

Boundaries in Action

Managing boundaries in integrative land use initiatives

Saskia van Broekhoven

Boundaries in Action

Managing boundaries in integrative land use initiatives

Grenzen in actie

Organiseren van grenzen in initiatieven voor integraal landgebruik

Proefschrift

ter verkrijging van de graad van doctor
aan de Erasmus Universiteit Rotterdam
op gezag van de rector magnificus Prof. dr. R.C.M.E. Engels
en volgens het besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op
donderdag 19 maart 2020 om 9.30 uur

door

Saskia Karin van Broekhoven

geboren te Haarlem

Promotiecommissie

Promotoren: Prof. dr. ing. G.R. Teisman
 Prof. dr. M.W. van Buuren
 Prof. dr. F.A.A. Boons

Overige leden: Prof. dr. ir. C.J.A.M. Termeer
 Prof. dr. M.A. van der Steen
 Prof. dr. J. Edelenbos

Table of Contents

1.	Introduction	7
1.1	Working together and apart to integrate land use functions in the Dakpark Rotterdam.....	7
1.2	Research background: Towards more integrative approaches for sustainable development.....	10
1.3	Problem statement: Why study boundaries in integrative initiatives?	12
1.4	Research questions	15
1.5	Research strategy and methods	16
1.6	Structure of this thesis	20
	References	22
2	Integrating functions for a sustainable urban system: A review of Multifunctional Land Use and Circular Urban Metabolism.....	27
2.1	Introduction	28
2.2	Materials and Methods	29
2.3	Introducing MLU and CUM	30
2.4	Challenges and Strategies.....	35
2.5	Conclusions and Discussion.....	44
	Appendix A: Reviewed studies.....	49
	References.....	53
3	Boundaries in action: A framework to analyse boundary actions in multifunctional land-use developments	63
3.1	Introduction	64
3.2	Boundaries in Multifunctional developments	66
3.3	How to identify boundary actions	68
3.4	Exploring boundary dynamics in the Dakpark Rotterdam case	71
3.5	Conclusions and discussion.....	81
	References.....	84
4	Managing boundaries over time in integrative planning processes: A process analysis of two cases of Multifunctional Land Use	91
4.1	Introduction	92
4.2	Conceptualising boundary management	93
4.3	Methods.....	98
4.4	Results	100

4.5	Conclusions and discussion.....	113
	Appendix A: Specification sets of boundary actions and rules to establish patterns	116
	References.....	117
5	Climate adaptation on the crossroads of multiple boundaries. Managing boundaries in a complex programme context.	123
5.1	Introduction	124
5.2	Conceptual framework	126
5.3	Methods.....	131
5.4	Results	133
5.5	Discussion and conclusions.....	143
	References.....	147
6	Conclusions	153
6.1	Introduction	153
6.2	Challenges for integrative initiatives and the perspective of managing boundaries	154
6.3	Conclusions on managing boundaries.....	157
6.4	Conclusions on realising effective integration	160
6.5	Contribution to the scientific debate	172
6.6	Policy implications.....	173
6.7	Reflections.....	176
6.8	Suggestions for further study	178
	References.....	179
	Summary	183
	Samenvatting.....	193
	Acknowledgements.....	Error! Bookmark not defined.
	About the author	203

1. Introduction

1.1 Working together and apart to integrate land use functions in the Dakpark Rotterdam

In 1998 a small group of actors in the city of Rotterdam had an innovative idea to combine two competing land use claims for a neighbourhood park and economic development on a small area of land located between a harbour and a deprived residential area. They envisioned a multifunctional plan where a public park was stacked on top of a commercial building, and adjacent to an already existing levee and underground city heating infrastructure. To realise this idea, municipal actors initiated a complex process involving residents, municipal departments, a project developer, water board, energy company and many other actors related to the various functions involved in the plan. Here we highlight one of the numerous discussions that rose over time.

In 2001, municipal actors attracted a project developer to develop the commercial building. In the previous years, residents had become closely involved in the process. Resident had exchanged ideas with municipal departments on what the park on the building should look like, and developed a vision summarised into eight 'commandments' for the design of the park. One of these commandments was that there should be one meter of soil, so that 'real' trees could grow in the roofpark. This over time became symbolic for what the park should be like for the residents: A real park with real trees, even if it was on top of a roof. These trees however presented a problem for the municipality and project developer, as their roots may damage the roofing and could cause leakage to the building below the park.

Municipality and project developer sought for ways to accommodate for the wishes of the residents, whilst at the same time looking for ways to ensure the roots of the trees would not cause damage or leakage to the building. Over the following years, many detailed discussions rose between municipal departments and with the project developer on a 'root and waterproof layer' that would be constructed between park and building. Actors had to deal with questions ranging from technical design, to finding a company able to build such a construction and an insurance company, to discussions on who would be responsible for the costs and construction of the roofing, how ownership could be arranged between public and private actors, and who would be responsible in the case there would be leakage. The issues actors struggled with are illustrated by the following quotes of municipal project managers: "The ... park on top of the building belongs to the municipality, but how do you organise that and establish that. That's just complex. And

both parties want to minimise risks. And both parties were having a romp for a long time. ... So then you are talking about a water- and rootproof layer that they would apply, but we would pay for those costs. Well, what then are the costs? But also things such as a lift, or stairs, or a fence. Yeah, whose is the fence? Because the fence belongs to the frontage [of the building] but also belongs to the park”. and “In negotiating the contract it was very difficult where you put the point of detachment. In that regard this is a unique project. A private building with a public park. ... And here you get a division in responsibilities. We have one joint insurer, so if there is leakage then we have the same insurer. But still you get of course: who pays for which layer of roofing, and what do you cause with your commercial building, and what do we as a municipality cause by wanting to develop a park?”

After many years of joint meetings and discussions, an innovative design was developed involving multiple layers of roofing. Municipality and project developer agreed on a construction where they divided public and private tasks and responsibilities in these multiple layers of roofing, working out exactly which layers of roofing belonged to the private building, and from which layer the public park and hence the municipal responsibilities and tasks started. ‘Grey areas’ that initially arose were more and more delineated in terms of cost, ownership and tasks. A project developer manager stated: “For us it was very important that the buildings were closed off with a waterproof layer. So the top of the layer is for us the boundary. The municipality has to construct the park, so for them the bottom of the park is a clear boundary. ... So then there is a small layer of insulation left where there was some discussion about: where does the insulation belong to?” Actors in this way work out divisions of tasks, costs, and ownership in detail in the physical shape of the project.

The story of the root- and waterproof layer in the Dakpark is a story about how actors can work together, and it is a story about how they make divisions when they aim to integrate functions. It is this story that led me to focus in this thesis on understanding how actors deal with boundaries when they want to realise initiatives for multifunctional land use (MLU). It fascinated me that the people I interviewed explained in great detail how they had dealt with the water- and rootproof layer in the Dakpark, and how the discussions on this layer of roofing were such an important part of their collaborative process. These discussions were about much more than finding a technical solution for a physical problem, it was about juggling different wishes and demands, about collaborating between different actor groups, and about how to divide between public and private tasks, risks and responsibilities. The water- and rootproof layer in the Dakpark became the physical interface between the public park and the private building. Having trees in the rooftop park was symbolic for residents, who had long lobbied for a ‘real’ park - not just

a grass rooftop. But the roots of the trees provided a problem as they could lead to an undesired crossing of the interface between park and building – between public and private actors. Even more fascinating, actors in the Dakpark had found a solution for dealing with these collaborative risks and tasks by creating very specific physical divisions: deciding to split the public and private ownership and responsibilities between the 7th and 8th layer of roofing. Similarly, a physical division was made in the stairs leading up to the park, and in the elevator.

In this thesis I study how actors manage boundaries when they aim to realise initiatives for MLU. The story of the water- and rootproof layer symbolizes how dealing with boundaries is a central issue for actors that work on initiatives for MLU. It shows an example of how actors bridge, discuss, and construct the boundary between public and private in their actions and interactions during the collaborative process. Initiatives for MLU involve multiple actors related to particular functions (e.g. water safety, spatial planning, recreation) and in the process to realise MLU initiatives multiple discussions on boundaries arise. This includes boundaries between sectors (e.g. water management, spatial planning, nature conservation), between governments and citizens, between groups of people, in geographical authorities and physical structures, in tasks, responsibilities, and ideas. Such boundaries can be acted upon for a long time and become well-established in the institutional system, as traces of past activities. At the same time they are often contested and constantly shaped and renegotiated, as they are viewed differently by different people, but also because they have consequences (Gieryn, 1999; Westerink, 2016). Demarcating the park as public and the building as private for example has economic and societal consequences such as the public costs for the development of the Dakpark and who can determine the design. Likewise, demarcating an area as nature area or dedicating it for water safety has consequences for who is the authority in charge and what kind of activities are legitimate. By drawing boundaries actors hence influence governance processes, demarcating who or what they do or do not consider as relevant, valid, or inside or outside a certain category (Churchman, 1970). This has important consequences for how we define problems and solutions and who is in charge of and responsible for addressing them.

Boundaries are in essence sites of difference; ways of differentiating something from what it is not (Abbott, 1995; Hernes, 2004). Differences between groups can make collaboration difficult, creating e.g. differences in how we view things and what we find important, leading to misunderstandings. At the same time, the story of the water- and rootproof layer shows that drawing boundaries can also help us understand and organise complex projects. It shows that managing boundaries is about how actors can collaborate and work together, spanning boundaries between usually separated groups, tasks and

responsibilities, as well as about how they construct and draw boundaries, and make divisions in tasks, responsibilities and objects that become overlapping and a joint responsibility when they decide to integrate functions.

1.2 Research background: Towards more integrative approaches for sustainable development

The institutional system in The Netherlands, as well as in many other Western countries, has long been dominantly organized according to the principals of bureaucracy: well divided into task units specialized and responsible for one function. In the last decennia however a movement towards more integrated approaches has taken place in order to come to a more sustainable development of our society. Water management has evolved in The Netherlands from a rather closed and technocratic issue to new approaches where water management is more and more connected with demands and issues coming from other sectors, and specifically spatial planning (van Buuren, Edelenbos, & Klijn, 2010). In order to deal with challenges posed by climate change and climate adaptation, there has been a shift in thinking about water: from battling the water to living with water (Wiering & Immink, 2006). Water has more and more become part of our living environment, rather than something that should be kept out. Water management is no longer just about water safety, but also about spatial quality, and has become an important topic in regional development processes (ibid). In spatial planning a similar change towards a more integrated approach has taken place. Whilst since the coming of industrialisation there has been a focus on separating functions for health and economic reasons and later under the influence of functionalism and zoning, more and more interest has now risen in integrated and multifunctional approaches towards planning (Priemus, Rodenburg, & Nijkamp, 2004). These approaches are seen as a solution to deal with scarcity of space and new spatial claims from climate adaptation measures, and to facilitate a more attractive and sustainable spatial development. Also in the field of nature development, where the primary focus has always been on separating functions in order to protect nature in dedicated nature areas (Natuur Netwerk in The Netherlands), interest has risen to - in addition - stimulate combining nature with other functions as a method to reach biodiversity targets. For example, in the Rijkswaterwet (2014) the Dutch government has stated it wants to stimulate synergies between nature and other societal functions such as economic development and water and energy supply. The new Environment and Planning Act (Omgevingswet) combines these developments towards more integrative approaches in a cross-sectoral policy, and requires multiple governmental actors across different sectors (including municipalities, water boards, provinces, and national government) to work in an integrative manner in order to ensure a sustainable development of the living environment.

This development towards integrated land use fits in a broader development towards more integrated governance initiatives, which often are aimed at producing a more sustainable development of society. In a recent study, the Dutch Council for the Environment and Infrastructure (Raad voor de Leefomgeving en Infrastructuur) advises the Dutch government that a more integrated, coherent and coordinated approach is needed to deal with the major policy tasks that need to be addressed in order to make the necessary transition to a more sustainable society and economy (transition of the energy system, food system, system of production and consumption, and climate and water robust water system and spatial planning (climate adaptation) (RLI, 2019). The study argues that these tasks cannot be seen separate and require an integrative approach, especially at the regional level. More generally, as such major policy tasks are interrelated and the capacity to address them is divided among multiple actors and levels of government and crosses sectoral and vertical policy boundaries, the transition towards more sustainable development calls for cross-boundary collaboration between multiple actors, levels of government, and sectors.

These developments lead to an increasing interest in and need for new and innovative approaches that integrate different social, ecological and economic functions. In this thesis I focus on initiatives for MLU. I understand MLU as the “*the implementation of more functions in a determined place in a determined period of time*” (Priemus, Nijkamp, & Dieleman, 2000). MLU provides a possible solution to deal with special scarcity and develop more sustainable measures that —by ‘stacking’ functions— simultaneously provide environmental health, economic vitality, and other social needs and exploit synergies between functions, which enables greater overall performance and more sustainable development (Lovell & Taylor, 2013; Rodenburg & Nijkamp, 2004; Selman, 2009). The idea is to combine functions that together provide something more, and more sustainable. For example community greening projects could support higher biodiversity as well as have social benefits by engaging local residents and enabling community development (Lovell & Taylor, 2013). Another example is green-blue urban infrastructures where functions as waterfronts and flood management, climate adaptation, green space, community development, economic functions and recreation are combined. The Dakpark Rotterdam, described at the start of this chapter, is an example of this. Another example is the idea of the East London Green Grid in the U.K. to develop green-blue structures that provide water buffers, develop more green areas and connect areas of urban vegetation, mitigate urban heat island effects, and enhance air quality in order to provide ecological benefits as well as improving health and social wellbeing (www.urbangreenbluegrids.com/projects/london-green-grid).

The cases of MLU which I study in this thesis take place in the context of the shift towards more integrative ways of working described above. Moreover, they take place in the context of shifting state-market-civic society relationships. Last decades we have seen the change from ‘government’ to ‘governance’, marking a change from governments addressing societal problems in a top-down manner towards approaches where governments work in collaboration with other actors (Kooiman, 2003; Rhodes, 1997). Not only have private actors become more involved through privatisation of many societal services, also civic organisations and citizens take and/or are given a larger role and responsibility in issues that were previously seen as governmental tasks, such as the care for elderly and sick relatives and nature conservation. Societal issues are now more and more addressed in networks of actors, with each their own perspective on the problems and possible solutions. Van der Steen et al. (2014) describe a shift in governance style from a form of governance extending from the government to other actors towards more involvement from other actors into governance. As a result of these developments more and more collaborative and network oriented modes of governance are used. This has several implications. It means that whereas integrative approaches were rather innovative and new at the time that the cases studied in this thesis were first started, the actors and organisations involved have since gained more experience with collaborative and integrative approaches. For instance, cross-sectoral projects and working groups are now quite normal rather than exceptions in many organisations. Nonetheless, the challenges that actors face in integrative work remain relevant, and much can be learned from studying the challenges that actors encountered and strategies that they used to work together during the planning and implementation processes of these earlier cases of MLU. It also means that to realise these current integrative and collaborative approaches, the insights developed in this thesis are highly relevant. Whilst the concept of MLU has received much attention in The Netherlands during the last decennia, it has lost in popularity in more recent years. Integrative approaches nevertheless remain high on the political agenda in The Netherlands and other Western European countries. As shown above, in The Netherlands integrative approaches are currently very relevant. Just as in MLU initiatives, actors that work on these integrative approaches will be confronted with boundaries. They will need to work across boundaries, challenge existing boundaries, deal with others that defend boundaries, and define or defend boundaries that are helpful to perform their own tasks adequately.

1.3 Problem statement: Why study boundaries in integrative initiatives?

Although its potential benefits make integration attractive and integrative initiatives often see wide support at the starting phase, their complexity ensures that only some endeavours are successful. Where modernist planning sought to eliminate potential conflicts by separating land uses, MLU in essence creates new ones by incorporating (or

even celebrating) the inherent complexity of spatial planning (Majoer, 2006). We know from previous research that such integrative initiatives are hard to achieve (O'Farrell & Anderson, 2010; Van Broekhoven & Vernay, 2018). A main challenge is that it requires involving multiple sectors and governmental, private and civic actors who need to act collectively, but who each act upon different and possibly incompatible interests, perspectives, and institutional settings (Owens & Cowell, 2011; Priemus et al., 2000; van Ark, 2006; Van Broekhoven & Vernay, 2018; Wiering & Immink, 2006). This leads to excessively lengthy processes, cost-overruns, and projects that fail to be realised.

It is therefore important to understand the underlying perspectives, interests, rules and ways of working that lead to integration challenges, as well as explore new solutions. One possible perspective to do so is to focus on how actors deal with boundaries during the integrative process. In this thesis I study integrating functions from the theoretical perspective of managing boundaries. When actors specify integration as their aim, they are confronted with boundaries. 'Integrating' already suggests there are separate entities that need to be brought together. It requires actors to work across different boundaries. At the same time, the idea of effective integration is complicated by the need or desire to construct and maintain boundaries. Although integration suggests overcoming boundaries to make whole what was separated before, we also know that boundaries have important social functions and that actors—especially formal organizations—actively construct and maintain them (Hernes, 2003; Lamont & Molnár, 2002). Moreover, research shows current practices can be deeply embedded in the structures, histories, and vested interests of sectors or organisations, and become defended, constraining the capacity to integrate (Cowell & Martin, 2003; Degeling, 1995; Derkzen, Bock, & Wiskerke, 2009). How then is effective integration possible, and what is needed for it?

