Code of Professional Conduct*. New York: AICPA
- Allen, A. S. (1999). *Institutional environmental change at Tulane University*. New Orleans: Tulane University.
- American Psychological Association- APA, (2001). *Publication Manual*. (5 ed.) Washington, D.C.: American Psychological Association.
- Anonymous (2002, February 5). Bad image brings UABC as a consequence of its waste. El Mexicano. (In Spanish)
- ANUIES (2000). *Higher education in the 21st century: strategic guidelines for development*. México City: ANUIES. (In Spanish)
- ANUIES-SEMARNAT (2002). *Sustainable development plan for higher education institutions*. México City: ANUIES-SEMARNAT. (In Spanish)
- Aoki, M. (1986). *Horizontal vs. vertical information structure of the firm*. The American Economic Review, 971-983.
- Armijo, C., Ojeda-Benítez, S., & Ramírez-Barreto, E. (2003). Mexican educational institutions and waste management programmes: a University case study. *Resources, Conservation and Recycling*, 39, 283-296.
- Avolio, B. J. & Bass, B. M. (1988). Transformational Leadership, Charisma and Beyond. In: H. James, B. Rajaram, D. Peter, & A. S. Chester (Eds.), *Emerging Leadership Vistas* (pp. 29-49). Lexington, Mass.: Lexington Books.
- Azjen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Process*, 50, 179-211.
- Banathy, B. H. (1992). *A systems view of education: Concepts and principles for effective practice*. Englewood Cliffs, NJ: Educational Technology Publications.
- Banathy, B. H. (1996). *Designing social systems in a changing world*. New York: Plenum.

- Barnes, P. & Jerman, P. (2002). Developing environmental management system for a multiple-university consortium. *Journal of Cleaner Production*, 10, 33-39.
- Bartone, C. (1999). Management, recovering and recycling of municipal waste: strategy for auto sufficiency in developing countries. CEPIS. Available at: <http://www.cepis.ops-oms.org/1999>. (In Spanish)
- Bass, B.M. (1990). *Bass & Stogdill's Handbook of Leadership*. New York: The Free Press.
- Bass, B.M. (1998). *Transformational leadership*. Mahwah, NJ: Lawrence Erlbaum Assoc.
- Bass, B.M. & Steidlmeier, P. (1999). Ethics, character, and authentic transformational leadership behavior. *Leadership Quarterly* 10 (2): 181 – 217.
- Bekessy, S., Burgman, M. A., Wright, T., & Leal-Filho, W. (2001). *Environmental best practice in Australian and international universities*. University of Melbourne.
- Belausteguigoitia, J. C. (1997). Financial aspects of recycling. In C.Hernández-Fernández & S. González Martínez (Eds.), *Municipal solid waste recycling* (pp. 201-206). Mexico: Programa Universitario de Medio Ambiente, UNAM. (In Spanish)
- Bennis, W. (2003). *On becoming a leader*. Cambridge, MA: Perseus Publishing.
- Bhurtel, J., Higuchi, T., & Ukita, M. (2000). A case study of municipal solid waste management system of Ube City, Japan. In R. Mersky (Ed.) In *The 16th International Conference on Solid Waste Technology and Management*.
- Birnbaum, R. (2001). *Management Fads in Higher Education*. San Francisco: Jossey-Bass.
- Blöbaum, A. (2000). Environmentally responsible mobility behavior – The effectiveness of situation characteristics and ecological norm orientation. *XXVII International Congress of Psychology, Stockholm*. Accessed at: http://eco.psy.ruhr-uni-bochum.de/projekte/e_umw_mobil.pdf
- Boldero, J. (1995). The prediction of household recycling of newspapers: the role of attitudes, intentions, and situational factors. *Journal of Applied Social Psychology*, 25, 440-462.
- Bolman, L. & Deal, T. E. (1997). *Reframing Organizations: Artistry, choice and leadership*. San Francisco, CA: Jossey-Bass Publishers.
- Boons, F. & LeBlansch, K. (2000). Ecological modernization: focus on organizational change. In: Boons, F., Baas, L., Bouma J.J., de Groene, A. and Le Blansch, K. (eds.). *The changing nature of business*. Utrecht: International Books.
- Boulder Environmental Center (2001). *Blueprint for a green campus: An environmental action plan for the University of Colorado at Boulder*. University of Colorado. Boulder: UCB.
- Bowers, C. A. (1997). *The culture of denial: Why the environmental movement needs a strategy for reforming universities and public schools*. Albany: State University of New York Press.
- Bratt, C. (1999). The Impact of Norms and Assumed Consequences on Recycling Behavior. *Environment and Behaviour*, 31, 630-656.

- Bravo, M. T. & Sánchez, D. (2000). *Environmental action of higher education institutions in Mexico: antecedents and actual situation*. Mexico: ANUIES. (In Spanish)
- Bruner, J. (1990). *Acts of meaning*. Cambridge, MA: Harvard University Press.
- Buenrostro, D. O. (2001). *Municipal solid waste: a multidisciplinary approach*. Morelia, México: Universidad Michoacana de San Nicolás Hidalgo. (In Spanish)
- Buenrostro, O. & G. Bocco. (2003). Solid waste management in municipalities in Mexico: goals and perspectives. *Resources, Conservation and Recycling* 39 (3):251-263.
- Burns, T. & Stalker, G.M. (1961). *The Management of Innovation*. London: Tavistock Publications.
- Capdevila, I., Burno, J., & Jofre, L. (2002). Curriculum greening and environmental research coordination at the Technical University of Catalonia, Barcelona. *Journal of Cleaner Production*, 10, 25-31.
- Careaga, J. (1997). Recycling in a context of integrated waste management. In C.Hernández-Fernández & S. González Martínez (Eds.), *Municipal solid waste recycling* (pp. 27-51). Mexico: Programa Universitario de Medio Ambiente, UNAM. (In Spanish)
- Castañón, R. & González, S. (2004). Consumer behavior: processes and strategies focusing on sustainable development. In *Environmental Management for Sustainable Universities - EMSU 2004*.
- CEC (Comission for Environmental Cooperation) (2002). Capacity Building for Pollution Prevention. http://www.cec.org/files/PDF/POLLUTANTS/341-03-05_en.pdf [On-line]. Available: http://www.cec.org/files/PDF/POLLUTANTS/341-03-05_en.pdf
- Cheung, S.F., Chang, D.K. & Wong, Z. S. (1999). Reexamining the theory of planned behavior in understanding wastepaper recycling. *Environment and Behavior*, 31, 587-612.
- Ching, R. & Gogan, R. (1992). Campus Recycling: Everyone Plays a Part. In David J.Eagan & David W.Orr (Eds.), *The Campus and Environmental Responsibility* (pp. 113-125). San Francisco: Jossey-Bass.
- Clugston, R. & Calder, W. (1999). Critical Dimensions of Sustainability in Higher Education. In W.Leal Filho (Ed.), *Sustainability and University Life* (pp. 31-46). New York: Peter Lang.
- Coggins, Ch. (2002). Responsibility, Players in Partnership and Market Development for Sustainable Waste Management. *Environmental & Waste Management*, 4, 209-216.
- Collins, J. (2001). *Good to great*. New York: Harper-Collins Publishers.
- COMPLEXUS (2002). Objetivos del COMPLEXUS. Available at: <http://ambiental.ws/complexus/>
- Cookson, P. S. (2000). Implications of Internet technologies for higher education: North American perspectives. *Open Learning*, 15(1), 71-80.
- Copernicus Campus (2005). Objectives. The university network for sustainability [On-line]. Available: <http://www.copernicus-campus.org/index.html>

- Cordano, M. & Hanson-Frieze, I. H. (2000). Pollution reduction preferences of U.S. environmental managers: Applying Ajzen's theory of planned behavior. *Academy of Management Journal*, 43, 627-641.
- Corless, J. & Ward, H. (1992). Can Brown be Green? Lessons from One University's Quest for Environmental Responsibility. In David J. Eagan & David W. Orr (Eds.), *The Campus and Environmental Responsibility* (pp. 45-54). San Francisco: Jossey-Bass Publishers.
- Cortinas de Nava, C. (2001). *Towards a Mexico without garbage: foundations and implications of waste policies* (1st. Ed.) Mexico: PVEM. (In Spanish)
- Cortinas de Nava, C. (2003). Guide for interpreting the Mexican General Law for waste prevention. <http://www.cristinacortinas.com/publicaciones/publicaciones.shtml> [On-line]. Available: <http://www.cristinacortinas.com/publicaciones/publicaciones.shtml> (In Spanish)
- Cote, R. 2000. Community matters at Dalhousie University. *The Declaration Vol. 3 (3)*, 8- 10.
- Cox, R., & Sinclair, J. T. (1996). *Approaches to World Order*. New York: Cambridge University Press.
- Creighton, S. H. & Cortese, A. (1992). Environmental literacy and action at Tufts University. In D.Eagan & D. Orr (Eds.), *The Campus and environmental responsibility* (pp. 19-30). San Francisco: Jossey-Bass.
- Creighton, S. H. (1998). *Greening the ivory tower: Improving the environmental track record of universities, colleges and other institutions*. Cambridge, MA: MIT Press.
- Cursio, A., Leung, S., Prentice, B., & Trubiani, G. (2003). *Student recycling behavior on the St. George Campus of the University of Toronto*. Students report. University of Toronto, Canada.
- Daft, R. L. (1995). *Organization Theory and Design*. St. Paul , Mn: West Publishing Company.
- Dahle, M. & Neumayer, E. (2001). Overcoming barriers to campus greening. *International Journal of Sustainability in Higher Education*, 2, 139-160.
- Davio, R. (2001). *Influences and motivations on Curbside Recycling Participation in Austin, TX*. Dissertation: University of Texas at Austin.
- De Jong, J. (1999). *Organizing waste reduction in the Dutch waste sector*. Thesis. University of Amsterdam, Amsterdam.
- de Rosnay, J. (1997). *Analytic vs. systemic approaches*. Principia Cybernetica [On-line]. Available: <http://pespmc1.vub.ac.be/ANALSYST.html>
- DeYoung, R. (2000) Expanding and evaluating motives for environmentally responsible behavior. *Journal of Social Issues*, 56 (3), 509-526.
- Díaz-Sánchez, E. (2004). Campus Monterrey Operations for sustainable development. In *Environmental Management for Sustainable Universities -EMSU 2004* Monterrey, N.L., Mexico.

Dieleman and Cramer (in press)

Dill, W. R. (1958). Environment as an Influence on Managerial Autonomy. *Administrative Science Quarterly*, 2, 409-43.

Donaldson, L. (1996). The Normal Science of Structural Contingency Theory. In: *Handbook for Organization Studies*, ed. Stewart R. Clegg, Hardy, C. & Nord. W.R. Thousand Oaks, CA: Sage Publications.

Doppelt, B. 2003. Leading change toward sustainability. Sheffield: Greenleaf.

DWM, (2001). Guideline 27: Implementing a recycling program. North Dakota Department of Health, Division of Waste Management. Available: <http://www.health.state.nd.us/wm/>

Eagan, D. (1992). Campus environmental stewardship. In D.Eagan & D. Orr (Eds.), *The campus and environmental responsibility* (pp. 65-76). San Francisco: Jossey-Bass.

Eco-Campus (2006). German Network for Environmentally Sound Development of Universities. <http://www.eco-campus.net/index.en.html> [On-line]. Available: <http://www.eco-campus.net/index.en.html>

El Mexicano (5 de Febrero 2003). UABC doesn't pay attention to its waste. Mexicali, B.C.: El Mexicano. (In Spanish)

Elkington, J. (1998). *Cannibals with forks: the triple bottom line of 21st century business*. Gabriola Island BC, Canada: New Society Publishers.

Environmental Protection Agency (EPA) (2002). *Municipal Solid Waste Disposal*. <http://www.epa.gov/epaoswer/non-hw/muncpl/disposal.htm> [On-line]. Available: <http://www.epa.gov/epaoswer/non-hw/muncpl/disposal.htm>

Ewert, A., & Baker, D., (2001). Standing for where you sit: An exploratory analysis of the relationship between academic major and environmental beliefs. *Environment and Behavior*, 33 (5), 687-707.

Feagin, J. R., Orum, A. M., & Sjoberg, G. (1991). *A Case for the case study*. Chapel Hill: University of North Carolina Press.

Fiedler, F.E. (1967). *A Theory of Leadership Effectiveness*. New York: McGraw-Hill.

Fiedler, F.E. & Chemers, M. M. (1982). *Improving leadership effectiveness: The Leader match Concept*. New York: Wiley.

Fien, J. (2002). Advancing sustainability in higher education: issues and opportunities for research. *Higher Education Policy*, 15, 143-152.

Fien, J., Kumar, P., & Ravindranath, M. J. (2001). An action research network as a strategy for educational change: the "learning for a sustainable environment" project. *Journal of Educational Change*, 2, 207-221.

Filley, A.C. & House, R. J. (1969). *Managerial process and organizational behavior*. Glenview, Ill: Scott, Foresman and Company.