There is only limited understanding of how actors deal with boundaries in initiatives for MLU and what role different ways to manage boundaries play in bringing about integration. The studies in this thesis are - to the best of our knowledge - the first to apply the perspective of boundary management to understand the challenges and strategies for integrating land use functions. Moreover, they are amongst first to study boundary management in a spatial planning context, other than geographical boundaries (Westerink, 2016). Recently, interest in boundary management in the broader context of integrative spatial planning and integrated water governance has risen, in order to study how the collaborative approaches that have emerged last decennia can be governed. Westerink (2016) has studied how boundaries are managed in the governance of spatial planning, focusing on the role of 'boundary arrangements'; meaning the tools and strategies that enable boundary actions (such as boundary objects, boundary spanners, boundary organisations). She shows that a combination of different boundary

arrangements is used in collaborative spatial planning initiatives. In her work she has applied the conceptual framework developed in chapter 3 of this thesis (first published as an article in 2015). Several studies in the field of integrative water governance and inter-sectoral policymaking have focussed on boundary spanning strategies. Several of these studies have analysed and provided insights into how boundary spanners can facilitate collaboration across boundaries (Bressers & Lulofs, 2010; Edelenbos & van Meerkerk, 2015; van Meerkerk, 2014; Warner, Lulofs, & Bressers, 2010; Williams, 2002). Other articles have analysed the role of boundary objects, finding that these can facilitate mutual understanding in order to come to collective action (Klerkx, Aarts, & Leeuwis, 2010; Opdam, Westerink, Vos, & Vries, 2015; Westerink, Opdam, van Rooij, & Steingröver, 2017). In contrast, an article by Derkzen et al. (2009) on an integrative project across the boundaries of agriculture and nature development showed how current practices are deeply embedded in the structures, histories, and vested interests of sectors or organizations, and become defended in integrative work, constraining the capacity to integrate.

Although the perspective of managing boundaries is not often applied to the context of integrating functions, boundaries have been an important research topic in other disciplines (see also Lamont and Molnar, 2001). An important source of literature on boundaries used in this thesis is the field of organisational studies and management. This body of literature studies activities to manage and span the boundaries of organisations (Ancona & Caldwell, 1992; Leifer & Delbecq, 1978; Tushman, 1977; Tushman & Scanlan, 1981; Yan & Louis, 1999), and the formation of boundaries (Abbott, 1995; Tilly, 2002). More recent studies have drawn attention to the construction and evolvement of boundaries as complex, socially constructed, and negotiated entities to understand organisational change and inter-organisational interaction (Heracleous, 2004; Hernes, 2004; Paulsen & Hernes, 2003; Santos & Eisenhardt, 2009). Additionally, studies have emphasised that boundaries have both constraining and enabling properties (Hernes, 2003). Whereas integration suggests that boundaries need to be overcome to join skills and resources, we know that boundaries also have important social functions. They enable amongst others complexity reduction, structure, and specialisation (Lamont and Molnár, 2002; Hernes, 2003). Other sources of literature are studies of boundary work at the science-policy interface, which study how scientists demarcate science from non-science to gain credibility, legitimacy, and epistemic authority for scientific work (Gieryn, 1983, 1999). The boundary here is observed as continuously contested and negotiated between scientists and others, who all look for demarcations that legitimise their actions. Boundaries have also been an important object of research in anthropology, where scholars analysed the construction of differences between groups of people, the formation of groups (i.e. the quality of boundaries to include, create groups, and generate

feelings of similarity), and formation and effects of stereotypes (Barth, 1969; Epstein, 1992). In this thesis we also draw upon studies on boundaries from the field of integrative health care, where, perhaps unexpectedly, rather similar challenges with collaboration across previously separated disciplines, groups of people, organisations and perspectives play a role as in integrating land use functions. Here we draw especially upon the work of Degeling (1995) on the stable and institutionalised nature of boundaries despite initiatives to work across them, and of Kerosuo (2006) and Mørk et al. (2012) who studied the activities of actors that work across multiple negotiated and contested boundaries in their daily practice.

In this thesis I build upon the concepts and knowledge developed in these different research fields. The discussion on the literature above shows that whilst many studies on integrative initiatives focus on - and provide valuable insights into - boundary spanning strategies, the boundaries themselves have received less attention. Studies here often predefine boundaries which are assumed to be rather static (e.g. sectoral or organisational boundaries). The literature on boundaries, especially from organisational studies, has however drawn attention to how boundaries are constructed, negotiated, and evolved or maintained when actors interact. Moreover, it has shown boundaries do not only constrain but also have enabling properties. Building upon this, the aim of this research is *to contribute to theories on effective integration by analysing where boundaries emerge and are spanned, but also are drawn, contested, defended and negotiated in integrative processes, and what kind of boundary management helps to realise integrating functions.* To do so I combine concepts and theories from the literature discussed above on the formation of boundaries, the contested and negotiated nature of boundaries, the activities of actors who deal with boundaries, and boundary spanning, and apply this to the context of integrating land use functions.

1.4 Research questions

In this thesis I address the following main research question and sub-questions:

How do actors manage boundaries in initiatives for multifunctional land use, and what kind of activities and sequences of activities are helpful to realise effective integration of land use functions?

1. *What are the challenges and strategies for realising initiatives for multifunctional land use in the wider literature concerning integration of functions?*
2. *How can boundaries and boundary management in initiatives for multifunctional land use be conceptualised and studied?*

3. *What kind of activities and sequences of activities do actors employ to manage boundaries during the process of initiatives for multifunctional land use?*
4. *What kind of activities and sequences of activities are helpful to realise effective integration of land use functions?*

Sub-questions 2-4 address how boundaries are managed and with what effects in initiatives for MLU. Before I focus on boundary management, I first explore the wider literature on integrating functions, and the challenges and strategies for realising multifunctional initiatives. I do so in order to position the role of boundary management in a broader context and explore different angles on the challenges and strategies for integrating functions. The literature review moreover enabled to better identify the research gaps and relevant other studies.

In this thesis I aim to contribute to the literature in a number of ways. I aim to contribute to our understanding of the challenges actors face and the strategies they can use when they aim to integrate land use functions for a more sustainable development by performing a literature review and by studying initiatives for MLU from the theoretical perspective of managing boundaries. I aim to contribute to the governance literature on working across boundaries and boundary spanning in the broader context of integrative initiatives for sustainable development (e.g. Bressers and Lulofs, 2010, Warner et al., 2010, Edelenbos and Van Meerkerk, 2015; Van Meerkerk, 2014) by studying how boundaries are not only spanned but also drawn, contested, defended and negotiated in integrative work. I do so based on the perspective that boundaries are complex, socially constructed, and negotiated entities, and that boundaries have both constraining and enabling effects. Moreover, I aim to contribute to the literature on integrative initiatives and the boundary literature analysing how the activities and the sequences of activities over time by which actors manage boundaries contribute to realising effective integration. So far, little is known about how managing boundaries takes place over time and changes in the course of a particular process. In addition, I aim to contribute to the boundary literature by developing a conceptualization of boundaries and a typology, based upon earlier work, which enables identifying and analysing the boundary activities of actors in their daily practices.

1.5 Research strategy and methods

Ontology and epistemology

I view boundaries as socially constructed entities. I hence assume that people actively construct social reality through their actions and interactions. I however do not take the

viewpoint that there is no reality independent of how we construct it. Instead, my view of reality and how we can understand and gain knowledge about reality is closer to critical realism: There is a real world existing independently of our interpretation. But people also make interpretations about this reality and act upon these interpretations, thereby actively constructing social reality. We can only understand this reality from our own perspective, which is shaped by our historical, social and cultural context (Maxwell, 2013). Different people can understand the same reality in different ways.

Qualitative research

To answer the research questions this thesis follows a qualitative research approach. As I aim to understand how people construct, span, defend and negotiate boundaries through their actions and interactions in integrating functions, research methods are required that enable capturing this process of social construction. Qualitative research methods suit this goal. These methods, such as case study research, semi-structured interviews, and observations, can produce rich, descriptive data and enable an in-depth understanding of social processes, developed in contact with the people involved to understand what is going on in the field (Boeije, 2009).

Case study research and selection

To explore how actors manage boundaries and study in-depth the micro-interactions of actors in initiatives for MLU I conduct case study research of three cases. Yin (2009, p. 18) defines a case study as: “*an empirical inquiry that investigates a contemporary phenomenon in-depth and within its real-life context*”. A case study is the most suitable method for this research as it allows us to study managing boundaries in integrating functions in-depth, while it is ongoing, and taking in account relevant contextual factors. I choose a research design with multiple cases, because this makes the empirical basis for the research stronger than a single case study approach. The research is limited to three cases because the gathering of data and in-depth analysis of case studies is time-consuming. In this thesis, a conceptual framework is constructed (chapter 3) that is based on theoretical insights on managing boundaries and on the challenges and strategies for integrating functions. This conceptual framework is applied in the three cases (chapters 3, 4, 5).

As this thesis concerns initiatives for multifunctional land use in The Netherlands, the selected cases must obviously be such initiatives. However, there are multiple and diverse initiatives for multifunctional land use. As I study only a limited number of cases, the three cases Dakpark Rotterdam, Westduinpark and Deltaplan Hoge Zandgronden, were selected following the principle of maximization, i.e. choosing a situation where the process of interest manifests itself most strongly and is ‘transparently observable’

(Boeije, 2009; Pettigrew, 1990). In the selected cases actors integrate several functions, one of which is water management. Given the important historical role and position of flood protection and water management in The Netherlands, this provides a socially relevant setting where boundaries as traces of past activities can be expected to be strongly present. Additionally, the cases represent two different types of MLU initiatives. The Dakpark and Westduinpark cases can be classified as concrete multifunctional ‘projects’, that take place on a defined area of land. The DHZ case is not such a concrete multifunctional project, but a collaborative regional programme on the nexus of water and spatial planning, where actors aim to develop an integrative regional approach for climate robust water supply and spatial planning including multiple policy levels, sectors, and public, private and societal actors. Recently, more and more integrative initiatives take a programmatic approach to realise more integrated and sustainable regional development. A well-studied example of this is the Room for the River programme that integrates flood management and ecologic aims. I choose to select the DHZ programme in addition to the ‘project’ cases, as I am interested in whether such programmatic approaches require a different type of boundary management than project approaches. Furthermore, the cases were selected on that they had been ongoing for a longer period of time, thus providing ample opportunity to study the emergence and dynamics of boundaries over time. The two project cases were at the last stages of implementation at the time they were studied. The programme case was in the design phase. Choosing cases that were ongoing moreover allowed to study boundary management in action through non-participatory observations. Lastly, the cases were selected on the ability to properly collect data. In this thesis we make use of interviews, document analysis, non-participatory observations and workshops. These data collection methods require that the researcher is allowed to study the project closely, by observing meetings and retrieving relevant data including possibly confident data such as minutes of meetings. Support from the actors in the cases for this type of data gathering is hence required. I was able to access data and participate closely in each of the cases. However, whilst already in the process of collecting the data for the Dakpark, actors of one organization (the Waterboard) expressed that they did not want to participate in the research. I therefore needed to analyse the case based on (the great amount of) data retrieved through the other participants. Nonetheless, as I have retrieved information about the process by different means and from a multitude of different sources (interviewing actors from different organizations, analysing a large variety of documents (including an evaluation of the project by the actors themselves), informal talks with different actors including the water board, observations of project group meetings) and organized a workshop where I presented my interpretation of the process to the involved actors, I am confident I have reconstructed and analysed the integrative process thoroughly and from different perspectives.

Process analysis

To study how actors manage boundaries over time in integrative processes I conduct a longitudinal analysis of the three cases. The process analysis requires constructing the narrative how the process evolved (Abell, 2004; Langley, 1999; Sminia, 2009). The decision-making and implementation process of the three cases is reconstructed and analysed, focusing on boundary actions and sequences of boundary actions.

Data collection and analysis

Data is gathered by: (a) semi-structured interviews with actors of different organisations; (b) document analysis (e.g. minutes of projects groups and steering groups, minutes of meetings of local authorities, project documents such as project proposals, strategy documents, design plans, news articles, formal objections of visions of actors upon the project); (c) non-participatory observation of actors' interaction (e.g. project groups, steering groups, meetings between actors, symposia, workshops and information evenings organised by the actors in the cases); and (d) workshops with stakeholders. Documents were collected through respondents and websites of involved organizations, interviews were transcribed. To identify boundary actions over time, a chronological database is developed by selecting from each interview, document and observation, articulations of incidents that indicate the activation, contestation or crossing of a boundary. This is an interpretive act of the researchers. These actions were then coded with the aim to identify occurrences of different types of boundary actions (further specified in chapter 3). The chronological database consists of 197 boundary actions in Dakpark, 55 in Westduinpark, and 88 in the Deltaprogramme Hoge Zandgronden. In addition to the case studies, in chapter 2 a structured literature review is conducted.

Validity

Using multiple data sources reduces the risk of distortions in post-factual accounts and increases internal validity. Moreover, for two cases a workshop was organized with the main stakeholders, end of 2014. In the workshops the process reconstruction and analysis were presented, discussed, and validated with the participants. However, our database obviously doesn't represent all boundary actions that occurred. Reconstructing all actions that happened over time is not humanly possible or desirable. Given our method of data collection we assume that we have captured at least the most significant boundary actions; also, there is no a priori reason to suppose our method biases a particular type of action

Generalisability

Case study research is context dependent. Chapter 5 studies how context matters in the case of the Deltaplan Hoge Zandgronden, and explicates that contextual factors influence

how actors manage boundaries and how well integration succeeds. Moreover, as I selected cases that were at a late stage of implementation, the findings need to be seen in the context of the time when these initiatives took place. Nevertheless, such research can still lead to insights that are more generally relevant. The generalisability of the findings is strengthened by comparing the empirical finding to the literature. In chapter 4 I explicitly do so with an approach for process analysis that matches the sequence of boundary actions found in the cases to sequences identified in the literature. This approach enables a systematic comparison of the empirical process with theoretical expectations, and of multiple empirical processes with each other. It thereby enables explicating how specific or more generally identified these patterns are.

1.6 Structure of this thesis

In the following chapters I address the research questions. Table 1.1 presents which chapter addresses which research questions.

	Chapter 2	Chapter 3	Chapter 4	Chapter 5
RQ1) What are the challenges and strategies for realising initiatives for multifunctional land use in the wider literature concerning integrating functions?	x			
RQ2) How can boundary management in initiatives for multifunctional land use be conceptualised and studied?		x		
RQ3) What kind of activities and sequences of activities do actors employ to manage boundaries during the process of initiatives for multifunctional land use?		x	x	x
RQ4) What kind of activities and sequences of activities are helpful to realise effective integration of land use functions?			x	x

Table 1.1 Research questions addressed per chapter

Chapter 2 presents a literature review of the challenges and strategies for integrating functions. This chapter reviews and brings together existing literature on the development of integration of functions, focusing on two integrative approaches; multifunctional land use and circular urban metabolism. Both approaches are important new directions to bring about urban sustainability through integration of functions. I choose to review

literature on both approaches, rather than only for multifunctional land use, as both share many similarities and this enables bringing together insight on challenges and strategies developed in both research fields, developing a more generalized understanding of underlying factors, and facilitating knowledge exchange between both research communities. I focussed in this literature review on the urban context, in order to deal with time constraints and focus the review.

A conceptual framework for identifying and analysing boundaries in integrative processes is presented in Chapter 3. This framework is based on concepts and theories from previous literature on the formation of boundaries, the contested and negotiated nature of boundaries, the activities of actors who deal with boundaries, and boundary spanning. This framework is applied for the empirical analysis of the three cases. Chapter 3 furthermore presents the application of the framework to analyse how actors manage boundaries in the Dakpark case, focussed on two sets of boundary actions: a public park on a private building, and combining the development and the existing levee.

Chapter 4 further applies the framework to analyse how actors manage boundaries *over time*, i.e. how they challenge, span, defend and construct boundaries during integrative processes, and what sequences of boundary actions help to realise effective integration of functions. It does so by a longitudinal analysis of the cases Westduinpark and Dakpark. More specifically, this chapter analyses temporal sequences of boundary actions using an approach for process analysis that compares empirical processes to theoretical expectations.

Chapter 5 analyses actors' boundary actions in the context of a complex programme on the nexus of water and spatial planning, and what this tells about the kind of boundary management that helps to realise integration in programme management approaches. It furthermore adds the impact of context on the boundary actions actors perform to the analysis. This chapter presents the empirical analysis of the case Deltaplan Hoge Zandgronden. It focusses on two integration attempts within the case: one which has anchored relatively well and one which has not yet succeeded. This enables me to explore why boundary management at the one integration attempt was more successful than at the other and what contextual factors shaped boundary management.

Chapter 6 combines the insights from the previous chapters, discusses the findings, and presents the conclusions of this thesis. I also reflect on the contribution to the scientific debate, the research theory and methods, and make recommendations for further study.

Chapter 2 on the literature review, chapter 3 on the conceptual framework and the case Dakpark Rotterdam, and chapter 5 on managing boundaries in a complex programme context and the case Deltaplan Hoge Zandgronden have been published in scientific journals. Chapter 4 is under review at a scientific journal.