- Fink, A. & Kosecoff, J. (1998) *How to Conduct Surveys: a Step-by-Step Guide*, (2nd ed.). Thousand Oaks, CA.: Sage publications.
- Fishbein, M. & Ajzen, I. (1975). Belief, attitude, intention, and behavior: an introduction to theory and research. Reading, MA: Addison-Wesley.
- Fiskel, J. (1997). The motivating forces. In J.Fiskel (Ed.), *Design for Environment: creating eco-efficient products and processes* (pp. 15-22). Mexico City: McGraw-Hill.
- Florisbela, A. L. & Wehenphol, G. (2001). The role of the informal sector in the integrated solid waste amangement. In *Guide for the integrated Municipal solid waste management*. Mexico: SEMARNAT.
- Fortune, J. & Peters, G. (1995). *Learning from failure: the systems approach..* West Sussex: John Wiley & Sons.
- Fujita, R. (2000). *Solid Waste Management in East Asia: an opportunity for PFI*. Research report. Fujita research: <http://www.fujitaresearch.com/reports/msw.html>
- Fullan, M. (2001). *Leading in a culture of change*. San Francisco: Jossey-Bass.
- Gamba, R., & Oskamp, S. (1994). Factors influencing community residents' participation in commingled curbside recycling program. *Environment and Behavior*, 26 (5), 587-612.
- Garcés, C., Lafuente, A., Pedraja, M., & Rivera, P. (2002). Urban Waste Recycling Behavior: Antecedents of Participation in a Selection Collection Program. *Environmental Management*, 30 (3), 378-390.
- García, G. A., Rosas, A. D., Velasco, H. E., Gómez, P., & Ramos, R. (2001). Report of the situation and knowledge about the main dioxin sources and emissions in Mexico. Mexico City: Centro Nacional de Investigación y Capacitación Ambiental, UAM. (In Spanish)
- Gatersleben, B. & Clark, Ch. (2001). *Public Participation and Environmental Decision making*. University of Surrey, Guildford. In: <http://www.toolsust.org/documents/toolsust-%20Guildford%20report.pdf>
- Gibson, J.L., Ivancevich J.M. & Donnelly, J. H. (2001). *Organizations: behavior, processes and structure*. Santiago, Chile: McGraw-Hill Interamericana.
- Gladwin, T. N. (1993). The meaning of greening: a plea for organizational theory. In: Fischer, K. and J. Schot (eds.) *Environmental strategies for industry*. Washington: Island Press.
- Glasson, J., Therivel, R., & Chadwick Andrew (1998). Introduction and principles. In M.Bruton & J. Glasson (Eds.), *Introduction to environmental impact assessment* (2nd ed., pp. 1-3). London: UCL Press.
- Goldenhar, L. M. & Connel, C. M. (1993). Understanding and predicting recycling behavior: an application of the theory of reasoned action. *Journal of Environmental Systems*, 22, 91-103.
- González, G. E. (1993). Towards a national strategy and environmental action plan. <http://cecaedu.semarnat.gob.mx/> [On-line]. Available: <http://cecaedu.semarnat.gob.mx/> (In Spanish)

- Green Nature (2003). How to launch a community recycling program.
<http://greennature.com/article209.html> [On-line]. Available:
<http://greennature.com/article209.html>
- GRI (2002). GRI at a glance. The Global Reporting Initiative Home Page [On-line]. Available:
<http://www.globalreporting.org/about/brief.asp>
- Guerin, D., Crete, J., & Mercier, J. (2001) A Multilevel Analysis of the Determinants of Recycling Behavior in the European Countries. *Social Science Research*, 30, 195-218.
- Gumport, P.J. (2000). Academic restructuring: Organizational change and institutional imperatives. *Higher Education*, 39, 67-91.
- Hall, R. (1991). *Organizations: Structures, Processes, and Outcomes*. Englewood Cliffs, N.J.: Prentice Hall.
- Hall, G.E. & Hord, Sh. M. (2001). *Implementing change: patterns, principles and potholes*. Needham Heights, Mass.: Allyn and Bacon.
- Hamburg, S. P. & Ask, S. I. (1992). The environmental ombudsman at the University of Kansas. In D.Eagan & D. W. Orr (Eds.) *The campus and environmental responsibility* (pp. 55-63). San Francisco: Jossey-Bass.
- Hammer, M. & Champy, J. (1993). *Reengineering the Corporation: A manifesto for business revolution*. New York: Harper Collins.
- Harland, P. (2001). *Pro-environmental behavior*. Thesis. Leiden, University.
- Harland, P. Staats, H. and Wilke, H. (1999). Explaining pro-environmental intention and behaviour by personal norms and the theory of planned behavior. *Journal of Applied Social Psychology*, 29, 2505-2528.
- Hatch, M. J. (1997). *Organization Theory: Modern, symbolic and postmodern perspectives*. New York: Oxford University Press.
- HENSE-Higher Education Network for Sustainability and the Environment (2000). *Report of the Higher Education Network for Sustainability and the Environment (HENSE) Conference* South Padre Island, TX.
- Hermosillo Declaration. (2002). In: Proceedings of of the international conference *Producción más limpia y prevención de la contaminación en universidades: historias desde adentro*. Hermosillo, México: Universidad de Sonora.
- Hernández, O., Rawlins, B., & Schwartz, R. (1999). Voluntary recycling in Quito: factors associated with participation in a pilot programme. *Environment & Urbanization*, 11, 145-159.
- Herremans, I. & Allwright, D. E. (2000). Environmental management systems at North American universities. *International Journal of Sustainability in Higher Education*, 1, 168-181.
- Hersey, P., & Blanchard, K. (1969). *Management of Organizational Behavior: Utilizing Human Resources*. Englewood Cliffs, NJ: Prentice-Hall.

- Heugens, P. (2003). Capability building through adversarial relationships: a replication and extension of Clarke and Roome (1999). *Business Strategy and the Environment*, 12, 5, 300 - 312.
- Hodge, B.J., Anthony, W.P. & Gales, L. M. (1996). *Organization theory: a strategic approach*. New Jersey: Prentice Hall.
- Hounsou, D. I. (1998). Coping with house waste management in Cotonou. *Environment and Urbanization*, 10, 191-208.
- House, R.J. 1971. A Path-Goal Theory of Leader Effectiveness. *Administrative Science Quarterly* 16 (2), 321-329.
- Hull and Associates, I. (1999). *Campus Waste and Recycling Program Audits and Analyses for Ohio Public Universities*.
- Hunt, J. G. (1999). Transformational/charismatic leadership's transformation of the field: an historical essay. *Leadership Quarterly* 10 (2), 129-144.
- INEGI & INE (2000). *Sustainable development indicators in Mexico 1999*. Mexico: INEGI-INE. (In Spanish)
- Instituto Nacional de Ecología (INE) (1999). *Minimization and environmental solid waste management*. Mexico: INE. (In Spanish)
- Instituto Valenciano de la Exportación-IVEX. (2003). *Municipal solid waste in Mexico*. Valencia, Spain: IVEX. (In Spanish)
- Jaramillo, V. G. (1999). About recycling and the economy of waste. CEPIS [On-line]. Available: <http://www.cepis.ops-oms.org/1999> (In Spanish)
- Jones, R.E. (1990). Understanding paper recycling in an institutionally supportive setting: An application of the theory of reasoned action. *Journal of Environmental Systems*, 19, 307-321.
- Juárez-Nájera, M., Rivera-Martínez, J., & Vaca-Mier, M. (2004). Education for sustainability in a higher education institution: the case study as a way to tackle the problem. In *Environmental Management for Sustainable Universities -EMSU 2004*.
- Kahn, S. A. (1996). Staff development for curriculum greening at the University of Hertfordshire. In W.Leal-Filho, F. MacDermott, & J. Padgham (Eds.), *Implementing sustainable development at university level- A manual of good practice* (Bradford: CRE-Copernicus.
- Kakkuri-Knuuttila, M.L., Lukka, K. & Kuorikoskim, J. (2004). *The Nature of Interpretive Research in Management Accounting: A Naturalistic Philosophical Case Study*. Finland: Turku School of Economics and Business Administration
- Kantola, S.J., Syme, G. J., & Campbell, N.A. (1982). The role of individual differences and external variables in a test of the sufficiency of Fishbein's model to explain behavioral intention to conserve water. *Journal of Applied Social Psychology*, 12, 70-83.

- Karau, S. J., & Williams, K. D. (1993). Social loafing: A meta-analytic review and theoretical integration. *Journal of Personality and Social Psychology*, 65, 681-706.
- Katzev, R., Blake, G., & Messer, B. (1993). Determinants of participation in multifamily recycling programs. *Journal of Applied Social Psychology*, 23, 374-385.
- Kegan, R. & Lahey, L. L. (2001). *How the way we talk can change the way we work*. San Francisco: Jossey-Bass.
- Keniry, J. (1995). *ECODEMIA: Campus environmental stewardship at the turn of the 21st Century*. Washington, DC: National Wildlife Federation.
- Kibert, N. C. (2000). *An analysis of the correlations between the attitude, behavior and knowledge components of environmental literacy in undergraduate university students*. Thesis for the Degree of Master of Science. Graduate School, University of Florida.
- Kliucininkas, L. (2001). Assessment of sustainability: studies at universities and colleges in Lithuania. *International Journal of Sustainability in Higher Education*, 2, 250-256.
- Klößner, C.A. & Matthies, E. (2004). How habits interfere with norm-directed behaviour: anormative decision-making model for travel mode choice. *Journal of Environmental Psychology*, 24, 319-327.
- Kotter, J. P. (1990). *A force for change: How leadership differs from management*. New York: The Free Press.
- Kotter, J. P. (1996). *Leading change*. Boston: Harvard Business School Press.
- Kreft-Burnman, K. (2002). Raising environmental awareness in the Baltic Sea area: results and experience gained from the SPA Project. *International Journal of Environment and Sustainable Development*, 1 (1), 88 – 96.
- Kusmieriek, K.: (2001) *Understanding and Addressing Resistance to Organizational Change*. Center for the Study of Higher and Postsecondary Education, University of Michigan Ann Arbor, Michigan. Online at: <http://www-personal.umich.edu/~marvp/facultynetwork/whitepapers/kusmieriekresistance.html>
- Lam, A. (2000). Tacit knowledge, organizational learning and societal institutions: an integrated framework. *Organization Studies*, 21, 487-513.
- Lauman, E., Galaskiewicz, J. & Marsden, P. (1978). Community structure as interorganizational linkages. *Annual Review of Sociology*, 4, 455-84.
- Lawler, E., Nadler, D. & Mirvis, Ph. (1983). Organizational change and the conduct of assessment research. In: *Assessing organizational change: a guide to methods, measures and practices*. New York: Wiley-Interscience.
- Leal-Filho, W. (1999). Sustainability and university life: some European perspectives. In *Sustainability and university life: environmental education, communication and sustainability* (pp. 9-11). Berlin: Peter Lang.

- Leal-Filho, W. (2000). Dealing with misconceptions on the concept of sustainability. *International Journal of Sustainability in Higher Education*, 1, 9-19.
- Leal-Filho, W. (2002). Towards closer integration of environmental education and industrial ecology. *International Journal of Environment and Sustainable Development*, 1, 20-31.
- Leis, H. (2001). *The unsustainable modernity*. Montevideo: Nordan-Comunidad. (In Spanish)
- León, C. (1993). *Environmental Research Program (ERP)*. Mexicali, B.C.: UABC. (In Spanish).
- Lieblich, A., Tuval-Mashiach, R., & Zilber, T. (1998). *Narrative Research: reading, analysis, and interpretation* (Vol. 47). Thousand Oaks, California: Sage Publications.
- Link, T. (2000). Transforming higher education through sustainability and environmental education. Issues in Science and Technology Librarianship [On-line]. Available: <http://www.istl.org/00-spring/article4.html>
- López, F. (1997). Recycling situation in Mexico. In: Hernández-Fernández C. & González-Martínez S. (Eds.). En: *Municipal solid waste recycling*. Programa Universitario de Medio Ambiente. Mexico City: UNAM.
- Ludwig, T. D., Gray, T. W., & Rowell, A. (1998). Increasing recycling in academic buildings: A systematic replication. *Journal of Applied Behavior Analysis*, 31, 683-686.
- Lussier, R. & Achua, C. (2002). *Leadership: Theory, Application, Skill Development*. South-Western Publishing, Thomson Learning, Inc.
- Lynne, G. D., Casey, C.F., Hodges, A., & Rahmani, M. (1995). Conservation technology adoption decisions and the theory of planned behavior. *Journal of Economic Psychology*, 16, 581-598.
- Maghooori, R. & Rolland, E. (1997). Strategic Leadership: The Art of Balancing Organizational Mission with Policy, Procedures, and External Environment. *Journal of Leadership Studies*, 2, 62 – 81.
- Márquez-Montenegro, Y. (2004). *Environmental behavior of a population according to the composition of its solid waste*. Thesis. Universidad Autónoma de Baja California, Mexicali, México.
- Martínez, L., Gerristen, P., Cuevas, R., & Rosales, J. (2004). University-Society: Integrating research and education with sustainable development in western Mexico. In *Environmental Management for Sustainable Universities -EMSU 2004*.
- Mason, I. G., Oberender, A., & Brooking, A. K. (2004). Source separation and potential re-use of source residuals at a university campus. *Resources Conservation and Recycling*, 40, 155-172.
- Mata-Sagreda, A. (2002). Sustainability and peace in Costa Rica: the case of University of Costa Rica. *Higher Education Policy*, 15, 169-176.
- McGuire, R.H., Hughes, W. W., & Rathje, W. L. (1982). *Garbage project on recycling behavior*. Technical Report PB-85-181527/XAB. Arizona Univ., Tucson (USA).

- McKenzie-Mohr, G. & Smith, W. (1999). *Fostering Sustainable Behavior: An introduction to community-based social marketing*. Gabriola Island B.C., Canada: New Society Publishers.
- Medellín-Milán, P. & Nieto-Caraveo, L. M. (1999). Engineering and environmental management: a practical proposal of scientific, technical and ethical formation. In *XIX Encuentro Nacional de la IMIDIQ, Mexico*.
- Medellín-Milán, P. (2004). Two approaches for pollution prevention in the chemical engineering curriculum at UASLP. In *Environmental Management for Sustainable Universities -EMSU 2004*.
- Merriam, S. B. (1998). *Qualitative research and case study applications in education*. (2nd ed.) San Francisco: Jossey-Bass Publishers.
- Messick, D. M. & Brewer, M. B. (1983). Solving social dilemmas; a review. In Wheeler & P. Shaver (Eds.), *Review of Personality and Social Psychology* (11-44).
- Meyer, J. W. & Scott, W. R. (1983). *Organizational environments: Ritual and Rationality*. Beberly Hills, CA: Sage.
- Miles, M. B. & Huberman, A. M. (1994). *Qualitative data analysis a sourcebook of new methods*. Beverly Hills: Sage Publications.
- Mintzberg, H. (1973). *The nature of managerial work*. New York, Harper & Row.
- Mintzberg, H. (1979). *The Structuring of Organizations*. Englewood Cliffs: Prentice-Hall.
- Mintzberg, H., Quinn, J. B., & Voyer, J. (1995). *The strategy process*. Englewood Cliffs, New Jersey: Prentice Hall.
- Missionaries, V. (1998). The payatas environmental development programme: micro- enterprise promotion and involvement in solid waste management in Quezon City. *Environment & Urbanization*, 10, 55-68.
- Morgan, G. (1997). *Images of Organization*. Thousand Oaks, CA: SAGE, Publications.
- Morrison, J. L. & Mecca, T. V. (1989). Managing uncertainty. In J. C. Smart (Ed.), *Handbook of theory and research in higher education*, 5 (pp. 351-382). New York: Agathon.
- Mullingar Chamber of Commerce (2003). Environmental Comparison Between Ireland and the EU Countries. <http://www.mullingar-chamber.ie/dbfiles/environmental%20comparison.pdf> [On-line]. Available: <http://www.mullingar-chamber.ie/dbfiles/environmental%20comparison.pdf>
- Murad, W. & Siwar, Ch. B. (2000). Links Between Poverty and Household Waste Management Systems Among Urban Squatters: A Literature Survey and Theoretical Framework. In. *16th International Conference on Solid Waste Technology and Management*.
- Nadakavaukaren, A. (2000). *Our global environment: a health perspective*. Illinois: Waveland Press, Inc.
- Nelkin, D. (1981). Nuclear power as a feminist issue. *Environment*, 23, 14-39.