References

- Abbott, A. (1995). Things of boundaries. *Social Research*, 62(4), 857–882.
- Abell, P. (2004). Narrative Explanation: An Alternative to Variable-Centered Explanation? *Annual Review of Sociology*, 30(1), 287–310. <https://doi.org/10.1146/annurev.soc.29.010202.100113>
- Ancona, D. G., & Caldwell, D. F. (1992). Bridging the Boundary: External Activity and Performance in Organizational Teams. *Administrative Science Quarterly*, 37(4), 634–665. <https://doi.org/10.2307/2393475>
- Barth, F. (1969). *Ethnic groups and boundaries: the social organization of culture difference*. Boston: Little, Brown.
- Boeije, H. R. (2009). *Analysis in Qualitative Research*. SAGE.
- Bressers, H., & Lulofs, K. (2010). *Governance and Complexity in Water Management: Creating Cooperation Through Boundary Spanning Strategies*. Edward Elgar Publishing.
- Cowell, R., & Martin, S. (2003). The joy of joining up: modes of integrating the local government modernisation agenda. *Environment and Planning C*, 21(2), 159–180.
- Degeling, P. (1995). The significance of ‘sectors’ in calls for public health intersectoralism: an Australian perspective. *Policy & Politics*, 23(4), 289–301.
- Derkzen, P., Bock, B. B., & Wiskerke, J. S. C. (2009). Integrated Rural Policy in Context: A Case Study on the Meaning of ‘Integration’ and the Politics of ‘Sectoring.’ *Journal of Environmental Policy & Planning*, 11(2), 143–163. <https://doi.org/10.1080/15239080902920126>
- Edelenbos, J., & van Meerkerk, I. (2015). Connective capacity in water governance practices: The meaning of trust and boundary spanning for integrated performance. *Current Opinion in Environmental Sustainability*, 12, 25–29. <https://doi.org/10.1016/j.cosust.2014.08.009>
- Epstein, C. F. (1992). Tinkerbells and Pinups: The Construction and Reconstruction of Gender Boundaries at Work. In *Cultivating differences: Symbolic boundaries and the making of inequality* (pp. 232–256).
- Gieryn, T. F. (1983). Boundary-Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Scientists. *American Sociological Review*, 48(6), 781–795. <https://doi.org/10.2307/2095325>
- Gieryn, T. F. (1999). *Cultural Boundaries of Science: Credibility on the Line*. University of Chicago Press.

- Heracleous, L. (2004). Boundaries in the study of organization. *Human Relations*, 57(1), 95–103.
- Hernes, T. (2003). Enabling and constraining properties of organizational boundaries. In *Managing boundaries in organizations: Multiple perspectives* (pp. 35–55). Hampshire: Palgrave Macmillan.
- Hernes, T. (2004). Studying Composite Boundaries: A Framework of Analysis. *Human Relations*, 57(1), 9–29. <https://doi.org/10.1177/0018726704042712>
- Kerosuo, H. (2006). *Boundaries in action. An Activity-theoretical Study of Development, Learning and Change in Health Care for Patients with Multiple and Chronic Illnesses*. Helsinki University Press, Helsinki.
- Klerkx, L., Aarts, N., & Leeuwis, C. (2010). Adaptive management in agricultural innovation systems: The interactions between innovation networks and their environment. *Agricultural Systems*, 103(6), 390–400.
- Kooiman, J. (2003). *Governing as Governance*. SAGE Publications.
- Lamont, M., & Molnár, V. (2002). The Study of Boundaries Across the Social Sciences. *Annual Review of Sociology*, 28.
- Langley, A. (1999). Strategies for Theorizing from Process Data. *The Academy of Management Review*, 24(4), 691–710. <https://doi.org/10.2307/259349>
- Leifer, R., & Delbecq, A. (1978). Organizational/Environmental Interchange: A Model of Boundary Spanning Activity. *The Academy of Management Review*, 3(1), 40–50. <https://doi.org/10.2307/257575>
- Lovell, S. T., & Taylor, J. R. (2013). Supplying urban ecosystem services through multifunctional green infrastructure in the United States. *Landscape Ecology*, 28(8), 1447–1463. <https://doi.org/10.1007/s10980-013-9912-y>
- Majoor, S. (2006). Conditions for multiple land use in large-scale urban projects. *Journal of Housing and the Built Environment*, 21(1), 15–32.
- Maxwell, J. A. (2013). *Qualitative Research Design: An Interactive Approach: An Interactive Approach*. SAGE.
- Ministerie van Economische Zaken. (2014). *Natuurlijk verder. Rijksnatuurvisie 2014*.
- Mørk, B. E., Hoholm, T., Maaninen-Olsson, E., & Aanestad, M. (2012). Changing Practice Through Boundary Organizing: A Case from Medical R&D. *Human Relations*, 65(2), 263–288. <https://doi.org/10.1177/0018726711429192>
- O’Farrell, P. J., & Anderson, P. M. L. (2010). Sustainable multifunctional landscapes: a review to implementation. *Current Opinion in Environmental Sustainability*, 2(1–2), 59–65.
- Opdam, P., Westerink, J., Vos, C., & Vries, B. de. (2015). The role and evolution of boundary concepts in transdisciplinary landscape planning. *Planning Theory & Practice*, 16(1), 63–78. <https://doi.org/10.1080/14649357.2014.997786>

- Owens, S., & Cowell, R. (2011). *Land and limits: interpreting sustainability in the planning process* (second edition). London; New York: Routledge.
- Paulsen, N., & Hernes, T. (2003). *Managing boundaries in organizations: Multiple perspectives*. 1–311.
- Pettigrew, A. M. (1990). Longitudinal Field Research on Change: Theory and Practice. *Organization Science*, 1(3), 267–292. <https://doi.org/10.1287/orsc.1.3.267>
- Priemus, H., Nijkamp, P., & Dieleman, F. M. (2000). *Meervoudig ruimtegebruik; stimulansen en belemmeringen*. Delft: Delft University Press.
- Priemus, H., Rodenburg, C. A., & Nijkamp, P. (2004). Multifunctional urban land use: A new phenomenon? A new planning challenge? *Built Environment*, 30(4), 269–273.
- Rhodes, R. A. W. (1997). *Understanding governance: policy networks, governance, reflexivity and accountability*. Buckingham: Open University Press.
- RLI. (2019). *De som der delen. Verkenning samenvallende opgaven in de regio*.
- Rodenburg, C. A., & Nijkamp, P. (2004). Multifunctional land use in the city: a typological overview. *Built Environment*, 30(4), 274–288.
- Santos, F. M., & Eisenhardt, K. M. (2009). Constructing Markets and Shaping Boundaries: Entrepreneurial Power in Nascent Fields. *Academy of Management Journal*, 52(4), 643–671. <https://doi.org/10.5465/AMJ.2009.43669892>
- Selman, P. (2009). Planning for landscape multifunctionality. *Sustainability: Science, Practice, & Policy*, 5(2), 45–52.
- Sminia, H. (2009). Process research in strategy formation: Theory, methodology and relevance. *International Journal of Management Reviews*, 11(1), 97–125. <https://doi.org/10.1111/j.1468-2370.2008.00253.x>
- Tilly. (2002). *Stories, Identities, and Political Change*. Rowman & Littlefield.
- Tushman, M. L. (1977). Special Boundary Roles in the Innovation Process. *Administrative Science Quarterly*, 22(4), 587–605. <https://doi.org/10.2307/2392402>
- Tushman, M. L., & Scanlan, T. J. (1981). Boundary Spanning Individuals: Their Role in Information Transfer and Their Antecedents. *The Academy of Management Journal*, 24(2), 289–305. <https://doi.org/10.2307/255842>
- van Ark, R. (2006). Meervoudig ruimtegebruik: dogma of eye-opener? In *Meervoudig ruimtegebruik, enkelvoudig recht: de spanningsvolle relatie tussen recht en innovatie* (pp. 11–22). Delft: Eburon.
- Van Broekhoven, S., & Vernay, A. L. (2018). Integrating Functions for a Sustainable Urban System: A Review of Multifunctional Land Use and Circular Urban Metabolism. *Sustainability*, 10(6), 1875. <https://doi.org/10.3390/su10061875>

- van Buuren, A., Edelenbos, J., & Klijn, E. H. (2010). *Gebiedsontwikkeling in woelig water: over water governance bewegend tussen adaptief waterbeheer en ruimtelijke besluitvorming*. Den Haag: Boom Lemma uitgevers.
- van der Steen, M., Hajer, M., Scherpenisse, J., van Gerwen, O. J., & Kruitwagen, S. (2014). *Leren door doen: Overheidsparticipatie in een energieke samenleving*.
- van Meerkerk, I. (2014). *Boundary Spanning in Governance Networks: A study about the role of boundary spanners and their effects on democratic throughput legitimacy and performance of governance networks*. Erasmus University Rotterdam, Rotterdam.
- Warner, J., Lulofs, K., & Bressers, H. (2010). The fine art of boundary spanning: Making space for water in the east Netherlands. *Water Alternatives*, 3(1), 137–153.
- Westerink, J. (2016). *Making a Difference: Boundary Management in Spatial Governance*. Wageningen University, Wageningen.
- Westerink, J., Opdam, P., van Rooij, S., & Steingröver, E. (2017). Landscape services as boundary concept in landscape governance: Building social capital in collaboration and adapting the landscape. *Land Use Policy*, 60, 408–418. <https://doi.org/10.1016/j.landusepol.2016.11.006>
- Wiering, M., & Immink, I. (2006). When water management meets spatial planning: a policy-arrangements perspective. *Environment and Planning C: Government and Policy*, 24(3), 423 – 438. <https://doi.org/10.1068/c0417j>
- Williams, P. (2002). The Competent Boundary Spanner. *Public Administration*, 80(1), 103–124. <https://doi.org/10.1111/1467-9299.00296>
- Yan, A., & Louis, M. (1999). The Migration of Organizational Functions to the Work Unit Level: Buffering, Spanning, and Bringing Up Boundaries. *Human Relations*, 52(1), 25–47. <https://doi.org/10.1023/A:1016968332082>
- Yin, R. K. (2009). *Case Study Research: Design and Methods*. Sage Publications.

2 Integrating functions for a sustainable urban system: A review of Multifunctional Land Use and Circular Urban Metabolism

Van Broekhoven, S.; Vernay, A.L. (2018) Integrating Functions for a Sustainable Urban System: A Review of Multifunctional Land Use and Circular Urban Metabolism. *Sustainability*, 10, 1875. <https://doi.org/10.3390/su10061875>

Abstract:

Cities pose environmental challenges but also offer possibilities to close material and energy loops and connect multiple societal and ecologic services. This article reviews and brings together the literature on two important new research directions that address urban sustainability by integrating functions or material flows: Circular Urban Metabolism (CUM) and Multifunctional Land Use (MLU). We focus on challenges to MLU and CUM and strategies to facilitate their realisation. The review shows that although MLU and CUM differ in what they integrate, they face partly similar integration challenges. In both fields, the collaboration between actors related to particular functions (water safety, recreation), high investment costs and uncertainties about costs and benefits, and legislation that hampers integration are identified as challenges. In both fields, strategies are proposed to facilitate the collaboration between actors. However, other challenges and strategies are specific. Whilst MLU scholars mostly highlight socio-economic aspects of realising integration, CUM scholars focus more on technical aspects. We find limited cross-fertilization between both fields so far. To stimulate discussion and knowledge exchange, we introduce ‘integration of urban functions’ as a shared idea for a sustainable urban system. To find further solutions for integration challenges, we propose conceptualizing MLU or CUM initiatives as processes of change, which requires connecting across previously separate ‘worlds’ and changing previously established monofunctional ways of working.

2.1 Introduction

Cities have an important role to play in tackling environmental issues. They are a source of environmental problems and are vulnerable to unpredictable future challenges, such as climate change, food insecurity, and limited resources [1,2]. At the same time, they can be seen as hotspots for solutions and possibilities to close material and energy loops and to connect multiple societal and ecological services [1–3]. In the past few years, measures that integrate different social, ecological, and economic functions have increasingly raised the interest of scholars and practitioners concerned with urban sustainability [4–7]. Examples are using household waste to produce heat to supply dwellings with district heating and realising multifunctional urban squares which are used for recreation but can serve as water retention areas in times of high precipitation. By integrating functions, multiple ecological and socio-economical services can be provided simultaneously and synergies can be developed, which enables greater overall performance and more sustainable development [2,6,8–10]. However, whilst supported by many, their organizational and technological complexity ensures that many of such integrated measures fail to be realised [11,12]. What then are the challenges faced when integrating functions, and what are strategies that can help facilitate these important new directions to bring about urban sustainability?

In this paper, we review and bring together existing literature on the development of integration of functions, focusing on two integrative approaches; namely, multifunctional land use (MLU) and circular urban metabolism (CUM). Both MLU and CUM are important new directions to bring about urban sustainability through integration of functions. MLU is about integrating various land use functions in a determined area and time period [6,13]. CUM is about creating local cycles of material and energy in order to decrease the environmental burden of existing urban areas [14,15]. These are not the only integrative approaches; they complement other concepts that address the idea of mixing urban functions and flows, such as mixed land use, compact city, and low carbon city. MLU and CUM are, however, specifically interesting to focus on if we want to study the specificities and challenges of integrating functions. Firstly, both approaches have as their core ambition the integration of (physical) functions. In contrast, concepts such as compact city and low carbon city are broader; they, respectively, are about designing cities to have high density, and—besides integrating material flows—the promotion of soft modes of transportation and efficient building. Moreover, MLU and CUM do not just aim to integrate but also aim to address urban sustainability by creating synergies between previously separated functions [6,16,17]. Secondly, despite these similarities, MLU and CUM have so far been studied by separate research communities. Research on both developed independently to one another and there has been very little cross-fertilization. Whilst research has been done on the barriers faced by both MLU and CUM

and to develop tools or strategies to overcome them, at present an overview of integration challenges and strategies that facilitate integration spanning across both research communities is missing. MLU and CUM share many similarities and scholars can build on each other's work. For example, both concepts connect previously separated socio-technical worlds, involving besides synergies also a variety of social and technical coordination challenges. It requires coordinated activities between actors (individuals and organizations), related to particular functions, with possibly conflicting perceptions and interests, who have to manage a great deal of legal, economic, and technical requirements and objectives.

The literature review was conducted with two objectives in mind. The first objective is to provide an overview of the academic research efforts into MLU and CUM and bring both fields together. We want to know to what extent and what types of integrations are studied in MLU and CUM, how, and with what perspectives. The second objective is to bring together insights on the challenges to and strategies for integrating functions and see to what extent they concur or differ in order to develop a more generalized understanding of underlying factors and facilitate knowledge exchange.

2.2 Materials and Methods

The literature was first searched using the scientific databases of Scopus and Web of Science. For MLU, we used as search tags “multifunctional land use” and “multifunctional landscapes” combined with urban/city/cities. This resulted in a total of 161 papers. For CUM, a search for “circular urban metabolism” only resulted in two papers. Even though the concept is widely used by practitioners and institutional bodies (see for instance [18–22]) when talking about best practices in sustainable urban development, scholars prefer using more specific concepts, such as sustainable implant, zero-waste, self-reliant city, urban harvest, cyclic design, city as ecosystem, circular urban systems, or territorial ecology. These reflect the specific aims of the paper which may be to close cycles locally, harvest local resources, decrease the dependency on an external resource, or minimize waste. To broaden the results, we searched for “urban metabolism” combined with other terms that embody the notion of circularity: “industrial ecology”, “closing cycles/loops”, “closed cycles/loops”, and “zero waste”, leading to 66 additional papers. We further completed the literature search using Google Scholar with similar search tags. Due to a high number of results for MLU, we here combined the search tags with words similar to “challenge” and “strategy” to aid finding relevant studies. We assessed those studies that appeared in the first 10 pages of the results.

To refine the search results, we scanned the titles and abstracts of the articles using the following criteria: Firstly, we selected papers that matched with our focus on the urban

context. We excluded studies that focus on non-urban (e.g., agricultural, rural) applications. Studies analyzing CUM or MLU conceptually without making a distinction between urban or rural applications were included. Secondly, to provide insight for our research question we required that the studies addressed drivers, challenges, and/or strategies for bringing about CUM and MLU. We omitted those that only mention MLU or CUM (e.g., as a possible strategy) but do not analyse it conceptually or empirically as well as studies that only discuss impacts of measures (e.g., impacts on sustainability). Thirdly, only peer-reviewed articles and books or book chapters were included. Fourthly, the literature search on CUM resulted in multiple articles that study “urban metabolism” but that do not specify creating circular urban metabolism or closing cycles. However, some of these papers do position analysing urban metabolism as a strategy for optimizing a city’s metabolism, and are referred to as a strategy for CUM by other studies. We included these studies if they were cited at least twice by articles that met all our selection criteria. The selection was further completed by checking reference lists from selected articles for further useful references and checking articles that cite the selected articles. The above approach resulted in 30 studies on MLU and 23 on CUM being selected (see Appendix A).

2.3 Introducing MLU and CUM

2.3.1 *Introducing Multifunctional Land Use*

Multifunctional land use refers to “*the implementation of more functions in a determined place in a determined period of time*” [23]. Whilst multifunctional use of urban space is perhaps as old as cities themselves, functions such as housing, work, infrastructure, and nature became separated in space (e.g., housing and working) and time (working hours) in many European and North-American cities with the coming of industrialization—for health or economic reasons—and later under the influence of functionalism and zoning [24,25]. Jane Jacobs [26] first criticized this monofunctional approach, arguing that compact mixed urban areas are more economically viable, safer, socially stable, and culturally and aesthetically interesting than monofunctional suburbs. In the past few decades, this idea has reappeared in planning literature, now adding that by mixing functions less space is needed and that it will require less traffic [9]. In the planning literature, it is associated with high density and has inspired various concepts, including compact city (designing cities to have high density), smart growth (concentrating growth in high density, walkable, bicycle-friendly areas), and mixed land use (combining uses, e.g., residential, commercial, and working). More recently, the concept of MLU has arisen in Dutch spatial planning especially. There is some discussion on the question of what is (not) MLU. MLU is generally understood to differ from other mixed and dense land use concepts by a focus on creating synergies between functions and promotion of a

sustainable form of land use more than sharing physical space [6,17,24]. Moreover, scholars have argued that whether an area is multifunctional depends on how the area and time frame is defined. Rodenburg and Nijkamp [9] propose that the concept is best understood as relative-not-binary and defining a degree of multifunctionality rather than demarcating between mono- and multifunctional land use: *“a land use pattern is said to become more multifunctional when, in the area considered, the number of functions, the degree of interweaving, or the spatial heterogeneity increases”*.

Multifunctionality has also gained attention in landscape ecology with the notion of multifunctional landscapes (the promotion of multiple economic, ecological, and social land use functions on the same land simultaneously and to mutual benefit [6]) and in agro-economics (describing agricultural diversification). The notion of multifunctional landscapes has been mostly applied to agricultural systems, but has more recently been also applied to the urban (eco)system, e.g., green-blue infrastructures and urban agriculture. For readability, we refer to both concepts as MLU.

MLU is now seen as a solution to deal with multiple challenges cities face and develop sustainable measures that—by ‘stacking’ functions—simultaneously support environmental health, economic vitality, and other social needs and exploit synergies between functions [2,6,9]. The idea is to combine functions that together provide something more and are more sustainable. For example, community greening projects could support higher biodiversity as well as have social benefits by engaging local residents and enabling community development. Another example is green-blue urban infrastructures where functions, such as waterfronts and flood management, climate adaptation, green space, community development, economic functions, and recreation, are combined. This is, for example, applied in the Dakpark Rotterdam in The Netherlands where a large public park is built on the roof of a commercial center and over a water defense structure, providing green space, community development, and employment in a deprived and dense urban area [27,28]. Another example is the idea of the East London Green Grid in the U.K. to develop green-blue structures that provide water buffers, develop more green areas and connect areas of urban vegetation, mitigate urban heat island effects, and enhance air quality in order to provide ecological benefits as well as improving health and social wellbeing [29]. Although MLU is hence about creating win-win solutions, combining functions can also lead to (unexpected) adverse effects. It often requires making some compromises towards achieving goals that one might have when thinking from the perspective of only one function, [65,66], and not all functions combine well with each other. In the Dakpark, for example, realising other functions very close to the water defense structure led to many discussions on how water safety could be guaranteed (see e.g., [28]).

2.3.2 Introducing Circular Urban Metabolism

Circular urban metabolism (CUM) refers to a situation where cities' outputs are used as inputs in the production system (see also [15]). In this context, the term urban metabolism refers to the “*sum total of the technical and socioeconomic processes that occur in cities, resulting in growth, production of energy, and elimination of waste*” [30]. It was coined by the American engineer Abel Wolman [31] (1965) in his pioneering book “The metabolism of cities”. Responding to growing concerns regarding air and water pollution, he quantified the in and out flows of energy, water, and material of a hypothetical city and showed the connection between goods consumption and waste generation [32]. Building upon his work, Girardet [14] highlighted the fundamental differences between linear and circular urban metabolism. A linear urban metabolism refers to situations where no links are made between inputs of resources and outputs of waste. Many scholars argue that the environmental burden of cities comes from the fact that they have a linear metabolism [3,33,34]. Cities did not always function in that way. They have long been considered as places where resources could be harvested for industrial and agricultural processes. This changed by the end of the 19th century, when the notion of urban waste and wastewater emerged and centralized solutions were developed to dispose of this waste [35].

The central idea of CUM is that by closing loops urban areas can be developed with less environmental impact and more in balance with the natural ecosystem upon which they depend as the use of materials and production of waste is reduced [36]. CUM conceptualizes the city itself as an ecosystem where the cyclical nature of natural ecosystems should be reproduced [10]. This conceptualization closely relates to the research field of Industrial Ecology, where scientists draw inspiration from ecosystems for how to create more sustainable industrial systems and transform industrial processes from linear to closed-loop systems where wastes can become inputs for new processes [37]. Recently, CUM has raised much interest in this research community [4]. The idea of CUM is also found in related concepts, such as eco-city, low-carbon city, or smart city. However, CUM is something more specific than these adjacent fields and concepts; it concerns initiatives that integrate material and energy inputs and outputs that belong to different user functions (e.g., heating, food consumption or production, cooking, cleaning) to create local cycles of material and energy in order to decrease the environmental burden of existing urban areas. In these related concepts, CUM is one of the solutions to decrease the environmental burden of cities along with non-integrative solutions, such as the promotion of soft means of transportation, of energy efficient buildings, or the use of information and communication technology to optimize urban infrastructure. An example of CUM is using organic waste to produce biogas and compost through anaerobic digestion, which has, for example, been applied in Lille

Metropole in order to integrate waste, transport, and energy systems [38]. Another application is Hammarby Sjöstad, a district in Stockholm, where CUM was used as the guiding principle in its development. Here, various forms of municipal waste (sewage, organic waste, municipal solid waste) are used as an energy source to produce district heating, district cooling, and biogas for cooking and for transportation [39]. Similarly, the Geneva Region uses CUM as a guiding principle for regional development. They, for instance, initiated a project aiming at reusing or recycling demolition waste in order to minimize the use of natural gravel [40]. Similar to MLU, although we here point out the advantages of closing loops, it may also lead to (unexpected) adverse effects.

2.3.3 General Observations on the Literature

Most studies on CUM and MLU have been published in environment- and planning-oriented journals (see Appendix A). The reviewed articles on MLU were mostly published in journals related to landscape ecology and planning whilst the articles on CUM cluster around the themes of urban technology, urban planning, and industrial ecology. Surprising is that most publications are relatively recent (mainly since 2004), even though both approaches have been around for a few decades. There is especially an increase in the number of publications about CUM since 2007, and since 2009 in publications on multifunctionality in the urban system in landscape-ecology-related journals.

Many of the reviewed articles concern cases in The Netherlands followed by the U.K.. In both countries, MLU and CUM have gained much interest from policymakers (see [6,41]). More generally, most empirical studies take place in North America and Western Europe.

CUM and MLU are both well-recognized as important innovative directions to bring about urban sustainability. The motives for and expected benefits of both are rather similar. Environmental considerations are a main motive. CUM is seen as a way to minimize cities' ecological footprint [14]. MLU is seen as a solution to develop a more sustainable form of land use by combining ecologic and socio-economic aims. Furthermore, MLU and CUM are seen as a way to make cities more self-reliant [14,42], e.g., enabling urban food security [43–45] or improving water management [46,47], thereby building their capacity to adapt to challenges such as climate change and resource scarcity (e.g., [2,36,48,49]). Both CUM and MLU are also presented as ways to improve spatial planning (e.g., [16,23]) and livability in urban areas [26,45,50]. For MLU, an important driver is pressure on space [9,23,48]. Economic considerations also play a role. For CUM, scholars mention creating jobs and boosting the local economy [21,51]. For MLU, scholars argue that multifunctionality can enable the realisation of projects that in

isolation cannot be achieved due to insufficient resources by coupling public projects costing money (e.g., redevelopment of obsolete industrial sites or neighbourhoods, green structures) with private projects promising benefits (e.g., housing, offices) [52,53]. Moreover, broader public support may be built when multiple stakeholders related to particular functions share support for a MLU development [48,54]. Finally, CUM and MLU are seen as ways to reconnect communities with their surrounding environment [6,54,55], e.g., reconnecting food production and consumption with restaurants using products from their own rooftop farm [45].

Regarding MLU, noticeable is that there is little referencing across studies from the planning and landscape ecology fields. Moreover, scholars working in both fields use different (though clearly related) concepts (see Appendix A column 6).

2.3.4 Types of Integration Studied

The reviewed articles show a variety of multifunctional and circular strategies designed in different forms and applied at different scales. MLU and CUM are studied in different fields, focus on different things they integrate and scales on which to do so, and involve different lines of thought.

MLU aims to integrate land use functions onto the same space, and focusses on physical space. Two categories can be distinguished: Firstly, some studies focus on the integration of socio-economic functions, e.g., combining shops, transport infrastructure, housing, and amenities. Secondly, many studies focus on integrating ecological and socio-cultural objectives in urban areas, often referring to the provision of multiple ecosystem services. Here, strategies (some strategies represent larger research topics, e.g., green infrastructure. Here, we do not discuss such research topics in-depth, but discuss strategies for as far as authors position it as MLU) include multifunctional green infrastructures (e.g., combining green areas with recreation and community development [2,28,5756], combining urban water management with ecological and socio-cultural functions [46,47,5857], and multiple ecosystem services provided by urban forestry [44]). Another strategy is multifunctional urban agriculture, e.g., food production on buildings, such as rooftop farms, rooftop greenhouses, and indoor farming [43,45]. More conceptually, authors discuss the integration of human and natural elements of the landscape [54,5958].

Rather than land uses, CUM is about linking human activity and connecting materials and energy flows that belong to different user functions. Most studies focus on connecting inputs and outputs between the systems of energy, waste management, and sanitation, e.g., waste recycling, producing biogas from black water (water from the toilet), and

producing energy from solid and organic waste [51,55,6059–6261]. Other types of integrations studied are connecting (urban) agriculture with other systems, e.g., fertilizing urban forests using nutrients from local wastewater [55,61 60,6362], recycling construction and demolition waste [21,6463], and connecting in- and outflows from industrial and recreational activities, e.g., using residual heat from industrial processes to heat swimming pools and dwellings [5960,6362]. CUM is found at two scales: the scale of the building, where input and output to the building is considered, and at the scale of a city, where material and energy flows within cities might be connected (e.g., heat networks).

Despite obvious differences regarding what MLU and CUM are trying to integrate, signs of conceptual connections are being made. Some recent publications discuss integrating urban functions as well as the material and energy flows of these functions. Thomaier et al. [45] discuss how sustainability benefits of urban agriculture can be further enhanced by recycling resources such as water, energy, and organic waste, e.g., improving the energy efficiency of buildings with roof top or vertical farms (like green roofs), using excess heat of rooftop greenhouses for heating, and using organic waste for composting. Agudelo Vera et al. [6059] and Leduc and van Kann [6362] consider the different functions urban areas have in their studies on integrating material and energy flows. They identify urban functions of an area (recreation, transportation, district heating, etc.) and analyze the role each function plays in the urban metabolism (how much resources they require and wastes they produce) in order to determine how flows can be integrated. Moreover, MLU and CUM share that they are both important innovative directions to bring about urban sustainability through integrating and face similar integration challenges. The next section delves into the challenges and strategies in both fields.

2.4 Challenges and Strategies

The above shows the opportunities to use CUM and MLU as a strategy for urban sustainability. Whilst successful examples exist, the complexity of integrating functions ensures that many other initiatives perish. Reviewing the literature reveals a number of challenges covering technical, economic, organizational, institutional, and social dimensions. To our surprise, despite the fact that challenges are often mentioned in the literature, we only found a limited number of studies that empirically analyze challenges. The degree of empirical evidence and the depth in which challenges are studied varies substantially across studies. In some studies, challenges are explicitly and exhaustively analyzed and underpinned by empirical (case) studies, whilst in others they are not the focus of the study or not underpinned by empirical cases but rather seem to come from authors' experiences over time with CUM and MLU. In contrast, strategies often do result from empirical studies. Below, we first discuss challenges and strategies for MLU

and CUM separately. In Section 2.4.5, we reflect on to what extent similar conclusions are found in both fields.

2.4.1 Challenges to Multifunctional Land Use

To start with, difficulties to bring about MLU stem from fragmentation of the institutional system: with tasks, responsibilities, and authorities sharply demarcated between government systems [5,41,53]. As a result, organizations approach spatial development from a monofunctional perspective [53]. Van Ark [41] describes how the Dutch institutional context, where policy and spatial claims are developed from policy sectors (nature, housing, working, etc.), leads to different policy practices that hinder integrated planning. Moreover, organizations link policies and plans to their territorial boundaries (e.g., municipality or province) complicating collaboration (ibid). MLU initiatives by definition cut across such established divisions of policy sectors and involve a large variety of public and private actors. For instance, developing green-blue infrastructures involves actors such as project initiators, urban planners, water managers, engineering specialists, investors, city administration, neighbors, and scientists. Van Broekhoven et al. [28] conceptualize the process to develop an MLU initiative as one of fragmentation and integration; realising multifunctionality requires actors to transcend well-established boundaries; e.g., of sectors, organizations, and physical functions, whilst at the same time effective integration is complicated by the need and/or desire to maintain boundaries, e.g., to ensure fulfillment of functional tasks or maintain hegemony in the wider political-administrative environment.

This leads to various coordination challenges between actors from different backgrounds. Where modernist planning sought to eliminate potential conflicts by separating land uses, MLU in essence creates new ones by incorporating (or even celebrating) this inherent complexity of urban development [5]. Although the idea is often that MLU is just about win-win situations, realising synergies often also requires making compromises towards achieving one's own goals [6564,6665]. Moreover, challenges stem from institutional norms and routines shaping actors' behavior, which may not match with each other and the integrative ambition [5], such as existing rules and regulations made for particular functions [9,23,45,676]. For example, zoning and building regulations may not match with urban farming, and environmental legislation can form problems for combining housing and recreation with infrastructure [23,45]. Furthermore, different perceptions of problems and solutions complicate effective communication [6766], e.g., due to differing epistemological backgrounds [2,46,48,6867]. Naveh [54] talks about "diseases of specialized deafness" to highlight people's tendency to ignore things outside their own expertise. Diverging academic traditions, differences in what constitutes meritable work, training programs not encouraging interdisciplinarity, and a lack of a common approach

to bridge between disciplines all complicate collaboration [46,67, 5668,68]. The way the interaction between actors is organized also affects the success of the process. Majoor [5] finds that an ‘introvert’ governance setting, where not all stakeholders actively participate in thinking about the development of an MLU project, leads to difficulties. Unequal power relations can also complicate interaction [6564].

Another cause of challenges concerns the innovative (technical) nature of many multifunctional strategies: a lack of knowledge regarding design and technical possibilities [23,43], an unknown nature and size of risks, and uncertainty of the long term effects of integrating functions [23]. Moreover, technologies may be known but not used together yet, and new technologies may not be easily accepted [43]. Also, the lack of a reference project to fall back on, or of practical experience, makes MLU challenging [45,667], and may lead to risk-avoiding behavior by potential participants [23]. Furthermore, when ecological functions are involved, this may lead to uncertainties on the effects and impacts [6].

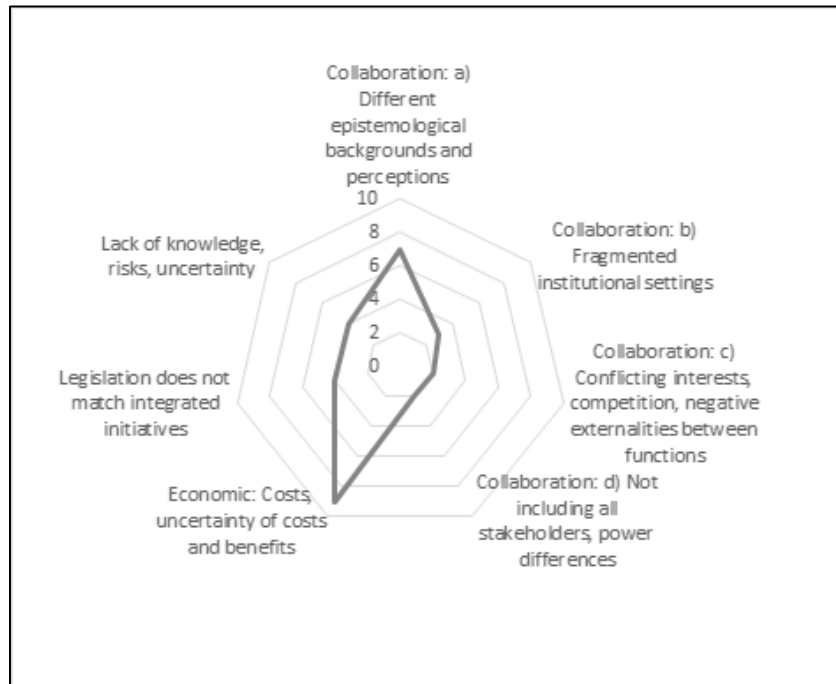


Figure 2.1 Challenges to MLU and the number of studies identifying them as problematic.

High development costs are another challenge identified in studies on combining amenities [9,23,69,70] as well as multifunctional farming [43,45]. Positive synergy benefits might cover a higher development cost; however, Rodenburg [69] and Eijgenraam and Ossokina [71] find that for a specific MLU project small positive synergy benefits exist in terms of willingness to pay, but this may not cover higher development costs. Moreover, costs and benefits for different actors are uncertain as

often different sources of financing are involved [23], and many benefits are unpriced, hard to quantify, or both, e.g., productivity improvements, agglomeration advantages, economies of scale [17,69,70], or ecosystem services [11]. Moreover, the time-consuming negotiation process may deter commercial investors [70]. Figure 2.1 shows the challenges that we have identified above and the number of studies that have found them problematic to MLU.

2.4.2 Strategies for Multifunctional Land Use

To facilitate actors' interaction, several studies state that a participatory approach involving all relevant stakeholders is crucial [2,5,53,645]. Some specifically stress the importance of community involvement, to, e.g., encourage commitment from residents, increase residents' satisfaction with results, and enable using local knowledge [2,16]. Strategies proposed to manage the interaction include: joint development of knowledge, ideas, and goals, e.g., by creating a setting where stakeholders (both proponents and critics) can discuss the meaning of a place and the pros and cons of MLU [5]; developing a shared conviction or vision on MLU [5,53]; regular feedback between experts and local stakeholders and consistency in the approach taken [53]; a design workshop where 'experts' help stakeholders with their vision [2]; scenarios to explore opportunities and alternatives (ibid); and visualization techniques to understand landscape conditions and evaluate alternatives (ibid). Realising integration, however, does not mean doing everything together. Van Broekhoven et al. [28] find that boundary-spanning strategies (e.g., jointly developing plans, working in joint project groups) facilitate interaction, but that it can also help to (jointly) reconstruct boundaries in the MLU project, e.g., dividing tasks and responsibilities, which can create a sense of order and clarity in terms of responsibility and accountability and hence enable implementation.

Furthermore, a transdisciplinary approach towards managing and analyzing MLU—i.e., bringing together scientific disciplinary expertise as well as practitioners—can provide a more holistic analysis of interacting factors [54,578,68] and enable a better understanding of the impacts of an intervention for different stakeholders as well as the multiple benefits thereof [46]. Above, we discussed challenges for a transdisciplinary approach. To bridge the gap between disciplines, several studies propose (in addition to the strategies facilitating interaction above) common conceptualizations or design frameworks that can serve as common ground [46,67,6856,68].