- Newport, D. & Chesnes, Th. (2001). *University of Florida Sustainability Indicators*. The Greening UF Program (Ed). University of Florida.
- Nieto-Caraveo, L. M. (2002). Mexican universities and sustainable development: diverse visions. <http://ambiental.uaslp.mx/docs/mats.htm> [On-line]. Available: <http://ambiental.uaslp.mx/docs/mats.htm> (In Spanish)
- Nieto-Caraveo, L. M. & Súcar, S. S. (2004). The Mexican Consortium of university environmental programs for sustainable development (COMPLEXUS): the challenge to interweave. In *Environmental Management for Sustainable Universities -EMSU 2004*.
- Noeke, J. (2000). Environmental management systems for universities: a case study. *International Journal of Sustainability in Higher Education*, 1, 237-251.
- Nonaka, I. & Takeuchi, H. (1995). *The knowledge creating company*. New York: Oxford University Press.
- Noriega-Crespo, P. (2004). Teaching sustainability to architects and civil engineers. In *Environmental Management for Sustainable Universities -EMSU 2004*.
- O'Toole, J. (1995). *Leading change: the argument values-based leadership*. New York: Ballantine.
- Oakley, E. Krug. D. (1991). *Enlightened leadership: getting to the heart of change*. New York: Fireside.
- Ogawa, R. T. & Paredes-Scribner, S. (2002). Leadership: spanning the technical and institutional dimensions of organizations. *Journal of Educational Administration*, 46, 576-588.
- Ogu, V. I. (2000). Private Sector Participation and Municipal Waste Management in Benin City, Nigeria. *Environment & Urbanization*, 12, 103-118.
- Ojeda-Benítez, S., Armijo de Vega, C., & Ramírez-Barreto, M. E. (2000). The potential for recycling household waste: a case study from Mexicali, Mexico. *Environment & Urbanization*, 12, 163-173.
- Ojeda-Benítez, S., Armijo de Vega, C., & Ramírez-Barreto, M. E. (2002). Formal and informal recovery of recyclables in Mexicali, Mexico: handling alternatives. *Resources, Conservation and Recycling*, 34, 273-288.
- Ojeda-Benítez, S. & Beraud-Lozano, J. L. (2003) The municipal solid waste cycle in Mexico: final disposal. *Resources, Conservation and Recycling*, 39 (3), 239-250.
- Ollervides, F. (2004). The School for Field Studies-Center for Coastal Studies: a model of sustainable development education. In *Environmental Management for Sustainable Universities -EMSU 2004*.
- O'Neill, J. W., Beauvais, L. L., & Scholl, R. W. (2001). The Use of Organizational Culture and Structure to Guide Strategic Behavior: An Information Processing Perspective. *The Journal of Behavioral and Applied Management*, 2, 132-150.
- Orduña V., Espinoza N., & González D., (2000). Relationship between demographic and contextual variables, environmental knowledge and water saving behavior. In: V.Corrál (Ed.),

- Conductas protectoras del ambiente; teoría, investigación y estrategias de intervención* (pp. 99-115). Hermosillo, México: Universidad de Sonora-CONAcYT. (In Spanish)
- Orr, D. (1991). *Ecological Literacy: Education and the Transition to a Postmodern World*. New York: State University of New York Press
- Orr, D. (1994). *Earth in mind*. Washington D.C.: Island Press.
- Orr, D. (1996). Greening the college curriculum: a guide to environmental teaching in the liberal arts. In J.Collet & S. Karakashian (Eds.), *Reinventing higher education* (pp. 8-23). Washington, D.C.: Island Press.
- Oskamp, S., Harrington, M., Edwards, T., Sherwood, D., Okuda, S., & Swanson, D. (1991). Factors influencing household recycling behavior. *Environment and Behavior*, 23, 494-519.
- Pedroza, G. (2004). Integrating sustainable development to communicator's education. In *Environmental Management for Sustainable Universities -EMSU 2004*.
- Petts, J. (1999). Environmental impact assessment: overview of purpose and process. In J.Petts (Ed.), *Handbook of Environmental Impact Assessment* (pp. 3-11). London: Blackwell Science.
- Pfeffer, J. (1978). The micropolitics of organizations. In M.W.Meyer & Associates (Eds.), *Environments and Organizations* (pp. 29-50). San Francisco: Jossey Bass.
- Phillips, P. S. (2001). *A Guide to Wastes Minimization*. University College Northampton.
- Pierce, M. (1992). Campus energy management programs. In D.Eagan & D. Orr (Eds.), *The campus and environmental responsibility* (pp. 31-43). San Francisco: Jossey-Bass.
- Piñera-Ramírez, D. (1997). *History of the Autonomous University of Baja California 1957 – 1997*. Mexicali: Universidad Autónoma de Baja California, México. (In Spanish)
- Pratt R.M. & Phillips, P. S. (2000). Waste Minimization Clubs in the UK: Cost Benefit Considerations. In *16th International Conference on Solid Waste Technology and Management* Widener University.
- PRECEUP (1996). Micro-business development for the decentralization of Municipal services.. [On-line]. Available: <http://www.blobenet.org/preceup/esp/fichasesp/ecuador.htm> (In Spanish)
- Pumar, E. S. (2005). Social networks and the institutionalization of the idea of sustainable development. *International Journal of Sociology and Social policy*, 25, 63-86.
- Quadri, G. (1997). Opning speech of the IV Annual meeting of the UNAM environmental program. In C.Hernández-Fernández & S. González Martínez (Eds.), *Municipal solid waste recycling* (pp. 201-206). Mexico City: PNUMA-UNAM.
- Quinn, J. B., Anderson, Ph., & Finkelstein (1996). Leveraging Intellect. *Academy of Management Executive*, 10, 7-27.

- Ramírez-López, A. (2004). Introducing sustainability principles in the curricula for engineers in the Institutos Tecnológicos de la República Mexicana. In *Environmental Management for Sustainable Universities -EMSU 2004*.
- Ray, D. (2001). *The performance culture: maximizing the power of teams*. IPC-Press.
- Reddy B.K., Raja Rao P., Nagabhushan, E., & Pullaiah, S. (2000). Domestic Solid Waste Recovery and Reuse—A Case Study in Hyderabad Study. In *16th International Conference on Solid Waste Technology and Management* Widener University.
- Riessman, C. K. (1993). *Narrative Analysis*. (vols. 30) Newbury Park, CA: Sage Publications.
- Salman, G. (1984). Organizations classification, the structure of the organization and the main interrelationships. In G.Salman & K. Thompson (Eds.), *Control e Ideología en las Organizaciones*. Mexico City: Fondo de Cultura Económica.
- Sarbin, T. R. (1986). The narrative as a root metaphor in psychology. In *Narrative psychology: The storied nature of human conduct*. New York: Praeger.
- Schein, E. H. (1992). *Organizational Culture and Leadership*. San Francisco: Jossey-Bass Publishers.
- Schmidheiny, S. & Business Council for Sustainable Development (1992). *Changing Course: a global perspective on development and the environment*. Cambridge, MA: MIT Press.
- Schultz, P. W. (2002). Environmental attitudes and behaviors across cultures. In W.J.Lonner, D. L. Dinnel, S. A. Hayes, & D. N. Sattler (Eds.), *Online Readings in Psychology and Culture*. Bellingham: Center for Cross-Cultural Research. (<http://www.wvu.edu/~culture>)
- Schwartz, S. H. (1968). Awareness of consequences and the influence of moral norms on interpersonal behavior. *Sociometry*, 31, 355-369.
- Schwartz, S. H. (1973). Normative explanations of helping behavior: A critique, proposal, and empirical test. *Journal of Experimental Social Psychology*, 9, 349-364.
- Schwartz, S. H. (1977). Normative influence on altruism. In L.Berkowitz (Ed.), *Advances in Experimental Social Psychology* (pp. 221-279). New York: Academic Press.
- Schwartz, S. H. & Howard, J. A. (1980). Explanations of the moderating effect of responsibility denial on the personal norm-behavior relationship. *Social Psychology Quarterly*, 43, 441.-446.
- Schwartz, S. H. & Howard, J. A. (1981). A normative decision-making model of altruism. In: J. P. Ruston & Sorrentino R. M. (Eds), *Altruism and helping behavior: social personality and development perspectives*. Hillsdale, NJ: Lawrence Erlbaum.
- Scott, W. R. (1983). The organization of environments: network, cultural and historical elements. In: *Organizational environments: ritual and rationality*, PP. 155-175, by John W. Meyer & Richard, W. Scott. Beverly Hills, Calif.: Sage Publications.
- Scott, W. R. 1987. *Organizations: rational, natural and open systems*. Englewood Cliffs, NJ: Prentice-Hall.

- SEDESOL (Secretaría de Desarrollo Social) (2002a). *Technical manual for the generation, transference and collection of municipal solid waste*. Mexico City: Secretaría de Desarrollo Social. (In Spanish)
- SEDESOL (Secretaría de Desarrollo Social) (2002b). *Public services coverage: the collection and disposition of municipal solid waste*. Secretaría de Desarrollo Social Web Page [On-line]. Available: www.sedesol.gob.mx (In Spanish)
- SEMARNAT (Secretaría del Medio Ambiente y Recursos Naturales) (2001). *Environmental and natural resources national program 2001-2006*. Mexico City: SEMARNAT. (In Spanish)
- SEMARNAT (Secretaría del Medio Ambiente y Recursos Naturales) (2002a). CECADESU's mission [On-line]. Available: <http://cecaquesu.semarnat.gob.mx/> (In Spanish)
- SEMARNAT (Secretaría del Medio Ambiente y Recursos Naturales) (2002b). ¿What is SEMARNAT? SEMARNAT Web Page [On-line]. Available: http://sadgitx02.semarnat.gob.mx/wps/portal/.cmd/cs/.ce/155/.s/1614/_s.155/1386 (In Spanish)
- SEMARNAT (Secretaría del Medio Ambiente y Recursos Naturales) (2003). Ley General para la Prevención y Gestión Integral de los Residuos. *Diario Oficial de la Federación*.
- Senge, P. (1990). *The Fifth Discipline: The art and practice of the learning organization*. New York: Double Day/Currency.
- Senge, P., Kleiner, A., Roberts, Ch., Ross, R., Roth, G. & Smith, B. (1999). *The dance of change: the challenges sustaining momentum in learning organizations*. New York: Doubleday.
- Seymour, D. T. (1992). *On Q: Causing quality in higher education*. New York: American Council on Education/Macmillan.
- Shah, K. L. (2000). *Basics of Solid and Hazardous Waste Management Technology*. Upper Saddle River, NJ: Prentice Hall.
- Sharp, L. (2002). Green campuses: the road from little victories to systemic transformation. *International Journal of Sustainability in Higher Education*, 3, 128-145.
- Shriberg, M. (2002a). Toward sustainable management: the University of Michigan Housing Division's approach. *Journal of Cleaner Production*, 10, 41-45.
- Shriberg, M. (2002b). Institutional assessment tools for sustainability in higher education: strengths, weaknesses, and implications for practice and theory. *Higher Education Policy*, 15, 153-167.
- Shriberg, M. (2002c). *Sustainability in U.S. higher education: organizational factors influencing campus environmental performance and leadership*. The University of Michigan.
- Sicular, D. (1992). *Scavengers, Recyclers and Solutions for Solid Waste Management in Indonesia*. Berkely, CA: Center for Southeast Asia Studies. Berkeley: University of California.
- Simmons, D. & Widmar, R. (1990). Motivations and barriers to recycling: Towards a strategy for Public Education. *The Journal of Environmental Education*, 22, 13-18.

- Sitarz, D. ed. (1994). *Agenda 21: The Earth Summit Strategy to Save Our Planet*. Boulder, CO: Earthpress.
- Sitarz, D. (1998). *Sustainable America: America's environment, economy and society in the 21st century*. Carbondale, Ill: EarthPress.
- Siwar, Ch. B. & Hossain, A. (2000). Policies to Improve Municipal Solid Waste Management: Source Reduction and Recycling Household Solid Waste in Malaysia. In *16th International Conference on Solid Waste Technology and Management* Widener University.
- Slovic, P. (1992). Perceptions of risk: reflections on the psychometric paradigm. In D. Golding & Krimsky, S., (Eds), *Theories of risk*. New York: Praeger.
- Smircich, L. (1983). Concepts of culture and organizational analysis. *Administrative Science Quarterly*, 28, 339-358.
- Smith, B. H. (1981). Narrative versions, narrative theories. In Konigsberg (Ed.), *American criticism in the poststructuralist age* (pp. 162-186). Ann Arbor, Michigan: University of Michigan Press.
- Smith, A. A. & Gottlieb, R. (1992). Campus Environmental Audits: The UCLA Experience. In David Eagan & David Orr (Eds.), *The Campus Environmental Responsibility* (pp. 9-18). San Francisco: Jossey-Bass.
- Smith, L. (1994). Biographical method. In: N. Denzin & Y. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 286-305). Thousand Oaks, CA: Sage.
- Social service students (2002). *Students reports for UABC's waste program* Internal report. Mexicali, B.C.: UABC.
- Sparks, P. & Shepherd, R. (1992). Self-identity and the theory of planned behavior: assessing the role of identification with "green consumerism". *Social Psychology Quarterly*, 55, 388-399.
- Stake, R. E. (1995). *The art of case study research*. Thousand Oaks, Calif: Sage Publications.
- Sterling, S. (2001). *Sustainable Education: re-visioning learning and change*. Bristol, UK: Green Book LTD.
- Stern, P.C., Dietz, T., Abel, T., Guagnano, G.A., & Kalof, L. (1995). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review*, 6:81-97.
- Strategos, I. (2005). Transactional leadership.
http://www.strategosinc.com/leadership_transactional.htm [On-line]. Available:
http://www.strategosinc.com/leadership_transactional.htm
- Súcar, S., Cabrera, R., & Juárez, F. (2004). Implementation of the environmental management system in the University of Guanajuato: obstacles and challenges. In *Environmental Management for Sustainable Universities - EMSU 2004*.
- Tannenbaum, A., Bogdan, K., Menachem, R., Mino, V., & Wieser, G. (1974). *Hierarchy in organizations*. San Francisco: Jossey-Bass.