To deal with uncertainties and adapt to emerging knowledge, information, and system dynamics, recent papers highlight a learning and adaptive approach. Some propose conceiving cities as 'living laboratories' where learning from small failures and successes can enable testing and monitoring new ideas to improve future design and small scale

‘safe to fail’ experiments by early adopters can help to diffuse technologies [2,48]. O’Farrell and Anderson [11] suggest forming transdisciplinary ‘learning organizations’; i.e., temporary groups that share and develop knowledge, resources, and ideas towards a common goal, are managed adaptively to meet this goal, and deal with natural and social system dynamics.

There have been various efforts to develop assessment tools to enable informed decision-making, such as valuation of land use functions and economic analysis of integrating functions [17,69–71]. O’Farrell and Anderson [11] provide a review of tools to analyze landscapes and their functioning. Scholars highlight that, to develop a holistic analysis, integrated assessment in planning and decision-making is essential, i.e., including ecological, socio-cultural, and economic values and perceptions of the area, and that tools for this need to be developed [11,17,70]. Paracchini et al. [72] provide a tool for the integrated assessment of sustainability of MLU, which can also be used to support discussions amongst stakeholders, e.g., identifying trade-offs between functions and applying weightings. Nardini and Miguez [47] furthermore emphasize that public participation and modelling tools for technical analysis can enhance each other to develop an integrated plan that is shared with both local communities and authorities.

Finally, some functions combine better together than others. Several studies explore and map potential synergies and trade-offs between functions as a strategy to identify where potential for MLU exists [9,46,567].

2.4.3 Challenges to Circular Urban Metabolism

To begin with, important challenges come from the way infrastructure has traditionally been and still is being designed. Firstly, different infrastructures (water, heat, energy) are designed apart from each other by a specialist who may not fully understand how they interact and what the possible linkages between them are [73]. In other words, these specialists are not aware of the diversity of metabolic functions that urban infrastructures fulfil [5960]. This is further complicated by the fact that prevailing legal-jurisdictional boundaries result in decision-makers having little concern for the external impacts of their decisions [42]. Moreover, Agudelo-Vera et al. [5960] argue that different resources are best managed at different scales, e.g., greywater (water from showers and sinks) is best treated at the neighborhood level and construction waste at the regional level. Additionally, cities are very dependent from other geographical areas for the resources they are consuming, and the infrastructure used to meet a city’s demand often reaches far beyond the boundary of the municipality, requiring collaboration between different institutional levels (e.g., municipality, region) [74]. More research is still needed to know what the optimal scale is for closing cycles [49,632].

Moreover, regulatory structures often fail to appropriately support the creation of new metabolic flows or may even prevent their creation [601]. For many years, French regulations for instance did not allow injection of biogas into the natural gas grid [12]. Furthermore, to implement integrated projects often a multitude of permits or exemptions have to be obtained, and failing to obtain one single element can block the realisation of the whole system [612].

Another source of challenges is that developing CUM takes large investments. This requires a high and consistent level of commitment from local governments [42,51]. Moreover, CUM applications may involve decentralized solutions, some of which only exist as pilot projects, making it difficult to benefit from economies of scale [612]. Furthermore, different infrastructural development can compete for resources and space [601], e.g., roofs may either be used for photovoltaic panels or as green-roofs [5960].

Furthermore, involved actors may have different viewpoints regarding what a CUM should look like [75]. Social coalitions can form around a particular vision of the urban future or, on the contrary, actors can have colliding visions of the future, e.g., with different understandings the problem, and contest each other's position and preferred solution (ibid). Additionally, it is important to understand how power relations between different interest groups shape technological decision-making and design strategies (ibid).

Intersectoral collaboration is often seen as a challenge [51,623,74]. To develop CUM, actors coming from sectors such as electricity and wastewater treatment have to interact. This requires new forms of collaboration between different organizations (e.g., local governments, utilities, construction companies) and stakeholders [51]. This is pointed out by scholars but has not been studied further. Only the study of Ramaswani et al. [74] is an exception. Building on institutional economic literature, authors mention that intersectoral collaboration is challenging because actors come from different disciplines and their behavior is shaped by different institutions (rules, social norms, and shared strategies). This supports the observation of Barles [3] that research considering the role of local stakeholders in CUM is limited.

Finally, CUM often involves decentralized types of solutions that require end-users to change their behavior for them to function properly [55]. Greywater treatment systems, for instance, require residents not to use strong cleaning products as this could kill the bacteria needed to clean the water. Changing the behavior of end-users, whose perceptions and habits may not be in line with CUM practices, is challenging [21,51,

634]. Figure 2.2 shows the challenges that we have identified above and the number of studies that have found them problematic to CUM.

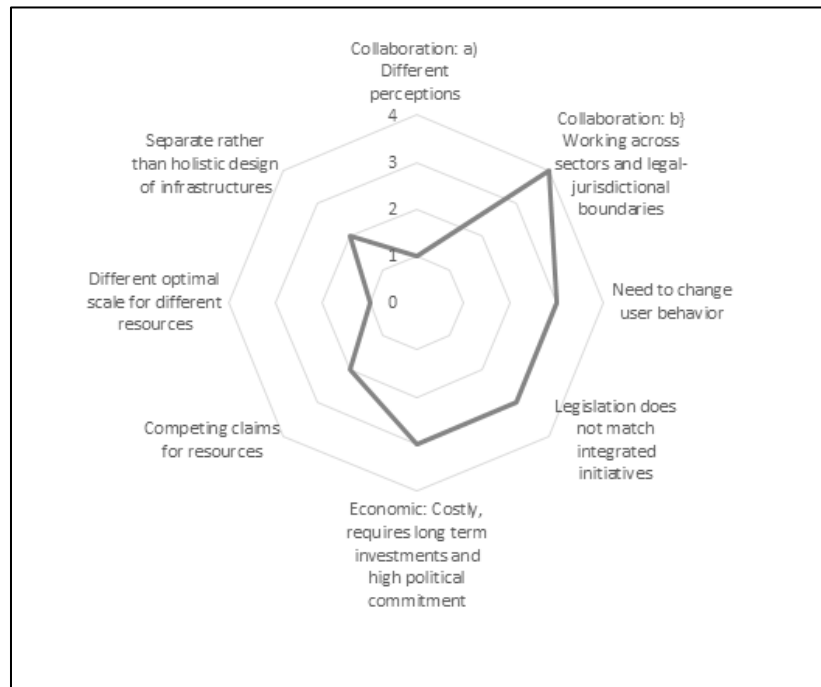


Figure 2.2 Challenges to CUM and the number of studies identifying them as problematic.

2.4.4 Strategies for Circular Urban Metabolism

Authors often argue that developing CUM requires further analysis of how the metabolism of the city functions, often citing Kennedy et al. [30] who argue that understanding a city's metabolism helps in uncovering the "metabolic processes that threaten the sustainability of cities". Scholars also refer to Newman's [50] argument that this data can then help to identify the activities between which circular flows could be created, and to Barles [35] who shows that it allows for allocating resources to those activities that can deliver the most benefits. Analyses of a city's metabolism can also be used to support policy design [3,30,49,601,634,76]. Recent papers highlight that in order to design policies that foster CUM, it is necessary to go a step further than assessing the type and size of material and energy flows, and to (1) understand how metabolic flows are influenced by urban forms, drivers, and lifestyle [3,50,77]—for example a denser city requires less energy for transportation but may face difficulties in sorting waste due to a lack of space—and (2) to understand how social, health, and economic factors influence consumption behavior and thereby metabolic flows [1,78]. However, urban metabolism studies are not easy to accomplish, and it is often difficult to access data at the municipal scale [30,49]. To overcome this, Voskamp et al. [79] propose a tool (SIRUP) that helps (1) identify the kind of data required by urban planners to develop resource-conscious

urban planning, (2) assess at which scale is data needed, and (3) identify whether the required data is available.

Some authors argue for an area-specific approach to facilitate CUM. Agudelo-Vera et al. [6059] and Leduc and van Kann [632] propose the “urban harvest approach”. This entails (1) inventorying the spatial functions present in a given area; (2) quantifying their energy demand and output; (3) analyzing the local renewable and residual energy potential; (4) identifying potential linkages and metabolic gaps; and (5) proposing concrete local spatial interventions to improve the efficiency of the urban metabolism. For example, Leduc and van Kann [632] analyzed a Dutch industrial park and identified excess waste heat of 200 °C which could be valorized if an industrial facility requiring such temperature (e.g., a brewery) was added. Based on this, Leduc and van Kann [632] propose developing policies to attract functions that fill metabolic gaps, and Agudelo-Vera et al. [6059] propose policies to increase the diversity of urban functions (recreational, industrial, residential, tertiary). As each function has its own metabolism (with specific in- and outflows and a specific consumption cycle, some consuming during the day while others at night), more diversity of functions can enable possibilities to close cycles (see e.g., [80]).

To facilitate interaction between specialists designing different infrastructures and help recognize their mutual dependence, public authorities can encourage utilities (i.e., firms providing public services such as water or electricity) to co-produce integrated solutions [55,621]. For instance, in developing the district Hammarby Sjöstad, the municipality of Stockholm requested utilities to deliver integrated solutions (e.g., to link wastewater treatment with biogas production for cooking) [81]. Furthermore, scholars argue that the education of practitioners should include training to think holistically in developing urban infrastructures [21,74].

Finally, to deal with challenges in end-user behavior in decentralized solutions, Haughton [42] states that end users should be empowered and play a more prominent role in the governance of urban systems.

2.4.5 Overview

This review shows that the challenges for realising integration in CUM and MLU are partly similar. Table 2.1 summarizes the challenges faced when attempting to make a transition towards MLU and CUM and the strategies that can help to realise them. We found that the need for collaboration between actors across disciplines, sectors, and government levels is most often identified as a challenge in the reviewed articles. This is especially so for MLU, where almost half the reviewed studies identify this as a

challenge. Integration is complicated as it requires collaboration between actors with different epistemological backgrounds who have differing perceptions on problems and solutions. MLU scholars add that interaction challenges find their origin in fragmented and monofunctional institutional settings, which shape actors' actions. For CUM, similar collaboration challenges are found, e.g., across sectors and across city and legal-jurisdictional boundaries and between actors with different perceptions. Surprisingly, however, amongst CUM scholars this has received much less attention than amongst MLU scholars and interaction challenges are hardly studied in depth, with only Ramaswami [75] being an exception. CUM scholars hence can find value in the work of MLU scholars on this challenge.

The review also shows that for both MLU and CUM high investment costs hamper their realisation. Several studies by MLU scholars have investigated the costs and benefits in depth. Whilst some studies find that small positive synergy benefits exist, others find high uncertainty about costs and benefits, which may deter investors. The last shared challenge that was found in this review is that scholars in both fields identify that legislation made for monofunctional practices obstructs integrated initiatives. In addition, lack of knowledge was named in both fields, as both approaches are still not often practiced. However, this concerned knowledge on different topics.

CUM scholars in addition identified several challenges that were specific to the development of CUM, such as difficulties in changing user behavior and the common practice to design infrastructures for one function rather than with a more holistic purpose.

Regarding strategies, we found that both MLU and CUM scholars propose strategies aimed at facilitating the collaboration process. Amongst the reviewed MLU studies, this is the main strategy to facilitate MLU. MLU scholars propose and study various tools that can help such a joined process, such as using workshops, scenarios, visualization techniques, integrated assessment methods of, amongst others, costs and benefits, and learning or transdisciplinary approaches. Interestingly, and in line with our findings regarding challenges, whilst MLU scholars mostly highlight the socio-economic aspects of realising integration, CUM scholars are more focused on technical aspects. CUM scholars in addition to collaboration strategies argue that we need to further analyze and understand the metabolic flows of cities in order to better develop opportunities for and realise CUM and propose ways to do so.

	Multifunctional Land Use	Circular Urban Metabolism
Challenges	<ul style="list-style-type: none"> • Collaboration between actors across organizational, sectoral, and disciplinary boundaries (a) Different epistemological backgrounds (t), differing perceptions of problems and solutions (e) (b) Fragmented institutional settings (e) (c) Conflicting interests (t), competition, negative externalities between functions (t) (d) Not including all stakeholders, power differences (e) • Economic: Costs, uncertainty of costs and benefits (e) • Legislation does not match integrated initiatives (t) • Lack of knowledge, risks, uncertainty (e) 	<ul style="list-style-type: none"> • Collaboration across sectors and across city and legal-jurisdictional boundaries (a) Different backgrounds between actors (t), differing perceptions of problems and solutions (e) (b) Legislation does not match integrated initiatives (t) • Need to change user behavior (e) • Economic: Costly, requires long term investments and high political commitment (t) • Competing claims for resources (t) • Different optimal scale for different resources (t) • Separate rather than holistic design of infrastructures (t)
Strategies	<ul style="list-style-type: none"> • Participatory planning process, including all stakeholders (e) • Facilitate interaction by joined developing of knowledge and goals; a shared vision; and providing regular feedback (e). E.g., using workshops, scenarios, visualization techniques (t) • Transdisciplinary approach; shared conceptualization (t) • Adaptive/learning approach: testing and monitoring new ideas, enable learning between stakeholders (t) • Enable informed decision-making by making benefits and costs more clear, develop integrated assessment tools (e) 	<ul style="list-style-type: none"> • Analyse urban metabolisms to a) identify and geographically locate opportunities for integration (e); b) design policies (e); and c) trigger discussion and exchange between disciplines (t) • Involve utilities to coproduce solutions and recognize their mutual dependence (e) • Develop education programs to train practitioners to think in holistic terms (e)

Table 2.1 Challenges and strategies for integrating function in multifunctional land use (MLU) and circular urban metabolism (CUM) and how they are derived by reviewed studies: derived empirically (e) or deduced from theory or postulated (t).

2.5 Conclusions and Discussion

This review shows that although MLU and CUM differ in what they integrate, they face similar challenges in integration. We found that in both fields the collaboration between actors related to particular functions (water safety, recreation, wastewater treatment) is an important concern. In the reviewed MLU articles this is the main challenge. Remarkably, whilst scholars identify similar collaboration challenges, these have been hardly studied in depth for CUM. The review furthermore shows that both high investment costs and uncertainties about costs and benefits for different actors hamper realisation. Moreover, legislation that does not accommodate integrated initiatives was found to hamper both CUM and MLU initiatives.

However, we also found challenges and strategies specific to CUM or MLU. Regarding both challenges and strategies, we find that whilst MLU scholars are mostly focused on socio-economic aspects of realising integration, CUM scholars are more focused on technical aspects. The strategies to overcome integration challenges that are proposed by MLU scholars are aimed at involving all relevant actors in the planning process and facilitating their collaboration, e.g., by using workshops, scenario's, visualization techniques, integrated assessment methods of amongst others costs and benefits, and learning or transdisciplinary approaches. CUM scholars in addition to collaboration strategies argue that we need to further analyze and understand the metabolic flows of cities in order to better develop opportunities for and realise CUM and propose ways to do so.

To our surprise, we found only a limited number of (case) studies that actually empirically and in-depth studied challenges to MLU and CUM. This hence points at an opportunity for future research to verify and better understand the challenges found in the reviewed studies.

2.5.1 Integration of Urban Functions as a Shared Idea for a Sustainable Urban System?

We found limited signs of cross-fertilization between research on CUM and MLU. Moreover, the review shows that for MLU there is little referencing across studies that use the different though clearly related concepts of multifunctional land use and multifunctional landscapes by scholars mostly coming from, respectively, the planning or landscape ecology field. Likewise, different concepts are used to talk about CUM. Moreover, whilst we have focused on MLU and CUM in this review, they complement other concepts that address the idea of mixing urban functions and flows, such as mixed land use, compact city, and low-carbon city. Reflecting on this diversity regarding MLU, Majoor [5] argues that these concepts should be seen as a provocation to think beyond established monofunctional practices, with the actual meaning, potential, and use of the concept depending on the actors' viewpoint and the local context in which they are developed. The same may be concluded for CUM and currently established linear practices. However, a risk is that academic contributions from different fields of study stay apart because they lack a common language.

With this review, we want to facilitate discussion and knowledge exchange within and between the fields of MLU and CUM as two approaches that propose integration for a sustainable urban system. Based on this review, we propose a possible point of convergence between CUM and MLU: they can both be framed as being about the integration of urban functions. The review moreover indicates some concrete possibilities for knowledge exchange. To start with, CUM scholars can find value in the work of

MLU scholars on understanding and facilitating the collaboration between actors from different backgrounds. Moreover, the studies on economic aspects and costs and benefits of MLU developed by scholars from the planning field [17,69,71], and studies on valuation of urban functions by different actors and integrated assessment tools developed by scholars in the landscape ecology field [2,11,72], can benefit both CUM scholars as well as MLU scholars across the planning and the (landscape) ecology research communities. In the field of MLU, more collaboration between scientists and practitioners from urban planning and landscape ecology may help to develop a systems-level view on how a city can develop more sustainably by bringing together knowledge on ecosystem services and principles of ecology with knowledge of planning processes and practice of urban planning and design [48,68,56]. For example, involving scientists and practitioners from both disciplines can help understand the multiple benefits and impacts of integrative initiatives for different stakeholders [46]. Moreover, it can help in developing solutions that connect socio-economic functions and ecologic aims. Furthermore, the work by CUM scholars could help frame urban functions not only as being present to fulfil societal and ecological functions or needs, but also as having a role in the metabolism of the city. Besides sharing lessons learned, one could imagine measures integrating land use functions and energy and material flows taking place in the same area to increase sustainability, such as urban farming initiatives involving roof top farming as well as water retention and reuse of organic wastes (see [45]) or neighborhood development where both connecting land use functions as green-blue infrastructures and connecting household material flows is realised.

2.5.2 A Process-Oriented Perspective

Based on our review, to find further solutions for the integration challenges we identified above we propose conceptualizing MLU or CUM initiatives as processes of change, which requires connecting across previously separate ‘worlds’ and changing previously established monofunctional ways of working. Integrating functions brings together more or less autonomous actors dominantly organized according to the principles of bureaucracy: well-divided into task units specialized and responsible for one function. As discussed by Van Ark [41], many challenges can be attributed to such underlying institutional structures. Whilst to realise integration actors need to work across boundaries of sectors and organizations, studies on inter-sectoral interaction have shown that this is complicated as this involves changing current practices that can be deeply embedded in their structures, histories, and vested interests [28,82,83]. We highlight that the different institutional backgrounds and logics of actors related to particular functions require particular attention in future studies. An important future research opportunity is hence the further empirical analysis of the process of change that unfolds when actors initiate an MLU or a CUM initiative, delving into the underlying perspectives, interests,

rules, and ways of working of actors that lead to integration challenges, as well as exploring which strategies are helpful at which moments during this process. In doing so, scholars can build upon insights from other fields. Here, we explore two perspectives that could be used and how these can help in dealing with integration challenges.

One perspective is to focus on how actors deal with boundaries in the integrative processes of MLU and CUM. When actors specify integration as their aim, they are confronted with boundaries. ‘Integrating’ already suggest there are separate entities that need to be brought together. Such boundaries include social boundaries between groups of people, such as spatial planners, water managers, and residents; cognitive boundaries between different perspectives, ways of working, knowledge, and language; and physical boundaries in physical objects and geographical jurisdictions [28]. Actors participating in integrative processes will try to influence the multiple boundaries they experience. They will try to change or bridge boundaries that constrain them, but construct and maintain boundaries that enable them to pursue their goals whilst keeping out external inferences or divide tasks and responsibilities [28,84]. Recently, the question of how actors deal with boundaries is rising amongst scholars studying the integrative planning process [28,84–86]. Previous work on boundaries provides insights that can help overcome the integration challenges identified in Table 1. Studies have shown how coordinating across boundaries can be facilitated; e.g., activities of boundary spanners, i.e., people or organizations that act as intermediaries, identify needs and facilitate shared problem perceptions and solutions by communicating and building relations [87], boundary objects, i.e., objects that can serve as means of translation and a basis for coordination between actors [88], or coordination mechanisms (e.g., steering groups) that encourage communication and meaningful exchange and can make group decisions accountable to all [89]. Drawing or defending boundaries can be problematic for cooperation and integration [82,83]. However, studies have also found that drawing boundaries in integrative work can be useful to keep complexity manageable, divide tasks, and create a sense of order or clarity in terms of responsibility and accountability, thereby facilitating realisation and making it possible for organizations to fulfil their core (functional) tasks into the future. [28,90]. To understand how integration is realised in CUM and MLU processes, it is important to address how actors manage boundaries over the course of integrative processes and what strategies to manage boundaries are helpful at different moments during these processes.

Another perspective is to analyze integrating functions as a process of integrating socio-technical systems: we refer to this process as systems integration. It is based on the understanding that technologies are not mere artefacts but are part of a larger whole of inter-related and heterogeneous entities that support and sustain them [91–93]. Science

and Technology scholars understand that a socio-technical system is composed of three inter-related elements: technical artefacts, organizations that, in interaction, fulfil a given societal function, and institutions understood as norms, values, and cognitive maps that these actors share with one another [94]. From this perspective, technological change cannot be understood without considering the social context in which these technologies are embedded and with which they co-evolve. Analyzing the integration of functions as a process of systems integration means re-constructing how linkages can be created between previously separated socio-technical systems and understanding how prevailing institutions may enable or constrain change. These linkages may be more or less important and as such various degrees of systems integration exist, each implying different degrees of inter-dependencies between initially separated systems [12]. Previous studies analyzed how actors negotiate their participation in systems integration by co-creating shared rules that allow for securing the highest level of autonomy [95,96]. More recently, scholars have shown interest in understanding the dynamics of integrated systems and whether and how they can maintain the capacity to adapt to changing circumstances [97–100]. They especially draw on previous work on intermediaries [71,101] and anchors [102–104], showing how these can also help overcome some of the challenges identified in Table 2.1. Intermediaries can, for instance, raise awareness about integration possibilities [105], facilitate communication [106], and help raise trust among participants who may be more willing to negotiate the conditions for systems integration [107,108].

Acknowledgments: This research is partly funded by the Dutch Knowledge for Climate Research Program

<http://www.knowledgeforclimate.nl/http://knowledgeforclimate.climate-research-netherlands.nl/>.

Author Contributions: Saskia van Broekhoven analyzed the literature and wrote the sections on MLU. Anne Lorene Vernay analyzed the literature and wrote the sections on CUM. Saskia van Broekhoven and Anne Lorene Vernay both wrote the remaining sections of the paper, with Saskia van Broekhoven being the lead author.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A: Reviewed studies

Study	Journal	Geographical Region Study	Type of Analysis	Type of Integration Studied	Concept Used
Agudelo-Vera et al. (2012)	Resource Conservation and Recycling	The Netherlands	empirical	water, energy, sanitation, industrial/agricultural production	closing urban cycles
Ahern (2012)	Landscape Ecology	/	conceptual	ecology and urban planning and design	multifunctional landscape
Baccini (1997)	Journal of Urban Technology	Switzerland	empirical	water; agriculture; waste; construction	sustainable metabolism
Barles (2009)	Journal of Industrial Ecology	France	empirical	/	/
Barles (2010)	Journal of Environmental Planning and Management	/	review	none specified	territorial ecology; closing material cycles
Beatley (2007)	Journal of Urban Technology	worldwide	review	sanitation and transportation; industry and district heating	circular urban metabolism; solar city
Castán Broto et al. (2012)	Journal of Industrial Ecology	/	review	/	circular metabolism
Clark and Nicholas (2013)	Landscape Ecology	multiple countries	empirical	multiple ecosystem services of urban agriculture and agro-forestry	/
Codoban and Kennedy (2008)	Journal of Urban Planning and Development	Toronto	empirical	urban forestry and sanitation; waste management and agriculture; water cascading	closing metabolic loops/metabolism flows
D'Hautesserre (2001)	Landscape and Urban Planning (special issue)	Monaco	empirical	natural and cultural elements in city	multifunctional landscape
Eijgenraam and Ossokina (2008)	bookchapter	The Netherlands	empirical	socio-economic functions	multifunctional land use
Engel-Yan et al. (2005)	Canadian Journal of Civil Engineering	/	review	water; transport; agriculture; waste	infrastructure interaction
Fischer-Kowalski and Huttler (1999)	Journal of Industrial Ecology	/	review	/	/

Chapter 2

Gallent and Shaw (2007)	Journal of Environmental Planning and Management	U.K.	empirical	various functions in 'green belt'	Multi-functionality
Gallent et al. (2004)	Local Environment: The International Journal of Justice and Sustainability	U.K.	empirical	cases: (1) Ecological regeneration, socio-cultural functions, community development; (2) Flood management, ecological conservation, recreation	Multi-functionality
Girardet (1992)	Book	worldwide	review	none specified	circular urban metabolism
Girardet (2008)	book	worldwide	review	transport; energy; waste; water; agriculture	circular urban metabolism
Guy and Marvin (2001)	Impact Assessment and Project Appraisal	U.K.	conceptual and empirical	none specified	CUM; self-reliant city
Haughton (1997)	Cities	/	conceptual	none specified	self-reliant, CUM
Herzog (2013)	Landscape and Ecological Engineering	Brazil	empirical	ecological functions and urban development in green infrastructure	multifunctional green infrastructure
Kennedy et al. (2007)	Journal of Industrial Ecology	worldwide	review	/	/
Kennedy et al. (2011)	Environmental Pollution	/	review	/	/
Leduc and van Kann (2013)	Journal of Cleaner Production	The Netherlands	empirical	residential, industrial, energy, agriculture; recreation	circular urban metabolism;
Lehmann (2011)	Sustainability	worldwide	review	construction sectors; construction and demolition waste	urban harvest zero-waste
Lovell and Johnston (2009)	Frontiers in Ecology and the Environment	/	conceptual, apply framework to case	landscape ecology and urban planning and design	multifunctional landscape
Lovell and Taylor (2013)	Landscape Ecology	US	conceptual	ecosystems services and socio-cultural objectives in green infrastructure	multifunctional landscape
Lundy and	Progress in	UK	empirical	multiple ecosystem	multifunctional

Integrating functions for a sustainable urban system

Wade (2010)	Physical Geography			services into water management	landscape
Majoer (2006)	Journal of Housing and the Built Environment (special issue)	The Netherlands	empirical	socio-economic functions	multiple land use
Nardini and Miguez (2016)	Sustainability	Colombia	empirical	flood management with natural and built environment	multifunctional landscapes
Naveh (2001)	Landscape and Urban Planning (special issue)	/	conceptual	biological and human aspects of landscapes in research approaches	multifunctional landscape
Newman (1999)	Landscape and Urban Planning	Australia	empirical	/	city as an ecosystem
O'Farrell and Anderson (2011)	Current Opinion in Environmental Sustainability	/	review	human use into ecological fabric of landscape	multifunctional landscape
Paracchini et al. (2011)	Ecological Indicators	/	methodological	economic, environmental, and social	multifunctional land use
Priemus and Hall (2004)	Built Environment (special issue)	/	empirical	various functions	multifunctional land use
Priemus et al. (2000)	book	The Netherlands	review	various functions	multifunctional land use
Ramaswami et al. (2012)	Journal of Industrial Ecology	/	conceptual	energy, water	/
Rodenburg (2006)	Journal of Housing and the Built Environment (special issue)	The Netherlands	empirical	socio-economic functions	multifunctional land use
Rodenburg and Nijkamp (2004)	Built Environment (special issue)	The Netherlands	conceptual	socio-economic functions	multifunctional land use
Rodenburg et al. (2008)	Tijdschrift voor Economische en Sociale Geografie	The Netherlands	empirical	socio-economic functions	multifunctional land use
Roe and Mell (2013)	Journal of Environmental Planning	UK	empirical	climate change adaptation, ecological and social values in	multifunctional landscape

Chapter 2

Selman (2009)	and Management Sustainability: Science, Practice, and	UK	conceptual discussing UK policy context	green infrastructure synergy between various social, economic, ecologic land use goals	multifunctional landscape
Specht et al. (2013)	Policy Agriculture and Human	multiple countries	review	Food production in/on buildings	multifunctional landscape
Thomaier et al. (2015)	Values Renewable Agriculture and Food	US	empirical	Food production in/on buildings	multifunctional land use
Tress and Tress (2001)	Systems Landscape and Urban Planning	/	conceptual	disciplines	multifunctional landscape
Van Ark (2006)	(special issue) book chapter	The Netherlands	conceptual	/	multifunctional land use
Van Broekhoven et al. (2015)	Environment and Planning C: Government and Politics	The Netherlands	empirical	public park on roof of retail building, flood protection, community development	multifunctional land use
Van Der Hoeven (2010)	Tunneling and Underground Space Technology	The Netherlands	empirical	motorway infrastructure and urban residential expansion	multifunctional land use
Van Leeuwen et al. (2011)	International Journal of Agricultural Sustainability	/	conceptual	multiple ecosystem services in urban greenspace, especially urban agriculture	multifunctional use
van Timmeren (2012)	book chapter	Germany, Denmark, The Netherlands, Sweden, Brazil, Abu Dhabi	reviewing existing practices	energy, sanitation	cyclic design; sustainable implant
van Timmeren et al. (2007)	Journal of Green Building	The Netherlands	empirical	energy, waste, and sanitation	sustainable implant, closing cycles
Vreeker et al. (2004)	Built Environment (special issue)	The Netherlands	conceptual, review	socio-economic functions	multifunctional land use

References

1. Grimm, N.B.; Faeth, S.H.; Golubiewski, N.E.; Redman, C.L.; Wu, J.; Bai, X.; Briggs, J.M. Global Change and the Ecology of Cities. *Science* 2008, *319*, 756–760, doi:10.1126/science.1150195.
2. Lovell, S.T.; Taylor, J.R. Supplying urban ecosystem services through multifunctional green infrastructure in the United States. *Landsc. Ecol.* 2013, *28*, 1447–1463, doi:10.1007/s10980-013-9912-y.
3. Barles, S. Society, energy and materials: The contribution of urban metabolism studies to sustainable urban development issues. *J. Environ. Plan. Manag.* 2010, *53*, 439–455, doi:10.1080/09640561003703772.
4. Broto Castán, V.; Adriana, A.; Elizabeth, R. Interdisciplinary Perspectives on Urban Metabolism. *J. Ind. Ecol.* 2012, *16*, 851–861, doi:10.1111/j.1530-9290.2012.00556.x.
5. Majoor, S. Conditions for multiple land use in large-scale urban projects. *J. Hous. Built Environ.* 2006, *21*, 15–32.
6. Selman, P. Planning for landscape multifunctionality. *Sustain. Sci. Pract. Policy* 2009, *5*, 45–52.
7. Suzuki, H.; Dastur, A.; Moffatt, S.; Yabuki, N.; Maruyama, H. *Eco2 Cities: Ecological Cities as Economic Cities*; World Bank Publications: Washington, DC, USA, 2010; ISBN 978-0-8213-8144-1.
8. Vreeker, R. Evaluating effects of multiple land-use projects: A comparison of methods. *J. Hous. Built Environ.* 2006, *21*, 33–50, doi:10.1007/s10901-005-9031-4.
9. Rodenburg, C.A.; Nijkamp, P. Multifunctional land use in the city: A typological overview. *Built Environ.* 2004, *30*, 274–288.
10. Newman, P.; Jennings, I. *Cities as Sustainable Ecosystems: Principles and Practices*; Island Press: Washington, DC, USA, 2008; ISBN 978-1-59726-188-3.
11. O'Farrell, P.J.; Anderson, P.M. Sustainable multifunctional landscapes: A review to implementation. *Curr. Opin. Environ. Sustain.* 2010, *2*, 59–65.
12. Vernay, A.B.H. Circular Urban Systems: Moving Towards Systems Integration. Ph.D. Thesis, Delft University of Technology, Delft, The Netherlands, 2013.
13. Priemus, H. System Innovation in Spatial Development: Current Dutch Approaches. *Eur. Plan. Stud.* 2007, *15*, 992–1006, doi:10.1080/09654310701448147.
14. Girardet, H. *The Gaia Atlas of Cities: New Directions for Sustainable Urban Living*; UN-HABITAT: Nairobi, Kenya, 1996; ISBN 978-1-85675-097-4.
15. Rogers, R.G. *Cities for a Small Planet*; Westview: Boulder, CO, USA, 1997; ISBN 0-8133-3553-1.
16. Gallent, N.; Shaw, D. Spatial planning, area action plans and the rural-urban fringe. *J. Environ. Plan. Manag.* 2007, *50*, 617–638, doi:10.1080/09640560701475188.

17. Vreeker, R.; Groot, H.L.; Verhoef, E.T. Urban multifunctional land use: Theoretical and empirical insights on economies of scale, scope and diversity. *Built Environ.* 2004, *30*, 289–307.
18. ACR+ Update—ACR+. Available online: <http://www.acrplus.org/index.php/en/publications/2-content/335-acr-update> (accessed on 13 April 2018).
19. UN-HABITAT. *State of the World's Cities 2008/2009—Harmonious Cities*; Earthscan: Abingdon, UK, 2008; ISBN 978-92-1-132010-7.
20. Worldwatch Insitute. *State of the World 2007: Our Urban Future*; W. W. Norton & Company: New York, NY, USA; London, UK, 2007; ISBN 978-0-393-32923-0.
21. Lehmann, S. Optimizing Urban Material Flows and Waste Streams in Urban Development through Principles of Zero Waste and Sustainable Consumption. *Sustainability* 2011, *3*, 155–183, doi:10.3390/su3010155.
22. Beatley, T. *Green Cities of Europe: Global Lessons on Green Urbanism*; Island Press/Center for Resource Economics: Washington, DC, USA, 2012; ISBN 978-1-61091-175-7.
23. Priemus, H.; Nijkamp, P.; Dieleman, F.M. *Meervoudig Ruimtegebruik; Stimulansen en Belemmeringen*; Delft University Press: Delft, The Netherlands, 2000.
24. Louw, E.; Bruinsma, F. From mixed to multiple land use. *J. Hous. Built Environ.* 2006, *21*, 1–13, doi:10.1007/s10901-005-9029-y.
25. Priemus, H.; Rodenburg, C.A.; Nijkamp, P. Multifunctional urban land use: A new phenomenon? A new planning challenge? *Built Environ.* 2004, *30*, 269–273.
26. Jacobs, J. *The Death and Life of Great American Cities*; Random House LLC: New York, NY, USA, 1961.
27. Dakpark Rotterdam|Grootste Dakpark van Europa. Available online: <http://www.dakparkrotterdam.nl/> (accessed on 13 April 2018).
28. Van Broekhoven, S.; Boons, F.; van Buuren, A.; Teisman, G. Boundaries in action: A framework to analyse boundary actions in multifunctional land-use developments. *Environ. Plan. C Gov. Policy* 2015, *33*, 1005–1023.
29. London Green Grid | Urban Green-Blue Grids. Available online: <http://www.urbangreenbluegrids.com/projects/london-green-grid/> (accessed on 13 April 2018).
30. Kennedy, C.; Cuddihy, J.; Engel-Yan, J. The Changing Metabolism of Cities. *J. Ind. Ecol.* 2007, *11*, 43–59, doi:10.1162/jie.2007.1107.
31. Wolman, A. The metabolism of cities. *Sci. Am.* 1965, *213*, 179–190.
32. Decker, E.H.; Elliott, S.; Smith, F.A.; Blake, D.R.; Rowland, F.S. Energy and Material Flow through the Urban Ecosystem. *Annu. Rev. Energy Environ.* 2000, *25*, 685–740, doi:10.1146/annurev.energy.25.1.685.