- Taylor, S. & Todd, P. (1995). An integrated model of waste management. *Environment and Behavior*, 27: 603-630.
- Tchobanoglous, G., Theisen, H., & Vigil, S. (1996). *Integrated solid waste management*. McGraw-Hill. (In Spanish)
- Tesch, R. (1990). *Qualitative research: Analysis types and software tools*. New York: The Falmer Press.
- Texas Environmental Profile (TEP) (2002). Waste to energy management option for municipal solid waste. Texas Environmental Profile [On-line]. Available: http://www.texasep.org/html/wst/wst_2mtx_incin.html
- Tøgersen, J. (1996). Recycling and morality. A critical review of the literature. *Environment and Behavior*, 28, 536-558.
- Tøgersen, J. & Ölander, F. (2003). Spillover of environment-friendly consumer behavior. *Journal of Environmental Psychology*, 23, 225-236.
- Tøgersen, J. (1999). The ethical consumer. Moral norms and packing choice. *Journal of Consumer Policy*, 22, 439-460.
- Tushman, M. L. & Anderson, P. (1986). Technological discontinuities and organization environments. *Administrative Science Quarterly*, 31, 439-465.
- UABC (Universidad Autónoma de Baja California) (1988). *Institutional Development Plan 1987 – 1991*. Mexicali: Universidad Autónoma del Estado de Baja California. (In Spanish)
- UABC (Universidad Autónoma de Baja California) (1991). *Institutional Development Plan 1991 – 1995*. Mexicali: Universidad Autónoma del Estado de Baja California. (In Spanish)
- UABC (Universidad Autónoma de Baja California) (1995). *Institutional Development Plan 1995 – 1998*. Mexicali: Universidad Autónoma del Estado de Baja California. (In Spanish)
- UABC (Universidad Autónoma de Baja California) (1999). *Institutional Development Plan 1999 – 2002*. Mexicali: Universidad Autónoma del Estado de Baja California, Mexicali. (In Spanish)
- UABC (Universidad Autónoma de Baja California) (2002). University reform. <http://www.uabc.mx/reforma/reformauniversitaria/> [On-line]. Available: <http://www.uabc.mx/reforma/reformauniversitaria/> (In Spanish)
- UABC (Universidad Autónoma de Baja California) (2003). *Institutional Development Plan 2003-2006*. Mexicali: Universidad Autónoma del Estado de Baja California. (In Spanish)
- UF Sustainability Task Force (2002). University of Florida Sustainability Task Force Report July 2002. Univ. of Florida. Available: <http://www.sustainable.ufl.edu/reports.html>
- UN (United Nations) (1999). Economic Aspects of Sustainable Development in Mexico . Sustainable development Home Page [On-line].

- UN (United Nations) (2000). The World Conferences. Briefing papers homepage [On-line]. Available: <http://www.un.org/geninfo/bp/worconf.html>
- UNESCO (1990). The Talloires Declaration Gland: UNESCO.
- UNESCO (1997). Educating for a sustainable future: A transdisciplinary vision for concerted action. In S. a. C. O. United Nations Educational (Ed.), *Environment and Society: Education and Public Awareness for Sustainability*.
- UNESCO (1998). World declaration on higher education for the XXI century: vision and action. Paris: UNESCO.
- UNESCO (2004). Education for Sustainable Development: UN Decade 2005-2014. United Nations Home Page [On-line]. Available: http://portal.unesco.org/education/en/ev.php-URL_ID=23279&URL_DO=DO_TOPIC&URL_SECTION=201.html
- Universidad de Guadalajara (2002). Education and sustainable development declaration. México D.F.: *La Jornada*.
- University Leaders for a Sustainable Future (ULSF) (2001a). What do we mean by "sustainability"? About ULSF [On-line]. Available: <http://www.ulsf.org/about.html>
- University Leaders for a Sustainable Future (ULSF) (2001b). Talloires Declaration. University Leaders for a Sustainable Future Web Page [On-line]. Available: http://www.ulsf.org/programs_talloires.html
- Valen, G. L. (1992). Hendrix College Local Food Project. In David Eagan & David Orr (Eds.), *The Campus Environmental Responsibility*. San Francisco: Jossey-Bass.
- Van Beukering, P., Madhushree, S. G., Reyer, G., & Vigía, K. (1999). *Analyzing urban solid waste in developing countries: a perspective on Bangalore India* (Rep. No. 24).
- van Weenen, J. C. (1999). Vision on a sustainable university. In: Proceedings of Environmental Management for Sustainable Universities. EMSU-1999. http://www.lu.se/green-campus/emsu00/keynotes/Weenen_EMSU99.html
- Venetoulis, J. (2001). Assessing the ecological impact of a university: the ecological footprint for the university of Redlands. *International Journal of Sustainability in Higher Education*, 2, 180-196.
- Viebahn, P. (2002). An environmental management model for universities: from environmental guidelines to staff involvement. *Journal of Cleaner Production*, 10, 3-12.
- Vining, J. & Ebreo, A. (1990). What makes a recycler? A comparison of recyclers and non recyclers. *Environment and Behavior*, 22, 55-73.
- Vining, J. & Ebreo, A. (1992). Predicting recycling behavior from global and specific environmental attitudes and changes in recycling opportunities. *Journal of Applied Social Psychology* 22: 1580-1607.

- Wals, A. E. & B. Jickling (2002). Sustainability in higher education: from doublethink and newspeak to critical thinking and meaningful learning. *International Journal of Sustainability in Higher Education*, 3, 3, 221-232.
- Watson, T. (1990). Recycling goes to college. *Resource Recycling*, 10, 76-81.
- Weber, M. (1947). *The theory of social and economic organization*. (1st American ed. ed.) New York: Oxford University Press.
- Webster, M. (2002). *Webster's Third New International Dictionary*. Springfield, MA: Merriam-Webster.
- weLEAD Inc. (2003). What is transactional leadership? weLEAD Online Magazine [On-line]. Available: <http://www.leadingtoday.org/Onmag/jan03/transaction12003.html>
- Wheatley, M. J. (1999). *Leadership and the new science: discovering order in a chaotic world*. San Francisco: Berrett-Koehler.
- Wilkening, K. (1999). Culture and Japanese Citizen Influence on the Transboundary Air Pollution Issue in Northeast Asia. *Political Psychology*, 20 (4), 701-724.
- Wilkins, A. L. & Ouchi, W. G. (1983). Efficient Cultures: exploring the relationship between culture and organizational performance. *Administrative Science Quarterly*, 28, 468-481.
- Williams, E. (1991). College Students and Recycling: Their Attitudes and Behaviors. *Journal of College Student Development*, 32 (1), 86-88.
- World Bank (1999). Decision Makers' Guide to Municipal Solid Waste Incineration. <http://web.mit.edu/urbanupgrading/urbanenvironment/resources/references/pdfs/DecisionMakers.pdf> [On-line].
- World Commission on Environment and Development (WCED) (1987). *Our Common Future*. Oxford: Oxford University Press.
- Wright, T. (2002). Definitions and frameworks for environmental sustainability in higher education. *International Journal of Sustainability in Higher Education*, 3, 203-220.
- Yin, R. K. (2003). *Case study research design and methods*. (Rev. ed.) Newbury Park, CA: Sage Publications.
- Zaccaro, Stephen J. and Richard J. Klimoski. (2003). In: *The Nature of Organizational Leadership Understanding the Performance Imperatives Confronting Today's Leaders*. 1-27 pp. Wiley.

Annex I

Research Report

Characterization of solid waste and recycling potential for a higher education institution in Mexico.

Engineering Institute, Universidad Autónoma del Estado de Baja California

Carolina Armijo de Vega*, Telephone/Fax: 52 (646) 174-5449, carmijo@uabc.mx

Abstract

During the last decades, one of the biggest challenges for sustainable development is to count with integral waste management programs and in order to reach that goal solid waste characterization is the first step that must be taken. This paper reports the results of a quantification and characterization study of the waste from Campus Mexicali I of the Universidad Autonoma de Baja California, Mexico. The aim of the study is to set the ground for a recovery and recycling program at this campus. The results show that 69% of the waste generates on campus is recyclable and potentially recyclable thus, the implementation of a recovery system of recyclable and, potentially recyclable waste is possible on Campus. The study also shows that the local market for recyclable waste, under the current conditions of types of waste it commercializes, can absorb the bulk of this waste. Some alternatives are discussed in the case of potentially recyclable waste, although there is currently no local market for it. Lastly, some strategies that could be started for source waste reduction are also discussed.

Keywords: Waste characterization, campus solid waste, potential for recycling.

1. Introduction

Waste is understood to be the remains of the productive system. If it is recyclable; it generates what we could call the new environmental recycling and reutilization industry. However, a lot of it cannot be part of this process and it becomes a problem. This is even worse in the case of potentially recyclable waste: if there is no infrastructure for it to be recycled or no market to absorb

and channel that waste, or reutilization and reduction strategies, the problem will prevail and very likely, grow.

It is very important to know the composition of municipal solid waste (MSW) and of the processes that determine its production, for the decision-making that will lead to its appropriate management; as well as to estimate the space and infrastructure required for the landfills (Acurio, *et al.*, 1997). However, this knowledge must pay special attention to the sources of waste generation, which is justified by the fact that the characteristics and the composition of waste differ according to their generating source (Tchobanoglous *et al.*, 1993). With this in mind, the proposals for waste management which are based on the knowledge of waste composition and also on the current situation of the market for recyclable waste, will have a greater chance for success than the proposals which are too ambitious, copied from programs applied in other places and under very different conditions as far as the recyclables market is concerned. For this reason, in order to propose waste management strategies based on the generator's local reality, both the characteristics of the waste, as well as of the waste market must be known.

In spite of the many benefits of proper waste management, the launching of a system to manage it is no easy task. Strange (2002) states that, in order to face the problems of waste management, we can turn to various implementations such as ways of minimizing waste. Among these are plans and programs, mandatory implementations (e.g. technical standards, regulations, etc.), financial implementations (e.g. taxes, financial incentives, etc.), and persuasive implementations (e.g. providing information, public relations, environmental management systems, etc.). In the case of Mexico most of these implementations have been used to control the problems of hazardous waste management but they haven't been used for MSW.

The current practice of waste management in Mexicali, as in most Mexican cities, is considered as the manipulation of mixed waste, that is, there is no segregation according to waste type, except in the cases of some industries, hospitals and other institutions. In the case of higher education institutions they handle mainly non-separated waste. In Mexico, the municipal collection services do not take care of the collection and the final disposal of institutional waste; the institutions themselves must pay a private company to perform the service. With this in mind, it is clear that a reduction of the amount of waste that must be transported and disposed of in the landfill would lead to two main consequences: a) a reduction of the institutional expense destined to this concept and, b) helping to prolong the useful life of final disposal sites. On the other hand, aside from the financial benefits, a reduction in waste to be disposed of bears environmental and social benefits, as well as for the institution concerned (WWF, 1991).

In Mexico non-hazardous solid waste regulation is almost exclusively under the responsibility of the States and Municipalities, and under their own Municipal Regulations (INE, 1999).

The municipalities, through the city hall, issue regulations in the matter, and they also have administrative institutions that are directly in charge of providing the public service that consists on street sweeping, collection, transportation, treatment and final disposal of solid waste. In this way, the Municipality of Mexicali has its own waste regulations, however, these don't include exploitation, appraisal or waste reduction strategies that will help the generators to act accordingly.

From October 8th, 2003, the General Law for the Waste Prevention and Integral Management (*Ley General para la Prevención y Gestión Integral de Residuos*) took effect in Mexico, (SEMARNAT, 2003) and through it, the waste generators are forced to prevent the generation, appraise and integrally manage hazardous waste, urban solid waste and waste needing special handling. Among other aspects, this law requires the generators to create a basic and general classification that will allow the standardization of their inventory, as well as orienting and encouraging generation prevention, appraisal and the development of integral management systems for it. Nevertheless to date not many organizations have responded to this new law.

1.1 Waste management in higher education institutions

Because colleges and universities are under the moral and ethical obligation of acting responsibly towards the environment and the society it would be expected that these institutions be the leaders in environmental protection activities, among them responsible waste management practices.

Appropriate waste management should impose a double concern, first for maximizing their financial resources to face the payment of the operations and above all, for giving the example to the students being formed there, as well as to the society.

Campus recycling programmes in developed countries vary from local volunteer efforts to official or institutionalized campus-wide recycle infrastructures (Armijo, et. al, 2003). Some of the efforts in universities directed to waste reduction and recycling have been very successful. In the developed countries, the recyclable waste recovery programs were begun in Universities 20 years ago, and in some cases, even before that.

Recycling programs are the most popular campus greening projects, and 80% of colleges and universities in the USA have institutionalized programs (Allen, 1999). In 1990 more than 78% of US institutions of higher education had fairly well-established waste management programs. These waste management programs were based in characterization studies. A study of waste composition, carried out at Brown University (USA) in 1992, revealed that approximately 45% of the waste

generated at that institution was recyclable under the existing market conditions of the time. Brown University has had a recycling program since 1972 and currently recycles 31% of its waste (Brown Programs, 2004). On the other hand, Colorado State University and University of Florida are recycling 54% and 30% of their waste, respectively (UF Sustainability Task Force, 2002). For example the Santa Clara University (California, USA) SCU's recycling program compares with the best programs in the USA in approaching a 50% recycled solid waste level (Clugston and Calder, 1999). As a part of the waste recycling strategies used some universities such as Rutgers University and Brown University, both in the USA; solid and liquid food refuse is given to local farmers for cattle, goat, and pig feed (UF Sustainability Task Force, 2002).