33. Brunner, P. Reshaping Urban Metabolism. *J. Ind. Ecol.* 2008, *11*, 11–13, doi:10.1162/jie.2007.1293.
34. Dunn, B.C.; Steinemann, A. Industrial Ecology for Sustainable Communities. *J. Environ. Plan. Manag.* 1998, *41*, 661–672, doi:10.1080/09640569811353.
35. Barles, S. *L'invention des Déchets Urbains: France (1790–1970)*; Champ Vallon: Seyssel, France, 2005.
36. Girardet, H. *Cities People Planet: Urban Development and Climate Change*, 2nd ed.; Wiley: Chichester, UK; New York, NY, USA, 2008; ISBN 978-0-470-77270-6.
37. Ehrenfeld, J.R. Industrial ecology: A framework for product and process design. *J. Clean. Prod.* 1997, *5*, 87–95, doi:10.1016/S0959-6526(97)00015-2.
38. Le Centre de Valorisation Organique (CVO). Available online: <http://www.lillemetropole.fr/mel/decouverte/equipements-de-la-mel/dechets-menagers/le-centre-de-valorisation-organique.html> (accessed on 13 April 2018).
39. SymbioCity. Hammarby Sjöstad: Three in One. Available online: <https://www.symbiocity.org/en/approach/Cases-undersidor/Hammarby-Sjostad-three-in-one/> (accessed on 13 April 2018).
40. Ecologie industrielle|Environnement. Available online: <http://ge.ch/environnement/ecologie-industrielle> (accessed on 13 April 2018).
41. Van Ark, R. Meervoudig ruimtegebruik: Dogma of eye-opener? In *Meervoudig Ruimtegebruik, Enkelvoudig Recht: De Spanningsvolle Relatie Tussen Recht en Innovatie*; Van der Heijden, G.M.A., Slob, A.F.L.: Eburon: Delft, The Netherlands, 2005; Volume 11.
42. Houghton, G. Developing sustainable urban development models. *Cities* 1997, *14*, 189–195, doi:10.1016/S0264-2751(97)00002-4.
43. Specht, K.; Siebert, R.; Hartmann, I.; Freisinger, U.B.; Sawicka, M.; Werner, A.; Thomaier, S.; Henckel, D.; Walk, H.; Dierich, A. Urban agriculture of the future: An overview of sustainability aspects of food production in and on buildings. *Agric. Hum. Values* 2014, *31*, 33–51, doi:10.1007/s10460-013-9448-4.
44. Clark, K.H.; Nicholas, K.A. Introducing urban food forestry: A multifunctional approach to increase food security and provide ecosystem services. *Landsc. Ecol.* 2013, *28*, 1649–1669, doi:10.1007/s10980-013-9903-z.
45. Thomaier, S.; Specht, K.; Henckel, D.; Dierich, A.; Siebert, R.; Freisinger, U.B.; Sawicka, M. Farming in and on urban buildings: Present practice and specific novelties of Zero-Acreage Farming (ZFarming). *Renew. Agric. Food Syst.* 2015, *30*, 43–54, doi:10.1017/S1742170514000143.
46. Lundy, L.; Wade, R. Integrating sciences to sustain urban ecosystem services. *Prog. Phys. Geogr.* 2011, *35*, 653–669.

47. Nardini, A.; Gomes Miguez, M. An Integrated Plan to Sustainably Enable the City of Riohacha (Colombia) to Cope with Increasing Urban Flooding, while Improving Its Environmental Setting. *Sustainability* 2016, 8, 198, doi:10.3390/su8030198.
48. Ahern, J. Urban landscape sustainability and resilience: The promise and challenges of integrating ecology with urban planning and design. *Landsc. Ecol.* 2013, 28, 1203–1212, doi:10.1007/s10980-012-9799-z.
49. Bai, X. Eight energy and material flow characteristics of urban ecosystems. *AMBIO* 2016, 45, 819–830, doi:10.1007/s13280-016-0785-6.
50. Newman, P.W.G. Sustainability and cities: Extending the metabolism model. *Landsc. Urban Plan.* 1999, 44, 219–226, doi:10.1016/S0169-2046(99)00009-2.
51. Beatley, T. Envisioning Solar Cities: Urban Futures Powered By Sustainable Energy. *J. Urban Technol.* 2007, 14, 31–46, doi:10.1080/10630730701531682.
52. Priemus, H.; Hall, P. Multifunctional urban planning of mega-city-regions. *Built Environ.* 2004, 30, 338–349.
53. Gallent, N.; Shoard, M.; Andersson, J.; Oades, R.; Tudor, C. Inspiring England's urban fringes: Multi-functionality and planning. *Local Environ.* 2004, 9, 217–233.
54. Naveh, Z. Ten major premises for a holistic conception of multifunctional landscapes. *Landsc. Urban Plan.* 2001, 57, 269–284.
55. Van Timmeren, A.; Sidler, D.; Kaptein, M. Sustainable Decentralized Energy Generation & Sanitation: Case EVA Lanxmeer, Culemborg, the Netherlands. *J. Green Build.* 2007, 2, 137–150, doi:10.3992/jgb.2.4.137.
56. Van Leeuwen, E.; Nijkamp, P.; de Noronha Vaz, T. The multifunctional use of urban greenspace. *Int. J. Agric. Sustain.* 2010, 8, 20–25, doi:10.3763/ijas.2009.0466.
57. Herzog, C.P. A multifunctional green infrastructure design to protect and improve native biodiversity in Rio de Janeiro. *Landsc. Ecol. Eng.* 2016, 12, 141–150.
58. D'Hauteserre, A.-M. Bridging the culture nature divide in Monaco. *Landsc. Urban Plan.* 2001, 57, 209–223, doi:10.1016/S0169-2046(01)00205-5.
59. Agudelo-Vera, C.M.; Leduc, W.R.W.A.; Mels, A.R.; Rijnaarts, H.H.M. Harvesting urban resources towards more resilient cities. *Resour. Conserv. Recycl.* 2012, 64, 3–12, doi:10.1016/j.resconrec.2012.01.014.
60. Codoban, N.; Kennedy, C.A. Metabolism of Neighborhoods. *J. Urban Plan. Dev.* 2008, 134, 21–31, doi:10.1061/(ASCE)0733-9488(2008)134:1(21).
61. Van Timmeren, A. Climate Integrated Design and Closing Cycles. In *Sustainable Urban Environments*; Springer: Dordrecht, The Netherlands, 2011; pp. 313–339, ISBN 978-94-007-1293-5.
62. Leduc, W.R.W.A.; Van Kann, F.M.G. Spatial planning based on urban energy harvesting toward productive urban regions. *J. Clean. Prod.* 2013, 39, 180–190, doi:10.1016/j.jclepro.2012.09.014.

63. Baccini, P. A city's metabolism: Towards the sustainable development of urban systems. *J. Urban Technol.* 1997, 4, 27–39, doi:10.1080/10630739708724555.
64. Roe, M.; Mell, I. Negotiating value and priorities: Evaluating the demands of green infrastructure development. *J. Environ. Plan. Manag.* 2013, 56, 650–673, doi:10.1080/09640568.2012.693454.
65. Fry, G.L.A. Multifunctional landscapes—Towards transdisciplinary research. *Landsc. Urban Plan.* 2001, 57, 159–168, doi:10.1016/S0169-2046(01)00201-8.
66. Van der Hoeven, F. Landtunnel Utrecht at Leidsche Rijn: The conceptualisation of the Dutch multifunctional tunnel. *Tunn. Undergr. Space Technol.* 2010, 25, 508–517, doi:10.1016/j.tust.2010.03.005.
67. Tress, B.; Tress, G. Capitalising on multiplicity: A transdisciplinary systems approach to landscape research. *Landsc. Urban Plan.* 2001, 57, 143–157.
68. Lovell, S.T.; Johnston, D.M. Creating multifunctional landscapes: How can the field of ecology inform the design of the landscape? *Front. Ecol. Environ.* 2008, 7, 212–220.
69. Rodenburg, C.A. Quantification of economic benefits of multifunctional land use—An empirical analysis among employees. *J. Hous. Built Environ.* 2006, 21, 69–81.
70. Rodenburg, C.A.; Nijkamp, P.; De Groot, H.L.F.; Verhoef, E.T. Valuation of Multifunctional Land Use by Commercial Investors: A Case Study on the Amsterdam Zuidas Mega-Project. *Tijdschr. Econ. Soc. Geogr.* 2008, 99, 454–469, doi:10.1111/j.1467-9663.2008.00475.x.
71. Eijgenraam, C.; Ossokina, I. Cost-benefit analysis of railway station area development: The case of Amsterdam South Axis. In *Railway Development*; Bruinsma, D.F., Pels, D.E., Rietveld, P.D.P., Priemus, P.D.H., van Wee, P.D.B., Eds.; Physica-Verlag HD Heidelberg, Germany, 2008; pp. 191–211, ISBN 978-3-7908-1971-7.
72. Paracchini, M.L.; Pacini, C.; Jones, M.L.M.; Pérez-Soba, M. An aggregation framework to link indicators associated with multifunctional land use to the stakeholder evaluation of policy options. *Ecol. Indic.* 2011, 11, 71–80, doi:10.1016/j.ecolind.2009.04.006.
73. Engel-Yan, J.; Kennedy, C.; Saiz, S.; Pressnail, K. Toward sustainable neighbourhoods: The need to consider infrastructure interactions. *Can. J. Civ. Eng.* 2005, 32, 45–57, doi:10.1139/104-116.
74. Ramaswami, A.; Weible, C.; Main, D.; Heikkilä, T.; Siddiki, S.; Duvall, A.; Pattison, A.; Bernard, M. A Social-Ecological-Infrastructural Systems Framework for Interdisciplinary Study of Sustainable City Systems. *J. Ind. Ecol.* 2012, 16, 801–813, doi:10.1111/j.1530-9290.2012.00566.x.

75. Guy, S.; Marvin, S. Constructing sustainable urban futures: From models to competing pathways. *Impact Assess. Proj. Apprais.* 2001, *19*, 131–139, doi:10.3152/147154601781767113.
76. Fischer-Kowalski, M.; Hüttler, W. Society's Metabolism. *J. Ind. Ecol.* 1998, *2*, 107–136, doi:10.1162/jiec.1998.2.4.107.
77. Minx, J.C.; Creutzig, F.; Medinger, V.; Ziegler, T. *Developing a Pragmatic Approach to Assess Urban Metabolism in Europe: A Report to the European Environment Agency*; TU Berlin: Berlin, Germany, 2011.
78. Kennedy, C.; Pincetl, S.; Bunje, P. The study of urban metabolism and its applications to urban planning and design. *Environ. Pollut.* 2011, *159*, 1965–1973, doi:10.1016/j.envpol.2010.10.022.
79. Voskamp, I.M.; Spiller, M.; Stremke, S.; Bregt, A.K.; Vreugdenhil, C.; Rijnaarts, H.H.M. Space-time information analysis for resource-conscious urban planning and design: A stakeholder based identification of urban metabolism data gaps. *Resour. Conserv. Recycl.* 2018, *128*, 516–525, doi:10.1016/j.resconrec.2016.08.026.
80. Spiller, M.; Agudelo, C. Mapping diversity of urban metabolic functions—A planning approach for more resilient cities. In Proceedings of the 5th AESOP Young Academics Network Meeting 2011, Delft, The Netherlands, 15–18 February 2011; Delft University: Delft, The Netherlands, 2011; pp. 126–139.
81. Pandis Iveroth, S.; Vernay, A.-L.; Mulder, K.F.; Brandt, N. Implications of systems integration at the urban level: The case of Hammarby Sjöstad, Stockholm. *J. Clean. Prod.* 2013, *48*, 220–231, doi:10.1016/j.jclepro.2012.09.012.
82. Degeling, P. The significance of 'sectors' in calls for public health intersectoralism: An Australian perspective. *Policy Politics* 1995, *23*, 289–301.
83. Derkzen, P.; Bock, B.B.; Wiskerke, J.S.C. Integrated Rural Policy in Context: A Case Study on the Meaning of 'Integration' and the Politics of 'Sectoring'. *J. Environ. Policy Plan.* 2009, *11*, 143–163, doi:10.1080/15239080902920126.
84. Westerink, J. Making a Difference. Ph.D. Thesis, Wageningen University, Wageningen, The Netherlands, 2016.
85. Bressers, H.; Lulofs, K. *Governance and Complexity in Water Management: Creating Cooperation through Boundary Spanning Strategies*; Edward Elgar Publishing: Cheltenham, UK, 2010; ISBN 978-1-84844-955-8.
86. Opdam, P.; Westerink, J.; Vos, C.; de Vries, B. The role and evolution of boundary concepts in transdisciplinary landscape planning. *Plan. Theory Pract.* 2015, *16*, 63–78.
87. Williams, P. The Competent Boundary Spanner. *Public Adm.* 2002, *80*, 103–124, doi:10.1111/1467-9299.00296.

88. Star, S.L.; Griesemer, J.R. Institutional Ecology, ‘Translations’ and Boundary Objects: Amateurs and Professionals in Berkeley’s Museum of Vertebrate Zoology, 1907–39. *Soc. Stud. Sci.* 1989, *19*, 387–420, doi:10.1177/030631289019003001.
89. Clark, W.C.; Tomich, T.P.; van Noordwijk, M.; Dickson, N.M.; Catacutan, D.; Guston, D.; McNie, E. *Toward a General Theory of Boundary Work: Insights from the CGIAR’s Natural Resource Management Programs*; HKS Faculty Research Working Paper Series; John, F., Ed.; Kennedy School of Government, Harvard University: Cambridge, MA, USA, 2010.
90. Hernes, T. Enabling and constraining properties of organizational boundaries. In *Managing Boundaries in Organizations: Multiple Perspectives*; Palgrave Macmillan: Hampshire, UK, 2003; pp. 35–55.
91. Bijker, W.E.; Hughes, T.P.; Pinch, T.; Douglas, D.G. *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*; Anniversary Edition; The MIT Press: Cambridge, MA, USA, 2012; ISBN 978-0-262-51760-7.
92. Hughes, T.P. *Networks of Power: Electrification in Western Society, 1880–1930*; Reprint Edition; Johns Hopkins University Press: Baltimore, MD, USA, 1993; ISBN 978-0-8018-4614-4.
93. Joerges, B. Large Technical Systems: Concepts and Issues. In *The Development of Large Technical Systems*; Mayntz, R., Hughes, T., Eds.; Westview Press: Boulder, CO, USA, 1988; pp. 9–36.
94. Geels, F.W. From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Res. Policy* 2004, *33*, 897–920, doi:10.1016/j.respol.2004.01.015.
95. Mulder, K.; Kaijser, A. The dynamics of technological systems integration: Water management, electricity supply, railroads and industrialization at the Göta Älv. *Technol. Soc.* 2014, *39*, 88–99, doi:10.1016/j.techsoc.2013.11.003.
96. Vernay, A.-L.; Mulder, K.F.; Kamp, L.M.; de Bruijn, H. Exploring the socio-technical dynamics of systems integration—The case of sewage gas for transport in Stockholm, Sweden. *J. Clean. Prod.* 2013, *44*, 190–199, doi:10.1016/j.jclepro.2012.11.040.
97. Ashton, W.S.; Chopra, S.S.; Kashyap, R. Life and Death of Industrial Ecosystems. *Sustainability* 2017, *9*, 605.
98. Boons, F.; Chertow, M.; Park, J.; Spekkink, W.; Shi, H. Industrial Symbiosis Dynamics and the Problem of Equivalence: Proposal for a Comparative Framework. *J. Ind. Ecol.* 2016, *21*, 938–952, doi:10.1111/jiec.12468.
99. Vernay, A.-L.; Boons, F. Assessing Systems Integration: A Conceptual Framework and a Method. *Syst. Res. Behav. Sci.* 2015, *32*, 106–123.

100. Wu, J.; Guo, Y.; Li, C.; Qi, H. The redundancy of an industrial symbiosis network: A case study of a hazardous waste symbiosis network. *J. Clean. Prod.* 2017, 149, 49–59, doi:10.1016/j.jclepro.2017.02.038.
101. Domenech, T.; Davies, M. The social aspects of industrial symbiosis: The application of social network analysis to industrial symbiosis networks. *Prog. Ind. Ecol. Int. J.* 2009, 6, 68–99, doi:10.1504/PIE.2009.026583.
102. Chertow, M.R. Industrial symbiosis: Literature and taxonomy. *Annu. Rev. Energy Environ.* 2000, 25, 313–337.
103. Korhonen, J. Industrial Ecology for Sustainable Development: Six Controversies in Theory Building. *Environ. Values* 2005, 14, 83–112, doi:10.3197/0963271053306096.
104. Korhonen, J. Some suggestions for regional industrial ecosystems—Extended industrial ecology. *Eco-Manag. Audit.* 2001, 8, 57–69, doi:10.1002/ema.146.
105. Yu, C.; de Jong, M.; Dijkema, G.P.J. Process analysis of eco-industrial park development—The case of Tianjin, China. *J. Clean. Prod.* 2014, 64, 464–477, doi:10.1016/j.jclepro.2013.09.002.
106. Shi, H.; Chertow, M.; Song, Y. Developing country experience with eco-industrial parks: A case study of the Tianjin Economic-Technological Development Area in China. *J. Clean. Prod.* 2010, 18, 191–199, doi:10.1016/j.jclepro.2009.10.002.
107. Ashton, W. Understanding the Organization of Industrial Ecosystems. *J. Ind. Ecol.* 2008, 12, 34–51, doi:10.1111/j.1530-9290.2008.00002.x.
108. Chertow, M.; Ehrenfeld, J. Organizing Self-Organizing Systems. *J. Ind. Ecol.* 2012, 16, 13–27, doi:10.1111/j.1530-9290.2011.00450

3 Boundaries in action: A framework to analyse boundary actions in multifunctional land-use developments

Van Broekhoven S, Boons F, van Buuren A, Teisman G. (2015) Boundaries in action: a framework to analyse boundary actions in multifunctional land-use developments. *Environment and Planning C: Government and Policy* 33(5): 1005–1023. <https://doi.org/10.1068/c1398>

Abstract:

One way to achieve more sustainable spatial development and deal with pressures on space is through integrated or multifunctional land-use. Achieving effective integration, although attractive, presents governance challenges. One challenge is how to deal with boundaries. Actors from different backgrounds need to coordinate across and manage their boundaries to realise effective integration of land-use functions. We develop a framework to analyse how actors construct, maintain, challenge, and reconstruct boundaries in their (inter)actions, and we apply the framework to a case analysis of a multifunctional development. The analysis shows that, although integration seems to suggest only boundary crossing, actors also actively defend and reconstruct boundaries. We reflect on how the process of achieving effective integration is not only about overcoming boundaries but also about reconstructing and respecting joint boundary demarcations. These demarcations help to create a sense of order and clarity in terms of responsibility and accountability, and hence enable implementation.