It must be considered that in the United States of America it is mandatory for schools and universities to have waste reduction and recycling programs. For example, The state of South Carolina, through its S.C. Solid Waste Policy and Management Act, passed in 1991, requires that all agencies, as well as schools and universities reduce their waste, measure that reduction, and initiate recycling activities, and that they report these activities yearly (Culler, 2003). Another example is the case of Kentucky, where, through Acts KRS-224.10-65 and KRS-160.294, colleges and universities are forced to recycle aluminum, paper and corrugated cardboard (KPPC, 2004).

One of the few papers reporting waste management issues at educational institutions in developing countries is the one by Mbuligwe (2002). This author reported a waste recovery potential and reutilization ranging from 71.6% to 86.8% in three higher education institutions in Tanzania. The author also mentions that, in an informal way, reutilization activities are practiced mainly for food refuse delivered to pig breeders, who use this waste as animal feed, significantly reducing the expenses of feeding them.

No published results of characterization studies in Mexico were found, but there were narrations of experiences with integral waste management programs at five institutions: Tecnológico de Monterrey, Campus Monterrey (Ramírez, 1993), ITAM (Instituto Tecnológico Autónomo de México), UNAM (Universidad Nacional Autónoma de México), Escuela de Estudios Superiores Zaragoza (the three latter, in Mexico City) (com. pers. Hernández-Fernández, 2000), and Universidad de Guadalajara (Navarro, 1997). However, none of the authors reports the waste composition or the waste recovery potential for these institutions.

It is expected that the lack of environmental reports in general, and waste management reports in particular, change in the short term as a response to the Action Plan for the Sustainable Development in Higher Education Institutions (ANUIES-SEMARNAT, 2002). This action plan,

among other activities, invites Mexican Universities to implement environmental management systems and to operate in a more sustainable way.

Precisely the lack of waste characterization studies in Mexican higher education institutions evidences the need to research and document waste composition in order have the elements needed to propose better ways to manage waste. In this sense, and in trying to contribute to fill the gap between the need of this kind of studies and the increasing demand of waste management programs imposed by the Mexican regulations the main goal of this study is to know the amount, composition and recycling potential of the waste generated in one of the four campuses of the Autonomous University of Baja California (UABC). These results will be used as one of the initial steps on which the UABC's integral waste management system can be based.

2. Methodology

The study methodology consisted of three main stages, mentioned as follows: a) daily waste generation estimation, b) sampling and characterization of the sample, and, c) data entry and analysis.

2.1 Daily waste generation estimation

Because UABC's personnel had never kept a record of the amounts of waste generated on campus, this information had to be estimated. This was done by weighting of the truck that transports the waste to the landfill. First the weight of the empty truck was recorded once; afterwards it was weighed 45 times after being filled with waste from UABC's Campus Mexicali I. The difference between the weights of the full truck minus the weight of the empty truck would provide the weight of the load itself. This information provided the average weight of the load. The truck was weighted in a private truck-balance, taken there by the owner of the truck and the author of this paper.

With the information of the number of times a week that the collection service was paid, divided by the amount of working days in the week, the number of times that the truck was filled daily was obtained. Finally, with the information of the average weight of the truck's load and the number of times per day that it was filled, the daily waste generation on Campus was estimated.

2.2 Sampling and characterization of the sample

The methodology for the sampling includes the identification of three different generation points: 1) buildings, 2) gardens and corridors and 3) community center (where food stands are placed).

The characterization of the waste was done according to the modified methodology proposed by Buenrostro-Delgado (2001) for household characterization studies. The sampling period lasted fourteen days; the first two days were the trial waste sampling. These samples helped standardize the way in which the participants would record data, as well as to unify criteria in confusing cases of waste identification; lastly, the trial sample also helped test the data recording form. The results of the waste analyzed during the following twelve days are what included in this paper. Direct sampling has been used to estimate the composition of municipal waste streams. Representative sampling methods were employed to achieve accurate results.

For taking the waste characterization data (sub-product recording form), the categories from the College and University Recycling Council (CURC) were used (CURC, 2001). These categories were used considering possible future comparisons with similar studies in other universities. With the information from the sampling test and the categories proposed by the CURC a data recording form was developed.

Prior the sampling the bags were tagged to know their origin (buildings or gardens). Each bag was weighed and its contents classified according to the categories established in the recording form.

2.3 Data entry and analysis

After the task of waste characterization, the information was entered into a database created specifically for this project. Although the team of researchers that participated in the project have developed other data bases for characterization studies, these don't include all the categories contemplated in this study. For this reason a specific database was created with the categories considered by CURC (CURC, 2001).

3. Results

3.1 Daily waste generation

The total estimated amount of waste (considering the waste from the community center) generated daily at UABC's Campus Mexicali I was a ton in average. The average weight of the full load of the truck was a ton (± 0.15 , confidence level 95%) and there was one trip per day.

3.2 Waste characterization

In total there were characterized 4.8 tons of waste, of which 4.6 corresponded to the sampling of buildings and gardens and 0.238 tons to the community center's. As for the first number, this does not mean that this quantity was the total weight of the waste generated during the 12 days of sampling at the buildings and gardens, but rather the amount of waste delivered to the analysis site

for its characterization. Since the daily estimate resulted in one ton and approximately 0.4 tons were characterized each day, this means that 38.3 % of the waste generated daily during 12 days was analyzed.

The composition of the sample of 4.6 tons from buildings and gardens and the 0.238 tons from the community center delivered the results shown in Table 1.

Table 1. Percentage composition of solid waste generated in UABC's buildings, gardens and community center

Waste Categories	Buildings	Gardens	Community center
Paper and cardboard	45.08%	7.50%	23.30%
Plastics	6.71%	2.97%	8.23%
Organic	10.76%	80.04%	54.09%
Metals	2.23%	0.41%	4.47%
Glass	3.65%	1.77%	4.62%
Construction/demolition	1.89%	0.17%	1.86%
Hazardous	0.24%	0.20%	0
Other	29.43%	6.93	3.43%

The information presented in Table 1 cannot be used to calculate the waste recycling potential presented daily, because not all the subcategories of each waste category have the same recycle status (see Tables 2 and 3). The following section presents the criteria used in this paper to assign to each subcategory a recycle status; based on these, the proportions of the solid waste with recyclable potential in UABC's Campus Mexicali I can be known.

3.3 Recycling potential of the university waste

The waste analyzed was classified into its subcategories, which fell within a recycle category. The latter categories were based on the waste recyclable potential according to the recyclable waste market in the area. Table 2 presents the number of formal businesses existing in Mexicali, which are in charge of trading the various waste types and that would be, potentially, the ones absorbing the

waste that might eventually be segregated through a program of integral waste management at UABC's Campus Mexicali.

Table 2. Number of companies that trade recyclables in Mexicali, by waste type

Type of company	Metals	Glass	Paper and cardboard	Plastics	Cars	Waste tires	Used oil
Recycling	3	2	6	1	0	0	1
Buy back/sales centers	18	3	4	3	5	0	0

Modified from: Ojeda et. al (2002)

A recycle category was assigned to each one of the waste subcategories based on the capacity of the local recyclables market. Table 3 describes the waste recycle potential categories used in this study.

Table 3. Recycling potential of waste categories

Category	Description
1. Recyclables	Waste for which there is currently a market in the area, that is, which has a buyer for recycling.
2. Potentially recyclables	Waste that can be recycled but that has no buyers currently in the area.
3. Non-recyclables	Waste that cannot be recycled.

Table 4 presents the assignment of recycle potential categories for each of the waste subcategories.

To calculate the real recycling potential of waste only the subcategories within the recyclable and potentially recyclable categories were used.

Table 4. Recycle potential categories for UABC's solid waste

Wastes sub-categories		Recycle potential		
		1	2	3
Paper and cardboard	White, Color paper, Newspaper, Magazines, Cardboard	✓		
	Other			✓
Plastics	Containers 1 and 2*	✓		
	Cont. 3 to 7, Plastic bags*		✓	
	Containers S/N, Diverse plastic			✓
Organics	Food refuse, leaves and grass, Tree trims, Harvest waste		✓	
	Organic diverse			✓
Metals	Aluminum cans, Tin cans, Metal diverse	✓		
Glass	Colorless, green and amber bottles	✓		
	Other glass		✓	
Construction/Demolition	Gravel, Rocs, Wood, Other		✓	✓
Hazardous	Batteries		✓	
	Reactive, Insecticides			✓
Other	Sanitary waste, Other			✓

* Refers to the number within the recycling symbol that appears on plastic bottles. Container 1 = PET, Containers 2 = HDPE, containers 3 to 7 the rest of the recyclable resins. Modified from Ojeda, et. al. 2000.

With the aim of knowing the recyclable and potentially recyclable proportions in each category Table 5 was constructed based on the classification of the subcategory provided in Table 4.

As can be noticed in Table 5, the recyclables waste category has the greatest percentage and together with the potentially recyclable category accounts for the 75.70% of the total waste generated at the campus. This shows the huge potential UABC's wastes has of being recovered and exploited, and stop being disposed of in a landfill.

Considering that Campus Mexicali I generates one ton of waste daily, then the portion of recyclable and potentially recyclable waste is equivalent to 0.75 tons per day, which is nearly three quarters of

the waste produced daily. This is the amount of waste that could be segregated from the main waste stream and could stop being landfilled.

Table 5. Recycling potential percentage of waste according to waste category

Waste category	Recycling potential		
	Recyclable %	Potentially recyclable %	Non recyclable %
Paper and cardboard	24.38	0.11	9.82
Plastics	3.09	3.55	1.49
Organics	18.38	19.96	0.59
Metal	1.38	0.00	0.00
Glass	3.23	0.09	0.00
Construction/ Demolition	0.00	1.06	0.49
Sanitary waste	0.00	0	9.28
Hazardous	0.00	0	2.43
Other	0.00	0.02	0.21
Total	50.91	24.79	24.30

4. Discussion

The characterization of solid waste, as mentioned earlier in this paper, is the first step to be considered in the planning of an integral solid waste management. The knowledge of the composition of waste permits knowing the potential of waste reduction and recycling, as well as the planning of strategies for separation, collection and delivery or sale for recycling.

The results of this research highlight two important aspects: a) the potential of exploitation of university waste, and b) a challenge for its integral management.

Based on the results from the different generation points, for the separation of recyclable waste the appropriate location of recycling bins would be as follows: bins for recyclable paper should be located in offices and classrooms, the bins for organic waste (food scraps), metals and plastics in community center. For corridors and gardens it would be appropriate to locate bins for plastics and

metals. The organic waste generated in gardens shouldn't be mixed with food scraps since the potential use of each waste could be different (animal food or composting).

4.1 Potential of exploitation of wastes

The results show that UABC has a great potential for diminishing the amount of waste whose final destination is a landfill; and that an integral waste management system can start, with simple reutilization and recycling practices that can achieve, in a short term, important reductions in the amount of waste to be disposed of and plan its management in the mid and long term.

Under the actual conditions of the recycling market in Mexicali it is possible to divert more than 50% of the wastes generated on campus. Considering that the new Mexican regulations for solid waste will promote the creation and consolidation of the Mexican recycling market then, in the short term, the potentially recycling wastes generated on campus could also be diverted from the main waste stream.

Besides the recycling potential, waste, such as paper, has a high reduction percentage. Thus, for example, the white paper waste had almost all just been used on one face of the sheet, which tells us that the practice of reusing paper is nonexistent. When looking for waste management alternatives, before considering recycling as an option, waste reduction strategies must be set in motion first. Reutilization is one of these strategies, and in the case of UABC, if white paper were reused, considering the best of cases, the waste generation from paper could be reduced to half. Also, if paper consumption reduction strategies are used, applying other communication strategies, such as establishing a document distribution via electronic format, the waste generation from paper could be reduced even further.

In the case of organic waste at UABC, practices such as those reported by Mbuligwe (2002), REMP (2003), UF Sustainability Task Force (2002), and N.C. Project Green (2004) could be implemented. Considering that the suburbs of Mexicali and its valley have many farms where goats, pigs and cows are bred, it is possible to consider these places as potential consumers of the much of the organic waste generated on campus. The campus itself could implement its own composting project for the recycling of organic waste.

4.2. A challenge for an integral waste management

It is clear that, although the recovery and recycling potential of UABC's waste is very high, this does not mean that in practice it is easy to achieve a total exploitation of this potential. In the cases presented of North American universities (Clugton and Calder, 1999; UF Sustainability Task Force,

2002; Brown programs, 2004), many years have passed since the first experiences in this field. In addition to this, from the beginning of the 1990's, a series of policies and programs have been issued in this country that guide and encourage the setting in motion of waste reduction and recycling programs in the higher education institutions. In Mexico, the case is different; however, with the recent events in waste management regulations and policies (new law) together with the Action Plan for the Sustainable Development in Higher Education Institutions (ANUIES-SEMARNAT, 2002) it is hoped that the foundations will be laid down, not only for an integral waste management, but also for environmental management systems that will take into account dimensions other than waste.

Aside from the high recovery potential of UABC's waste, another fact that it is important to highlight is that the proportions of recyclables vary depending on the point where the waste is generated. In this way, the waste coming from administrative buildings has a higher proportion of paper and cardboard waste and a lower proportion of organic waste and plastics. In the case of the waste from the community center, one of the main components is organic waste and waxed paper used to cover food. It is important to consider this data from two perspectives: the technical-operative and the sensitization. The first refers to the amount of bins to separate recyclables, location, collection frequency, etc. The second refers to the public who will be targeted by the sensitization campaign for the adequate handling of waste. Although both will be related in one point, the message given to the students consuming food in the dining area won't be the same as the one aimed at the store tenants who purchase products, transform and sell them. The very nature of the activities in one and the other waste generation sources marks the difference between them.

Although this study is the first of its kind in a higher education institution also is important to mention that in this study the seasonal variation of waste wasn't considered. Several authors (Buenrostro, 2001; Shah, 2000; INE, 1999) have reported the existence of a seasonal variability in the composition and quantity (the generation increasing in the hot months) of municipal solid waste. The waste analyzed in the present study was generated at a university; however, it could be assumed that, throughout the year, it may present similar variations to those reported for the municipal solid waste. This is assumed because, although the academic and administrative activities are the same throughout the year on Campus (except at the time of vacations), there is a marked difference in Mexicali between the summer temperatures and the winter temperatures, where the difference can be of up to 35°C or more between one season and the other, thus reaching temperatures in the 50°C in July and August. In the warm season of the year, greater amounts of refreshing beverages (sodas, juices, iced tea) and bottled water are consumed, marketed both in the

bottler's own container, in the case of juices and sodas, or in waxed paper or foam cups in the case of beverages prepared at the restaurants in the community center.

On the other hand, tree-pruning and lawn-mowing is more intensive from May to August which represents a greater waste generation from gardens. We believe that, should the sampling be taken at a different time of the year, the proportions of waste would change, due to which, if the behavior of each category throughout the year is to be known, there should be at least one sampling in each season. The study reported here was performed in October; therefore, the results of the characterization are valid only for the time when the study was performed or for months with similar weather conditions. Considering the influence that the seasonal variations have over the amount of waste generated, discussed in the paragraph above, it can be said that the estimates given in this paper, for the daily waste generation, are conservative, and therefore, the volumes of recyclable and potentially recyclable waste could be higher in the warmer months.

So far, there have been discussed the possibilities of recycling but most important of all is to look for the preventive approach of waste generation. Prevention is the first level in the hierarchy of waste management options. Waste can only be prevented at the front end of the material cycles by changing the way goods are produced and consumed (Ludwig, et. al, 2003). Thus, to be really "integral" a waste management program should include a preventive approach that looks into strategies for avoiding waste generation. If this is considered a more comprehensive approach to waste management should be proposed at UABC, one that comprehends green purchasing policies as well as education campaigns.

Last, concerning the taking of the sample, an easier way would have been the splitting method proposed by the Mexican Standard NMX-AA-015-1985 (SECOFI, 1985). The methodology proposed by this standard consists in taking, from the waste disposal site, a fourth of the waste produced in one day for the analysis. If it had been done in this way, all the bags of waste would have had to be opened, the sample homogenized with shovels, and then sampled and transported to the analysis site. Or else, the work should have been carried out at the final disposal site, which would in turn have meant problems for the analysis of samples, since that site has no facilities to perform the analysis. However, the splitting method would have ensured that the total waste produced in one day would have been sampled. Thus, this method is recommended for characterization studies on the rest of the UABC Campus.

Conclusions

UABC waste presents a great exploitation potential. The actual conditions of the local recyclables market can absorb the portion of waste catalogued as recyclable (50.91%). The portion in the potentially recyclable (24.79%) category could also have a different fate other than the disposal in landfills.

Although some efforts have taken place in waste management initiatives among Mexican universities this is the first waste characterization study reported for a Mexican higher education institution.

Seasonality and sampling methods should be considered important aspects to consider in future characterization studies.

Bibliography

Acurio, G., A. Rossin, P. F. Teixeira y F. Zepeda. 1997. *Diagnóstico de la situación del manejo de residuos sólidos municipales en América Latina y el Caribe*. Banco Interamericano de Desarrollo – Organización Panamericana, Washington, D.C., USA.

Allen, A.S. 1999. *Greening the campus: Institutional environmental change at Tulane University*. Tulane University Environmental Studies Program, New Orleans, USA.

ANUIES – SEMARNAT. 2002. *Plan de Acción para el Desarrollo Sustentable en las Instituciones de Educación Superior*. Asociación Nacional de Universidades e Instituciones de Educación Superior – Centro de Educación y Capacitación para el Desarrollo Sustentable (CECADESU) – SEMARNAT. México.

Armijo, de Vega Carolina; Ojeda-Benítez, S. and M.E. Ramírez-Barreto. 2003. Mexican educational institutions and waste management programmes: a University casa study. *Resources Conservation and Recycling* 39:283 – 296.

Brown University. Brown Recycling Program. Brown is Green.
http://www.brown.edu/Departments/Brown_Is_Green/waste/recysum.html

Buenrostro, D.O., 2001. *Los Residuos Sólidos Municipales: perspectivas desde la investigación multidisciplinaria*. Universidad Michoacana de San Nicolás de Hidalgo, México.

College and University Recycling Council (CURC). 2001. <http://www.nrc-recycle.org/councils/CURC/default.htm>

Clugston, R. and W. Calder. 1999. Critical Dimensions of Sustainability in Higher Education. In: *Sustainability and University Life*, Leal Filho, Walter (Editor). Peter Lang Scientific Publishers: New York.

Culler, W. W., 2003. State Agencies, Colleges and Universities Waste Reduction, Recycling and Buy Recycled. Fiscal Year 2002 Annual Report. S.C. Department of Health and Environmental Control. Office of Solid Waste Reduction and Recycling. South Carolina, USA.

- INE., 1999. *Minimización y Manejo Ambiental de los Residuos Sólidos*. Instituto Nacional de Ecología, SEMARNAT, México.
- Kentucky Pollution Prevention Center (KPPC), <http://www.kppc.org/spotlight/universities.cfm#1>
- López, F., 1997. Situación actual del reciclaje en México. In: *Reciclaje de Residuos Sólidos Municipales*. Hernández-Fernandez y González-Martínez (Ed.), Universidad Nacional Autónoma de México, México, D.F., pp. 161-173.
- Ludwig, Ch., Hellweg, S. and Stucki, S., 2003. *Municipal Solid Waste Management: Strategies and Technologies for Sustainable Solutions*. Springer-Verlag, Berlin, Germany.
- Mbuligwe, S. E., 2002. Institutional solid waste management practices in developing countries: a case study of three academia institutions in Tanzania. *Resources, Conservation and Recycling* 35 No. 3: 131-146.
- Navarro, V., 1997. Programa universitario de recuperación de residuos. In: *Reciclaje de Residuos Sólidos Municipales*. C. Hernández-Fernández y S. González-Martínez (Ed.) Programa Universitario de Medio Ambiente, Universidad Nacional Autónoma de México, pp. 224-230.
- N.C. Project Green. (2004). Appalachian State University Environmental Sustainability Report. <http://www.p2pays.org/ref/07/06568/2001/nframe.asp?page=UNV-AppStatehome.htm>.
- Ojeda-Benítez, S., Armijo de Vega, C. and Ramírez-Barreto, M. E., 2000. The potential for Recycling Household Waste: A Case Study from Mexicali, Mexico. *Environment and Urbanization*, 12 No. 2, pp. 163-173.
- Ojeda- Benítez, S., Armijo de Vega, C. and Ramírez-Barreto, M. E., 2002. Formal and Informal Recovery of Recyclables in Mexicali, Mexico: Handling Alternatives. *Resources, Conservation and Recycling*, 34 No. 4, pp. 273-288.
- Ramírez, H. D., 1993. *Proyecto de Aprovechamiento Integral de los Desechos Sólidos del Campus Monterrey*. Centro de Calidad Ambiental. ITESM Campus Monterrey. México.
- REMP., 2003. Resource and Environmental Management Program. Ithaca College, USA. <http://www.ithaca.edu/remf/>
- SECOFI (Secretaría de Comercio y Fomento Industrial, 1985. Relación de Normas Oficiales Mexicanas Aprobadas por el Comité de protección al Ambiente. Contaminación del Suelo. México.
- SEMARNAT (Secretaría de Medio Ambiente y Recursos Naturales), 2003. Ley General para la Prevención y Gestión Integral de los Residuos. Diario Oficial de la Federación. 8 de octubre de 2003. México.
- Shah, K.L., 2000. *Basics of Solid and Hazardous Waste Management Technology*. Prentice Hall, USA..
- Strange, K., 2002. Overview of Waste Management Options: Their Efficacy and Acceptability. In: *Environmental and Health Impact of Solid Waste Management Activities*. R.E. Hester and

R.M. Harrison (Ed.). Royal Society of Chemistry., Thomas Graham House, Cambridge, UK. pp.1-52.

Tchobanoglous, G., Theisen H, Vigil SA., 1993. *Integrated Solid Waste Management: Engineering Principles and Management Issues*. McGraw-Hill. New York, USA.

UF (University of Florida) *Sustainability Task Force, 2002*. Final Report. UF Office of Sustainability., USA. www.sustainable.ufl.edu

WWF. 1991. *Getting at the source: Strategies for reducing municipal solid waste*. Island Press, Washington, D.C. US

Annex II

Questionnaire

Read carefully the following statements and choose one option or answer the questions.

Part I. Personal information

- At UABC I am:
 Student Faculty Visit
 Cleaning staff Administrative staff
- Name of the faculty or department where I study or work

3. Semester that I'm in (for students)_____

Part II. Perception of waste as an environmental problem

- Waste poses a problem for the environment
 Strongly agree Do not agree
 Agree Strongly disagree
 Neutral
- The problems that waste poses to the environment finish once it is picked-up and taken out of the university.
 Strongly agree Do not agree
 Agree Strongly disagree
 Neutral

Part III. Perception of the 3 R's as valuable strategies for reducing the waste impact on the environment

- Waste reduction is an alternative for waste management that diminishes the impact of waste on the environment.
 Strongly agree Do not agree
 Agree Strongly disagree
 Neutral
- Reusing is an alternative for waste management that diminishes the impact of waste on the environment.
 Strongly agree Do not agree
 Agree Strongly disagree
 Neutral
- Recycling is an alternative for waste management that diminishes the impact of waste on the environment.

- Strongly agree Do not agree
 Agree Strongly disagree
 Neutral

Part IV. Acceptance or denial of responsibility towards waste.

9. UABC buildings are clean.

- Strongly agree Do not agree
 Agree Strongly disagree
 Neutral

10. There are problems related with waste management at UABC.

- Strongly agree Do not agree
 Agree Strongly disagree
 Neutral

11. Waste management at UABC is the sole responsibility of cleaning staff.

- Strongly agree Do not agree
 Agree Strongly disagree
 Neutral

Part V. Information about the program

12. There is a new waste management program at UABC.

- Yes No

13. I know the procedures and rules of the new waste management program at UABC.

- Strongly agree Do not agree
 Agree Strongly disagree
 Neutral

14. I know the characteristics of the waste that must be placed in the recycling bins.

- Strongly agree Do not agree
 Agree Strongly disagree
 Neutral

15. The location (situation) of the recycling bins is adequate.

- Strongly agree Do not agree
 Agree Strongly disagree
 Neutral

16. If you do not agree with question 15, where do you think the bins must be placed?

17. How would you like to be reached to receive information about the waste management program? (You can choose more than one)

- Video Internet site
 Fliers and posters E-mail
 Multimedia material On-line course
 TV Radio

Other _____

Part V. Desire to participate in the waste management program

18. I would you like to receive information about environmentally friendly waste management practices.

- Yes
 No

19. In case you answer YES the question 18 please leave your e-mail address:

E-mail: _____

20. I would like to participate in the UABC's waste management program

- Strongly agree Do not agree
 Agree Strongly disagree
 Neutral

Part VI. Perception of UABC as an institution that cares for its environment

21. I know some of the activities that my University is implementing to take care of the environment

- Yes
 No

22. What concrete actions you know that UABC is implementing in favor of the environment?

23. What kind of actions or activities to protect the environment you think that UABC should be involved in?

ANNEX III

Results of the interviews used to analyze the three variables of Fiedler's model.

Person interviewed	Phase of the program	Relevant information given during the interview
Former rector	Before the reform	<p>The relationship with the director of maintenance was cordial. They maintained good communication and exchange of information.</p> <p>No direct orders were given to the director of maintenance about the waste management program. The only tasks that director of maintenance received were the ones accorded during the initial meeting when the program was approved by the rector. The rector never told him what was expected from him in relation to the waste program.</p> <p>The rector of the university holds the maximum power within the institution.</p>
Present-day rector	Transition	<p>The relationship with the director of maintenance was cordial. They shared mutual trust, respect and confidence.</p> <p>Direct orders were given to the director of maintenance. He was told what had to be done and how he should do it. He was even told what people to involve in the waste program. A written document was delivered to the director of maintenance in order to know the background of the program.</p>
	After the reform	<p>The relationship with the Coordinator of Administrative Services was cordial. They shared mutual trust, respect and confidence.</p> <p>The rector didn't give the Coordinator of Administrative Services any specific order related to the waste program. No one advised the coordinator about the waste management program.</p> <p>The rector of the university holds the maximum power within the institution.</p>
Director of maintenance.	Before the reform	<p>The relationship with the chief of maintenance was cordial. They shared mutual trust, respect and confidence.</p> <p>The director of maintenance didn't give any specific order to the chief of maintenance in relation to the waste management program.</p> <p>The director of maintenance was a powerful position. His decisions were supported by the rector. Directors can rewards and punish the behavior.</p>
Director of	Transi-	The relationship with the chief of maintenance was cordial. They

Person interviewed	Phase of the program	Relevant information given during the interview
maintenance	tion	<p>shared mutual trust, respect and confidence.</p> <p>The director of maintenance gave specific orders to the chief of maintenance in relation to the waste management program. He sent documents specifying what activities should be done and how. The results of these activities were the relocation of the temporary site for the waste disposal and the hiring of a new waste transportation company.</p> <p>The director of maintenance was a powerful position. His decisions were supported by the rector.</p> <p>Directors can rewards and punish the behavior.</p>
Coordinator of administrative services	After the reform	<p>The relationship with the chief of maintenance was cordial. They shared mutual trust, respect and confidence.</p> <p>The Coordinator of Administrative Services didn't give any specific order to the chief of maintenance in relation to the waste management program.</p> <p>The Coordinator of Administrative Services was a powerful position. His decisions were supported by the rector. Coordinators can use rewards and punishment media.</p>
Chief of maintenance	Before the reform	<p>The relationship with janitor's supervisors was cold and based on the usual routines. The main interaction was to receive the reports of his duties and of his subordinates. He didn't use the words trust, respect and confidence to describe his relationship.</p> <p>The Chief of Maintenance didn't give any specific order to the janitor's supervisors in relation to the waste management program.</p> <p>The Chief of Maintenance lacked the power to make his subordinates perform the activities needed to be done.</p>
Chief of maintenance	Transi-tion	<p>The relationship with the janitor's supervisors was cordial. They shared mutual trust, respect and confidence.</p> <p>He gave specific order to his subordinates about the waste management program but these were transmitted verbally. He never wrote a description of what had to be done and how this was to be accomplished.</p> <p>The Chief of Maintenance didn't have the power to ensure nor prevent the outcomes desired.</p> <p>The janitor's supervisors were reluctant to follow his orders.</p>

Person interviewed	Phase of the program	Relevant information given during the interview
Chief of maintenance	After the reform	<p>The relationship with the janitor's supervisors was cordial. They shared mutual trust, respect and confidence.</p> <p>He gave specific orders to his subordinates about the waste management program. These were transmitted verbally as well as in written form which clearly detailed the activity and product of that activity.</p> <p>The janitor's supervisors were reluctant to follow the Chief's of Maintenance orders. These orders meant more work for them as well as for the janitors. The supervisors didn't want to have problems with janitors.</p>
Janitor's supervisors	Before the reform	<p>The relationship of the janitor's supervisor with the janitors in general was based more on routines than on personal interaction. In the words of one of the supervisors interviewed "<i>we didn't need to have a relationship... janitors know what has to be done. We just check that they don't skip a work-day and that they arrive on time to fulfill their duties</i>".</p> <p>The janitor's supervisors didn't give any specific order to janitors in relation to the waste management program. The tasks of the program were not defined.</p> <p>Janitor's supervisors said that it is almost impossible for them to make the janitors do different things than they're used to. They also mentioned that it was difficult to make them work on tasks that are not specified in their job description book.</p>
	Transition	<p>Relationship with janitors was just the same as in the previous phase.</p> <p>Janitor's supervisors didn't give any specific orders to janitors in relation to the waste management program. The tasks of the program were not defined.</p> <p>The janitor's supervisors said that it was almost impossible for them to make the janitors do different things than they're used to. They also mentioned that it was difficult to make them work on tasks that are not specified in their job description book.</p>
	After the reform	<p>The relationship with janitors improved. Because half of the janitors were fired during the downsizing process, the janitors still working for the university had a bigger work-load. For this reason the relationship with janitors had to be closer in order to explain to them the changes that were taking place in the university.</p> <p>Janitor's supervisors didn't give any specific orders to janitors in</p>

Person interviewed	Phase of the program	Relevant information given during the interview
		<p>relation to the waste management program. The tasks of the program were not defined.</p> <p>The janitor's supervisors said that it was almost impossible for them to make the janitors do different things than they're used to. They also mentioned that it was difficult to make them work on tasks that are not specified in their job description book.</p>
Coordinator of the waste management program	Before the reform	<p>The relationship with the rector was good when the waste program was created. Afterwards there was no relation at all. It was impossible for the coordinator to reach the rector when she needed to communicate something about the program. The rector never asked her about the program either. The relationship of the coordinator with the director and the chief of maintenance, janitor's supervisors and janitors were not good in general terms. These persons didn't like her to tell them what to do and didn't like a woman involved in the waste management issues.</p> <p>The coordinator described in a detailed way each of the activities that had to be performed by each of the persons involved. She delivered written documents with the descriptions of the tasks to these persons. After that she contacted them for a follow-up of the activities. Workshops were held in order to coordinate the activities and ensure that all the participants were clear about what to do.</p> <p>Despite the coordinator efforts, she was not taken seriously by the rest of the people involved in the waste management program. They didn't heed to her recommendations.</p>

Samenvatting

Bodemverontreiniging, waterverontreiniging, buitensporige geluidsniveaus en luchtverontreiniging zijn verschijnselen die overal optreden in dichtbevolkte gebieden.

Milieuverontreiniging is een proces dat al eeuwenlang plaatsvindt. Maar door de toename van de menselijke populatie en de diversificatie van haar activiteiten bereikt het effect op het milieu nieuwe proporties en een grotere complexiteit. Gelukkig wordt hetzelfde menselijk vermogen om nieuwe vormen van productie en menselijke welstand die tot vervuiling leiden, ook gebruikt om te trachten de schade aan het milieu te voorkomen en herstellen of op z'n minst de snelheid van vernietiging te verminderen.

De industriële sector is de pionier en leider geweest in de implementatie van milieutherstel en *pollution prevention* maatregelen – en met zeer goede resultaten. Deze trend die de afgelopen drie decennia heeft plaatsgevonden, sijpelt door naar andere sectoren. Deze kopiëren de aanpak in de industriële sector en nemen op basis daarvan ook initiatieven om milieu-effecten te voorkomen en te verminderen.

De onderwijs sector, met name de hoger onderwijs sector, is heel actief geweest in het voorstellen en starten van milieubescherming initiatieven. De publicaties over diverse initiatieven tonen aan dat er goede resultaten zijn bereikt. Deze resultaten zijn echter niet bereikt zonder hard werken en grote problemen. Gerapporteerde ervaringen over milieuprogramma's bij hoger onderwijs instituten geven aan dat het gebrek aan milieubeleid, het ontbreken van een coördinator alsmede van financiële bronnen tot de meest voorkomende knelpunten voor een succesvolle aanpak van milieuproblemen behoren. In deze rapporten, hoe informatief ook, ontbreekt het analysesniveau om diepgaander veranderingen te suggereren die tot efficiëntere milieuprogramma's kunnen leiden. Andere kenmerken in de gerapporteerde ervaringen van milieu-initiatieven in het hoger onderwijs is hun focus op één of twee variabelen van de interne organisatie.

Het gebrek in eerdere studies aan een systeem benadering om milieu initiatieven in hoger onderwijs instituten te kunnen begrijpen was de aanleiding voor het onderhavige, systeem gerichte onderzoek. Binnen dit onderzoek werden externe en interne organisatievariabelen meegenomen. Het doel van dit onderzoek was om de sleutelvariabelen te identificeren die een specifiek milieuprogramma beïnvloeden, te weten het afvalmanagement programma van de Autonome Universiteit van Baja California (AUBC), Mexico. Een ander doel van dit werk was om te ontdekken hoe die variabelen op elkaar inwerkten om de aangetoonde resultaten van het afvalmanagement programma te bereiken.

De in deze studie in beschouwing genomen externe variabelen waren: a) de duurzaamheids trends in het hoger onderwijs, en b) het afvalmanagement systeem in Mexico. De geanalyseerde interne variabelen waren: a) leiderschap, b) structuur, en c) cultuur, gericht op positief milieugedrag. Gebaseerd op de resultaten van deze variabelen en hun interacties was het mogelijk om enige richtlijnen voor milieu-initiatieven in hoger onderwijs instituten voor te stellen.

Diverse theoretische perspectieven werden gebruikt om de doelstellingen van de studie te bereiken. Voor de analyse van de externe variabelen werden de concepten van taak- en algemene omgevingen, organisatie velden, netwerken en historische elementen gebruikt. Voor de analyse van de interne variabelen werden Fiedler's *Contingency Model* en transformatie leiderschap theorieën gebruikt om leiderschap te analyseren; Mintzberg's indeling van organisatievormen en Lam's interpretatie om organisatievormen aan de dynamiek van leren en innoveren te koppelen werden gebruikt om de organisatiestructuur te analyseren; Azjen's *Theory of Planned Behavior* en andere factoren zoals beleid, plaats van recycle tonnen, gewoonten, etc., werden gebruikt om enige aspecten van positief milieugedrag te analyseren.

Wat betreft de geanalyseerde externe variabelen is een conclusie van de studie dat om succesvolle milieuzorginitiatieven in de Mexicaanse hoger onderwijs sector te bevorderen een nationale strategie aanwezig moet zijn. Deze strategie zou de kloof moeten dichten tussen de overheidsorganisaties op milieugebied en de onderwijs instelling – in het bijzonder zijn aandacht voor het stimuleren van milieuonderwerpen binnen het hoger onderwijs. Een andere conclusie is dat om dit te laten slagen prikkels en prestatiestandaarden ontwikkeld en toegepast moeten worden in het hoger onderwijs. Een laatste uit deze studie getrokken conclusie is dat ‘bruggenbouwers’ aanwezig moeten zijn om te helpen bij het opbouwen van relaties en communiceren tussen de externe omgeving en de mensen binnen de organisatie.

In het speciale geval van de variabele “Mexicaans afvalstelsel” wordt geconcludeerd dat de lokale recycling markt een negatief effect had op UABC's afvalmanagement programma. Regionale en lokale recyclingmarkten moeten ontwikkeld worden om de onzekerheid te verminderen die is ontstaan door de afhankelijkheid van de Mexicaanse grensstaten van de N-Amerikaanse recyclingmarkt. Geconcludeerd wordt ook dat het gebrek aan ondersteuning en prikkels vanuit het Mexicaanse afvalstelsel om geëigende afvalmanagement alternatieven te initiëren en implementeren, organisaties aan hun lot overlaten. Dit bemoeilijkt het alloceren van financiële middelen en de benodigde vaardigheden.

De variabele “duurzaamheid trends in het hoger onderwijs” blijkt geen enkel effect te hebben gehad op de onderwijsinstelling. Dit leidt tot de conclusie dat UABC een diffuse invloed had op

het bestaan van nationale en internationale netwerken die aan duurzaamheid in het hoger onderwijs werken. In deze zin spelen de kennis netwerken COMPLEXUS (Mexicaans Consortium van Universiteiten voor Duurzaamheids Milieuprogramma's) en REMEXMAR (Mexicaans Netwerk voor Milieumanagement van Afval) geen belangrijke rol speelden om een paradigmaverandering te genereren die succesvolle milieu-initiatieven aan UABC zou kunnen helpen creëren. Geconcludeerd wordt dat deze situatie vooral te wijten was aan het ontbreken van een proces van diffusie, assimilatie en uiteindelijk institutionalisering van nieuwe ideeën die in die netwerken werden voorgesteld.

Wat betreft de geanalyseerde interne variabelen van de onderwijsinstelling blijkt dat leiderschap direct invloed had op het afvalmanagement programma. De conclusie is dat positieve programmaresultaten naar voren kwamen wanneer tenminste één van de kenmerken van een transformatie leider (visie delen, morele doelstelling, relatie opbouw, kennis creatie en -deling, coherentie ontwikkeling) aanwezig was in combinatie met een goede leiderschapsituatie (volgens Fiedler's model). De goede leiderschapsituaties waren vooral aanwezig bij hogere macht posities.

Uit deze studie blijkt dat de organisatiestructuur van UABC het succes van het afvalmanagement programma niet heeft gefaciliteerd. Het afvalmanagement programma vereiste samenwerking tussen de administratieve en academische sectoren.

Geconcludeerd wordt dat de verschillende werkculturen van deze sectoren problemen tussen hen genereerden. Aan de ene kant gedroeg de academische sector zich als Mintzberg's professionele bureaucratie – de creatief-innovatieve zijde van de universiteit – terwijl aan de andere kant de administratieve sector zich als Mintzberg's machine-bureaucratie gedroeg – geworteld in een interne arbeidsmarkt die rond eng gedefiniëerde banen is georganiseerd. Geconcludeerd wordt ook dat het probleem van het zich eigen maken door de administratie staf van veranderende omstandigheden het hen moeilijk maakte om aan de innovatie en flexibiliteit vereisten van het afvalmanagement programma tegemoet te komen. Een andere conclusie van deze studie is dat de oppervlakkige benadering van leren en de geringe innovatieve capaciteit het moeilijk maakten de administratieve sector te mobiliseren om nieuwe manieren van omgaan met afval te leren en hen te laten participeren in het afvalprogramma.

Men leerde ook dat zelfs bij structurele veranderingen aan UABC geen positieve resultaten voor het afvalprogramma werden verkregen. De conclusie is dat de structurele veranderingen zelfs een gecompliceerdere en verticale organisatiestructuur voortbracht die haaks stond op vereisten voor duurzaamheids initiatieven. Deze hebben zowel horizontale relaties nodig als naadloze integratie van alle eenheden en functies in planning en besluitvorming. Hieruit kan worden afgeleid dat

UABC de op macht en controle gebaseerde structuur handhaafde die scheiding tussen de organisatie functies creëerde. Op deze wijze werden de barrières die de kunde om dwars door departementale lijnen heen samen te werken, gehandhaafd.

De studieresultaten tonen aan dat het de coördinator van het afvalprogramma aan autoriteit en macht ontbrak vanwege diens structurele positie in de hiërarchie. Dit resultaat samen met het type structuur van UABC staat de conclusie toe dat een formele positie binnen de organisatiestructuur de coördinator van het afvalprogramma behulpzaam kan zijn om activiteiten succesvol uit te voeren.

Wat betreft de interne variabele “positief milieugedrag” tonen de resultaten dat ondanks de erkenning van de noodzaak van de gebruikt strategieën in het afvalprogramma (reductie, hergebruik en recycling) personen niet de wil demonstreerden om in het programma te participeren. Daarbij toonde met name de administratieve staf de laagste participatiebereidheid. Het bleek moeilijk te zijn om dit aspect aan een enkelvoudig en specifiek oorzakelijke variabele te verbinden. Er worden vier conclusies uit deze resultaten afgeleid: 1) het bureaucratisch mechanistisch gedrag van de administratieve staf beperkt flexibiliteit en openheid om nieuw gedrag, nieuwe attitudes en activiteiten uit te voeren en te ervaren. De participatiebereidheid van de administratieve staf in het afvalprogramma was laag als gevolg van het ontbreken van geschreven regels en een bestaande gezagsketen om gedrag bij te stellen en te sturen. 2) De UABC gemeenschap zag geen persoonlijk gewin in het voorgestelde gedrag. Wanneer individuen er geen persoonlijk voordeel in zien om zich te gedragen volgens de recycling, hergebruik en reductie strategieën, vinden zij het niet de moeite waard om zich voor de voorgestelde activiteiten in te spannen. 3) De mensen bij UABC kunnen zich niet voorstellen dat wat anderen denken over hun afvalpraktijken belangrijk is. Deze subjectieve normen zouden in het nadeel van het afvalprogramma gewerkt kunnen hebben. 4) De mensen bij UABC hebben niet het gevoel dat zij controle hebben over de uitvoering van het nieuwe gedrag. Deze perceptie verhindert hun participatie in het programma. Verder wordt gesuggereerd dat andere variabelen zoals beloning, de plaats van de recycle tonnen en het ontbreken van afvalbeleid ook in het nadeel van de participatie bereidheid in het afvalprogramma gewerkt zou kunnen hebben.

De voornaamste bijdrage van deze studie is de bevinding dat de gebeurtenissen in het afvalprogramma niet het resultaat van een enkelvoudige variabele zijn. In plaats daarvan liet het in deze studie geïntegreerde raamwerk het toe om vast te stellen dat een wisselwerking tussen verschillende variabelen leidde tot de bereikte resultaten. Met andere woorden, er werd aangetoond dat een enkel verschijnsel terug te voeren is tot meer dan één bron en een gevarieerde

set actoren. De voornaamste theoretische bevinding is dat ondanks de wisselwerking tussen de verschillende geanalyseerde factoren, de variabele *organisatiestructuur* een belangrijker rol in het beïnvloeden van de resultaten van het milieu-initiatief speelde.

Om een succesvol UABC afvalprogramma te realiseren wordt op basis van deze studie de noodzaak aangegeven van een formele steun van het top-management in de vorm van schriftelijke verklaringen en betrokkenheid in de ontwikkeling van een institutioneel plan. Ook moet de ontwikkeling van het vereiste beleid en toewijzing van financiële middelen een plaats krijgen. Ook wordt voorgesteld dat op verschillende niveaus binnen de organisatie leiderschap vereist is. Daarbij heeft de directeur van de onderhoudsafdeling een sleutelpositie om het hele systeem volgens de plannen van het afvalmanagement programma op één lijn te krijgen. De positie van een afvalprogramma coördinator zou alleen ingesteld moeten worden wanneer die positie formeel is geïntegreerd in het organisatiemodel. Er moeten verschillende mechanismen worden gebruikt om een milieubewustere cultuur in de universiteit te bevorderen. Deze mechanismen moeten gericht zijn op het creëren van een gemeenschappelijk denkkader, geloof, en aannames en gedeelde waarden over de noodzaak om zorg te dragen voor het milieu en daarnaar te handelen.

De auteur stelt ook de oprichting van een academisch centrum voor dat zich bezig houdt met milieu onderzoek, onderwijs, informatieverstrekking en *audits* als een alternatieve manier om veel problemen waarop het afvalmanagement programma is gestuit, te vermijden.

De hier gebruikte systeem gerichte aanpak biedt het raamwerk waarop toekomstige studies kunnen worden gebaseerd. Het onderzoek wordt afgesloten met het stellen van een aantal vragen en het laten van ruimte voor alternatieve interpretaties en de ontwikkeling van nieuwe hypothesen.

Resumen

La contaminación del suelo, aire y agua, y los excesivos niveles de ruido son fenómenos presentes en donde quiera que los humanos estén congregados en números considerables. Esto ha tenido lugar por siglos. Conforme la población humana aumenta y sus actividades se diversifican, el impacto en el ambiente alcanza nuevas proporciones y complejidad. Afortunadamente, la misma grandeza humana para crear nuevas formas de producción y confort humano que generan contaminación es también usada para tratar de prevenir y sanar el daño hecho al ambiente, o al menos, disminuir el ritmo de destrucción.

El sector industrial ha sido el pionero y el líder en poner en marcha medidas de prevención y remediación ambiental con muy buenos resultados. Esta tendencia ha tomado lugar durante las últimas tres décadas y ha permeado a otros sectores que, copiando el esquema del sector industrial, están llevando al cabo iniciativas para disminuir los impactos al ambiente.

El sector educativo, especialmente el sector de la educación superior, ha sido muy activo en proponer y poner en marcha programas de protección ambiental. Las publicaciones sobre diversas iniciativas indican que se han obtenido buenos resultados. Sin embargo, los resultados no han estado libres de problemas y trabajo arduo. Las experiencias reportadas acerca de programas ambientales en instituciones de educación superior indican que entre las barreras más comunes para la solución exitosa de problemas están la falta de políticas ambientales, ausencia de un coordinador, y falta de recursos económicos. Aunque informativos, estos reportes carecen de un nivel de análisis que permitan sugerir cambios profundos que pudieran resultar en programas ambientales más eficientes. Otra característica de las experiencias reportadas de iniciativas ambientales en la educación superior es su enfoque en una o dos variables del ambiente interno de las instituciones.

La ausencia de una aproximación sistémica de los estudios previos para entender las iniciativas ambientales en las instituciones de educación superior fue el incentivo para realizar esta investigación bajo un enfoque sistémico. Bajo esta aproximación fueron consideradas variables internas y externas de la organización. El propósito de este estudio fue el detectar las variables clave que afectan a un programa ambiental, específicamente el programa de manejo de residuos de la Universidad Autónoma de Baja California, México (UABC). Otro objetivo de este trabajo fue el de detectar como esas variables interactuaron para producir los resultados mostrados por el programa de manejo de residuos.

Las variables externas consideradas en este estudio fueron a) las tendencias de sustentabilidad en la educación superior, y b) el sistema Mexicano de manejo de residuos. Las variables internas analizadas fueron: a) liderazgo, b) estructura organizacional, y c) cultura enfocada en el comportamiento pro-ambiental. Con base en los resultados de estas variables y en sus interacciones fue posible sugerir algunos lineamientos para las iniciativas ambientales en las instituciones de educación superior.

Para alcanzar los objetivos de este trabajo se usaron diversas perspectivas teóricas. Para el análisis de las variables externas se utilizaron los conceptos de ambiente de trabajo y ambiente general, redes y elementos históricos. En cuanto a las variables internas, para el análisis de liderazgo se utilizaron el Modelo de Contingencias de Fiedler, y la teoría de liderazgo transformacional; para el análisis de la estructura se utilizó la división organizacional de Mintzberg y la interpretación de Lam para ligar las formas organizacionales con las dinámicas de aprendizaje e innovación; por último, para el análisis del comportamiento pro-ambiental se usó la Teoría del Comportamiento Planeado de Azjen así como otros factores tales como políticas ambientales, localización de los botes para separar reciclables, hábitos, etc.

En lo referente a las variables externas analizadas el estudio concluye que para promover iniciativas ambientales exitosas en el sector de la educación superior mexicano éste debe contar con una estrategia nacional. Esta estrategia debe llenar los huecos existentes entre los sectores involucrados en la protección ambiental y el sector educativo –en particular su interés en promover aspectos ambientales en las universidades. También se concluye que para que esto suceda deben existir incentivos e indicadores de desempeño que deberán ser aplicados a las instituciones de educación superior. Otra conclusión derivada de este estudio es que deben existir y definirse roles de interacción para ayudar en el proceso de crear relaciones y comunicación entre medio ambiente externo y la gente dentro de la organización.

Para el caso específico de la variable “sistema mexicano de manejo de residuos” se concluye que el mercado de reciclables tuvo un impacto negativo en el programa de manejo de residuos de la UABC. Para disminuir la incertidumbre creada por la dependencia en el mercado norteamericano deben desarrollarse los mercados del reciclaje locales y regionales sobre todo para los estados Mexicanos localizados en la Frontera con los Estados Unidos de Norteamérica. También se concluye que la falta de apoyo y de incentivos por parte del sistema mexicano de residuos, para iniciar y poner en marcha alternativas apropiadas de manejo de residuos deja solas a las organizaciones, dificultándoles la obtención de recursos económicos y las habilidades necesarias para conseguir ese fin.

Para el caso especial de la variable “tendencias de sustentabilidad en la educación superior” se encontró que esta variable no afectó a la institución. Esto permite concluir que la UABC cuenta con una influencia difusa por parte de las redes nacionales e internacionales que promueven la sustentabilidad en la educación superior. En este sentido también se concluye que las redes del conocimiento como COMPLEXUS (Consortio Mexicano Para el Desarrollo Sustentable en Universidades) y REMEXMAR (Red Mexicana de Manejo Ambiental de Residuos) no jugaron un papel importante como para producir un cambio de paradigma que pudiera ayudar en la creación de iniciativas ambientales exitosas en la UABC. También se concluye que esta situación se debió principalmente a la falta de un proceso de difusión, asimilación y finalmente de institucionalización de las nuevas ideas propuestas por esas redes.

En relación con las variables internas de la institución analizadas en este trabajo, se encontró que el liderazgo directamente afectó al programa de manejo de residuos. Se concluye que los resultados positivos del programa se dieron cuando estuvo presente al menos una de las características del líder transformacional (visión compartida, propósito moral, construcción de relaciones, creación y distribución del conocimiento, coherencia) en combinación con buenas situaciones de liderazgo (de acuerdo al modelo de Fiedler). Las situaciones de liderazgo buenas en su mayoría estuvieron presentes en las más altas posiciones de poder.

En este trabajo se encontró que la estructura organizacional de la UABC no facilitó el éxito del programa de manejo de residuos. El programa de manejo de residuos requería de la colaboración entre los sectores administrativo y académico. Se concluye que las diferentes aproximaciones hacia el trabajo entre estos sectores generaron dificultades entre ellos. Por un lado el sector académico se comportó como la burocracia profesional de Mintzberg – el sector de la universidad creativo e innovador- mientras que por el otro lado el sector administrativo se comportó como una burocracia mecanizada (burócrata-mecanicista) –basada en fuerza de trabajo alrededor de tareas estrechamente definidas. También se concluye que la dificultad del personal administrativo para adaptarse a circunstancias cambiantes les dificultó mostrar los requerimientos de innovación y flexibilidad que demandaba el programa de manejo de residuos. Otra conclusión de este trabajo es que la aproximación superficial al aprendizaje mostrado por la burocracia y su poca capacidad para innovar dificultó la movilización del sector administrativo hacia el aprendizaje de nuevas formas de manejar a los residuos y hacerlos participar en el programa de residuos.

También en este estudio se aprendió que aún cuando en la UABC tuvieron lugar cambios estructurales no se generaron resultados positivos para el programa de manejo de residuos. Se concluye que el cambio estructural produjo una estructura organizacional aún más compleja y

vertical, lo que representa exactamente el requerimiento opuesto para las iniciativas de sustentabilidad. Estas iniciativas necesitan relaciones horizontales así como una integración en la planeación y toma de decisiones de todas las unidades y funciones. Se dedujo que la UABC mantuvo la misma estructura basada en el poder y el control que crea la separación entre las funciones organizacionales, perpetuando de esta manera las barreras que limitan la habilidad de un trabajo conjunto entre líneas departamentales.

Los resultados de este trabajo muestran que el coordinador del programa de residuos carecía de la autoridad y poder derivados de la posición del individuo dentro de la jerarquía estructural. Considerando este resultado junto con el tipo de estructura de la UABC permite concluir que una posición formal dentro de la estructura organizacional ayudaría al coordinador del programa de residuos a desarrollar sus actividades exitosamente.

En lo relacionado a la variable interna “comportamiento pro-ambiental” los resultados muestran que a pesar del reconocimiento de que eran necesarias las estrategias utilizadas por el programa de manejo de residuos (reducir, reutilizar y reciclar) la gente no demostró la intención de participar en el programa, siendo el grupo del personal administrativo el que presentó los niveles más bajos de intención para participar. Fue difícil relacionar este aspecto a una única variable causante. Estos resultados se explicaron de cuatro maneras distintas: 1) el comportamiento burócrata-mecanicista del personal administrativo limita la flexibilidad y apertura para desempeñar y experimentar nuevos comportamientos, actitudes y actividades. La intención por parte del personal administrativo de participar en programa de residuos fue baja como consecuencia de la falta de reglas escritas y a la ausencia de una cadena de comando para moldear y dirigir el comportamiento deseado. 2) La comunidad de la UABC no percibió ganancias personales en el comportamiento propuesto. Si un individuo no concibe ventajas personales como consecuencias del reciclaje, de la reutilización y de la reducción de residuos posiblemente no considera que valga la pena hacer un esfuerzo extra para realizar las actividades propuestas con estas estrategias. 3) La gente en la UABC no percibe que es importante lo que otros piensan acerca de sus prácticas de manejo de residuos. Estas normas subjetivas podrían haber trabajado en contra del programa de manejo de residuos. 4) La gente en la UABC no sienten que ellos pueden controlar el desarrollo de un nuevo comportamiento. Esta percepción evita su participación en el programa. Más aún, se sugiere que otras variables, tales como ausencia de incentivos, la ubicación de los botes para reciclaje y la ausencia de políticas de manejo de residuos también pudieron trabajar en contra del deseo de participar en el programa de manejo de residuos de la UABC.

La mayor contribución de este trabajo es el haber encontrado que los eventos del programa de manejo de residuos no fueron el resultado de una sola variable. La aproximación integradora usada en esta tesis permitió detectar que fue la interacción de diversas variables lo que produjo los resultados mostrados en el programa. En otras palabras, se mostró que un solo fenómeno puede tener más de un origen y varios grupos de jugadores. El principal hallazgo teórico fue que, a pesar de la interacción de los diversos factores analizados, la estructura organizacional fue la variable que jugó un papel más importante por su influencia en los resultados de la iniciativa ambiental.

Este estudio propone que para que la UABC tenga un programa exitoso de manejo de residuos la iniciativa deberá ser apoyada formalmente por las personas en puestos de poder altos dentro de la administración a través de compromisos por escrito y una estrategia para alcanzarlos plasmada en el plan de desarrollo institucional. También deberán tener lugar la creación de políticas sobre manejo de residuos y la obtención de recursos económicos. También se propone que son necesarios diferentes niveles de liderazgo, siendo el cargo de director de mantenimiento una posición clave para que todo el sistema se alinee de acuerdo a los requerimientos del programa de manejo de residuos. Deberá crearse la posición de coordinador del programa de residuos solamente si ésta queda totalmente integrada dentro del esquema organizacional. Deben usarse diferentes mecanismos para promover una cultura ambiental universitaria. Estos mecanismos deberán estar orientados a la creación de un entendimiento común, creencias, asunciones y valores compartidos sobre la necesidad de cuidar el ambiente y de actuar en consecuencia.

El autor también propone la creación de un centro académico que se haga cargo de la investigación, extensión, vinculación y auditoría en aspectos ambientales como una forma alternativa para evitar muchos de los problemas enfrentados por el programa de manejo de residuos.

La aproximación sistémica usada en esta tesis plantea un marco de referencia sobre el que pueden basarse estudios futuros. Finalmente esta investigación plantea preguntas y deja espacio para interpretaciones alternativas y para la generación de otras hipótesis.

Curriculum Vitae

CAROLINA ARMIJO

Biologist graduated from the Autonomous National University of Mexico-UNAM (Universidad Nacional Autónoma de México) with a Masters Degree on Coastal Oceanography from the Autonomous University of Baja California, Mexico-UABC (Universidad Autónoma de Baja California). She enrolled the Erasmus University on 2002.

She worked as an environmental consultant for two different private environmental firms where she participated on risk assessment and environmental impact studies.

She became the founder and director of CIRIO, a non-profit organization pursuing the improvement of the standards of living of Baja California rural communities.

Since 2000 she is a full time researcher at the Engineering Institute of the UABC, where she performs her activities within the waste management line of research. She is the coordinator of different studies specially focused on waste characterization and on waste management alternatives.