3.1 Introduction

Western land-use planning has seen a period of monofunctional approaches—planning separately e.g. housing, employment, water management, nature—but last decades ideas to integrate multiple land-use functions in spatial planning received attention of policy makers and scientists (Louw and Bruinsma, 2006). Pressure on space and additional spatial claims from new measures—e.g. to adapt to climate change—make multifunctional land-use an attractive idea. Moreover a holistic approach combining economic, ecological, and social objectives is one way towards more sustainable spatial development in a fragmented governance context (Helming and Wiggering, 2003; O’Farrell and Anderson, 2010; Priemus et al, 2004). As the capacity to manage natural resources is often divided among multiple actors and crosses sectoral and vertical policy boundaries, actors need to coordinate activities and look for measures that integrate multiple objectives (Bressers and Lulofs, 2010). Such developments fit with numerous integrated governance initiatives aimed at producing more sustainable development, such as environmental policy integration and mainstreaming climate adaptation, or at more effective policy outcomes in other fields such as health care or social welfare (Keast, 2011; Van Buuren et al, 2013).

Realising such integration however entails a difficult governance task (O’Farrell and Anderson, 2010; Priemus et al., 2000). Studies on integrative initiatives show coordination challenges arise from different views and objectives between policy domains and from discrepant activities at governmental levels, and note that differing institutional structures, practices, and contextual dynamics shape actors’ willingness to integrate (Nilsson et al, 2009; Watson et al, 2008; Wiering and Immink, 2006). Tensions rise at the interface of actors (individuals and coalitions of individuals, e.g. organisations) with different and possibly incompatible interests, views, and institutional settings (Cowell and Martin, 2003; Degeling, 1995; Derkzen et al, 2009; Owens and Cowell, 2011; Priemus et al, 2000; Van Ark, 2006).

Here we focus on how actors deal with boundaries in multifunctional developments. Multifunctional developments bring together more or less autonomous governance systems dominantly organised according to the principals of bureaucracy: well divided into task units specialised and responsible for one function. Different governmental units, and often also actors from the private and civic domain, need to act collectively and balance their interests, objectives and frames. This implies that to realise multifunctionality actors from different backgrounds, previously acting individually, need to coordinate or align across well-established boundaries, of sectors, organizations, task responsibilities, roles, ideas, ways of financing and working. At the same time, the idea of effective integration is complicated by the need or desire to construct and maintain

boundaries. Although integration suggests overcoming boundaries to make whole what was separated before, we also know that boundaries have important social functions and that actors—especially formal organisations—actively construct and maintain them (Hernes, 2003; Lamont and Molnár, 2002). Moreover, research shows current practices can be deeply embedded in the structures, histories, and vested interests of sectors or organisations, and become defended, constraining the capacity to integrate (Cowell and Martin, 2003; Degeling, 1995; Derkzen et al, 2009). How then is effective integration possible, and what is needed for it? The aim of this article is to contribute to theories on effective integration in complex governance systems by analysing where boundaries emerge, are crossed, broken down, defended, and possibly reconstructed in multifunctional developments.

Previous organisational research shows that boundary spanning enables actors to coordinate practices across boundaries (e.g. Ancona and Caldwell, 1992; Leifer and Delbecq, 1978; Tushman, 1977; Tushman and Scanlan, 1981; Yan and Louis, 1999). Studies show that coordination challenges can be mediated by boundary spanners (Wenger, 2000; Williams, 2002), boundary objects (Star and Griesemer, 1989), or boundary organisations (Guston, 2001). Many organisational studies focus on, and provide valuable insights into, coordination across boundaries that are assumed to be relatively stable. Recent organisational studies, however, have drawn attention to the construction and evolvment of boundaries as complex, socially constructed, and negotiated entities to understand organisational change and multi-actor interaction (e.g. Heracleous, 2004; Hernes, 2004; Kerosuo, 2006; Mørk et al, 2012; Paulsen and Hernes, 2003; Santos and Eisenhardt, 2009). This puts the focus on how boundaries are evolved, negotiated or maintained when actors interact. We build on this and argue that, to understand integration in multifunctional developments, we need to understand the construction and reconstruction of boundaries. In multifunctional developments, negotiation and evolvment of boundaries can especially be expected and requires attention. To achieve integration, actors need to change or cross boundaries that others have defined and may want to maintain. Such boundary construction is researched in science and technology studies with the notion of boundary work. These two fields of literature so far are limitedly connected. Boundary work describes how scientists demarcate science from non-science to gain credibility, legitimacy, and epistemic authority for scientific work (Gieryn, 1983; 1999). The boundary is observed as continuously contested and negotiated between scientists and others, who all look for demarcations that legitimise their actions.

Whilst studies on boundary work focus on the demarcation of knowledge; here, however, we examine how boundaries are constructed, spanned, challenged, and reconstructed in

attempts by multiple actors to act collectively to realise multifunctionality. Besides this novel application, our contribution to these literatures is of an operational nature. The multi-actor context of multifunctional developments elucidates how actors act upon a multitude of boundaries that become salient at different times or for different issues (Abbott, 1995; Tilly, 2004). We cannot rely on assumptions about what boundaries are relevant (e.g. between science and policy, organisation and context). To identify where boundaries become salient and how they are (re)constructed, we argue that one effective method is to study how boundaries are created in action. This is what we do here. We develop a framework to systematically map and analyse in depth the dynamics of boundary (re)construction in action during the process of achieving multifunctional developments.

Regarding multifunctional developments, studies on boundaries have been few and so far focused on boundary spanning (e.g. Bressers and Lulofs, 2010). We aim to contribute to a better understanding of the challenges and strategies for realising effective integration of land-use functions by analysing how actors construct, span, maintain, reshape and negotiate boundaries. We apply the framework to a case study where actors create a multifunctional development at the crossroads of water safety, economic development, and urban development. In the case, Dakpark Rotterdam, actors combine a private commercial building, public rooftop neighbourhood park, flood defence structure, and energy infrastructure in an urban development.

The remainder of this paper is organised as follows. In section two, we define the concept of boundaries and show how boundaries are constructed and reconstructed. In section three, we develop a framework and methodology to analyse the processes involved in (re)constructing boundaries. Section four presents the case study. Finally, we discuss the findings and the applicability of the framework for the analysis of boundaries.

3.2 Boundaries in Multifunctional developments

Actors in multifunctional developments often use terms like ‘integration’ or ‘collaboration’. They are aware of a need to deal with boundaries. However, capturing these boundaries conceptually is no easy task. As argued by Hernes (2004) among others; boundaries are not readily visible. There are no clear lines of demarcation like a country’s boundary marked by fences. In governance systems, there can be some tangible boundaries, e.g. lists of who is included in, or excluded from, meetings, or territorial lines of division. Most boundaries, however, are more subtle, invisible, inchoate, or at best blurred, e.g. boundaries in the ways problems or solutions are conceived or in routines (Hernes, 2004; Jones, 2009). To study boundaries systematically, a specification of the

concept and the way in which we analyse them has to be developed. In the next section, we define and conceptualise boundaries, reviewing some of the literature on the concept.

3.2.1 Defining boundaries

Boundaries are in essence sites of difference—ways of differentiating something from what it is not (Abbott, 1995; Hernes, 2004). Following Kerosuo (2006, page 4), we define boundaries as temporary stabilised “*distinctions and differences between and within activity systems that are created and agreed on by groups and individual actors over a long period of time while they are involved in those activities. These distinctions and differences can be categorisations of material objects, people and practices*”.

Sturdy et al (2009) usefully elaborate that boundaries are about difference, identity and an intention about this; i.e. a boundary comes about by creating a difference, relevant in identifying one in relation to another, and making this salient by intending to cross, change, or maintain it. By drawing boundaries actors influence governance processes, demarcating who or what they do or do not consider as relevant, valid, or inside or outside a certain category (Churchman, 1970). Boundaries thereby have a quality which separates and alienates, as well as includes, creates groups, and generates feelings of similarity (Epstein, 1992; Yan and Louis, 1999; Sturdy et al, 2009). At the same time, they link two sides together and are about interaction between both. They enable, provide a barrier to, or regulate interaction across (Lamont and Molnár, 2002; Star and Griesemer, 1989; Tilly, 2004). More generally, boundaries have constraining and enabling properties (see Hernes, 2003). Whereas integration suggests that boundaries need to be overcome to join skills and resources, the idea of bureaucratic order stresses that boundaries have important functions. They enable complexity reduction, structure, and specialisation (Lamont and Molnár, 2002; Hernes, 2003).

3.2.2 A focus on boundaries in action

Various boundary scholars have argued that it is useful to view boundaries as dynamic and study how they are maintained or evolved when actors interact, rather than thinking of boundaries as fixed divisions, emphasising their socially constructed, multiple, and evolving nature (Barth, 1969; Heracleous, 2004; Hernes, 2004; Jones, 2009; Sturdy et al, 2009). Following Hernes (2004), Sturdy et al (2009), and others, we focus on how actors construct, negotiate, and shape boundaries. Firstly, boundaries are social constructs; they exist in the minds of social actors as part of their mental maps/frames or boundary judgments (Churchman 1970). These mental constructs become part of social reality through actors’ articulations, actions, and interactions. They do not exist independent of such enactment. The boundaries that affect governance processes are those that are shaped by being acted upon over and over again, based partly on past activities and

experiences and partly on interactions with the other side and changes in the environment (Hernes, 2004; Hirschhorn and Gilmore, 1992; Kellogg et al, 2006). Secondly, multifunctional developments bring together a multitude of actors and potential boundaries. Moreover, individual actors act upon multiple boundaries, e.g. of sectoral units, organisations, projects, informal coalitions of co-workers (Abbott, 1995; Hernes, 2004; Lamont and Molnár, 2002; Sturdy et al, 2009; Tilly, 2004). Thus actors act in a variety of roles, and this gives rise to various inside/outside relations (Sturdy et al, 2009). Consequently, actors act within a set of multiple, permeable, ambiguous boundaries. Thirdly, boundary theorists emphasise that boundaries are never finished or fixed. They are constantly interpreted, shaped by being acted upon, and discussed and struggled upon by groups of actors with different views (Hernes, 2004; Hirschhorn and Gilmore, 1992; Jones 2009; Lamont and Molnár, 2002). This does not prevent some boundaries from becoming agreed upon and relatively stable in a historic context, making them more difficult to cross or modify (Hernes, 2004; Lamont and Molnár, 2002).

One consequence of this conceptualisation is that we cannot take boundaries for granted, for instance in terms of legal entities or formal jurisdictions. For example, we can assume that organisations' boundaries are relevant. However, actors may organise a working group involving actors from different organisations and develop joint-ness within this group and boundaries between the actors and their home organisations. Several authors suggest exploring the construction, evolvment, and maintenance of boundaries in action (Abbott, 1995; Barth, 1969; Hernes, 2004; Kerosuo, 2006). We take the (re)construction of boundaries in action as our starting point. Rather than researching how interaction across given groups' predefined boundaries takes place, we start by analysing the enactment of boundaries by actors in the empirical context. This brings us to the question of how boundaries are studied and identified in such an approach, especially for multifunctional developments where multiple actors interact on a complex multitude of potential boundaries.

3.3 How to identify boundary actions

Boundaries become part of social reality and evolve through actors enacting them. Therefore, rather than researching how interaction across predefined boundaries takes place, we start by analysing the enactment of boundaries by actors in specific empirical contexts. We argue that one way to study how boundaries are (re)constructed and evolve is to identify and observe or reconstruct (from documents and respondents' stories) the boundary actions of the involved actors in specific empirical contexts. We define a boundary action as: *a recurring set of articulations, actions, and interactions that shape a demarcation, taking place over a longer period of time.*

To identify actors' boundary actions, we use a typology of boundary actions, building upon earlier typologies. Research on organisational boundaries shows that actors draw boundaries (e.g. to guard release of information or resources, enable feelings of similarity, or 'buffering' to protect from external disturbances) as well as span boundaries (e.g. to coordinate or exchange resources, or scout for new connections) (Ancona and Caldwell, 1992; Fennell and Alexander, 1987; Friedman and Podolny, 1992; Yan and Louis, 1999). Adding to this, Mørk et al (2012) differentiate between stabilising and destabilising boundaries to highlight how they are challenged and negotiated in innovation processes. Dumez and Jeunemaitre (2010) similarly distinguish strategies to change boundaries and strategies to maintain boundaries when controversies about boundaries arise. We follow this. Actors who see benefit in multifunctional developments may develop strategies aimed at changing boundaries to realise multifunctionality. Other actors in response may develop strategies to maintain or defend boundaries. We see this process of destabilising and stabilising boundaries as emergent, as done 'in the making'. Given the intangible nature of boundaries, it is quite likely that actors do not completely know at the start of a multifunctional development which boundaries will prove relevant or problematic. Rather, boundaries are drawn in response to something that apparently challenges or activates them, and evolve through actors' interactions and contextual dynamics. We distinguish boundary actions in four ways:

- 1) Challenge boundaries, referring to problematising existing ideas or divisions. Actors challenge boundaries to e.g. include new actors, ideas, or resources. Distinct from spanning, this entails intending to change a previous demarcation. Multifunctionality generally implies challenging boundaries to realise integration;
- 2) Stabilise or maintain boundaries, referring to strategies to defend or draw demarcations. This may occur to demarcate who or which problems and solutions are included, to protect or buffer something from conflicting interest, to enable successful action within. We subdivide actions to draw boundaries and regulate flow of information or resources. In processes of integration, drawing boundaries can be a response to being challenged by the idea to integrate;
- 3) Span a boundary whilst respecting the distinction it entails, referring to e.g. scouting or spanning. This may occur to facilitate coordinating practices or exchange information across boundaries. This is a distinct action, as spanning facilitates flow across a boundary without challenging its relevance or place but rather reconfirm it as active. The boundary is not directly changed;
- 4) Lastly, boundaries are enacted, upheld, and made part of social reality through articulations of stories (Hernes, 2004; Tilly, 2002). Boundary stories are stories people tell to distinguish themselves from others, or a project from what it is not (Tilly, 2002). They can be seen as rationalisations about why boundaries are there

and provide insight into why they are maintained or overcome. A story may reflect upon multiple previous actions.

Physical dimension	Social dimension	Cognitive dimension
<p><i>Material, technological, or spatial arrangements providing distinctions between actors</i></p> <p>Relates to ownership or authority over territories or objects, appropriating something as yours enduring over time (Barth, 1999). Tends to be tangible and have instrumental purposes, can also have symbolic effects (Hernes, 2004), e.g. physical or territorial divisions or connections, boundary objects (Hernes 2004, Sturdy et al, 2009).</p>	<p><i>Social relations between actors</i></p> <p>Relates to the social bonding between actors, who is considered inside and outside, sets limits that mark social groups (Barth, 1999; Hernes, 2004). Reflected in e.g. loyalty, trust, identity, and norms (Hernes, 2004). Also involves the emotional connection established in personal relationships, e.g. who is involved or taken into account in decision making, who is referred to as ‘us’ and ‘them’.</p>	<p><i>Ideas, interpretations, and beliefs</i></p> <p>Explanations and interpretations can be valid inside certain boundaries but not hold outside of them (Weick, 1995). Boundaries here are differences of kind; both sides see different issues as being at stake, or their perceptions of issues may be incompatible (Cohen, 1999), e.g. differing conceptions of problems or solutions, limits to what is seen as possible or not, boundaries in flow of information and ideas.</p>

Table 3.1 Dimensions of boundaries, adapted from Hernes (2004)

Enactment Dimension	Boundary stories	Challenging/ destabilising	Stabilising/maintaining		Assuming but spanning
			Reconfirming or establishing	Regulating	
Physical	Story/narrative people tell to communicate a demarcation between sides	Physical events or things that do not keep to the demarcation between social worlds	Physical or territorial (ownership) divisions	Physical interfaces regulating or monitoring the physical flow across	Physical connections perceived by involved actors as not directly challenging a demarcation, boundary objects
Social		Problematising / changing established demarcations about who is in/excluded in decision-making process	In/excluding actors in decision making or group actions Use of language: We/us–they/them	Buffering or regulating the access of others across a demarcation	Building or enhancing connections with actors across a demarcation
Cognitive		Problematising / changing existing frames/ideas or (im)possibilities. Problematising divisions of roles, tasks, or responsibilities	Demarcating limits on (im) possibilities or ideas taken into account Differing conceptions of problems or solutions Dividing who leads on what	Buffering or regulating the flow of information or ideas between social worlds	Strategies enhancing flow of information or ideas across a demarcation, e.g. exploring other’s interests, developing ‘common ground’ shared stories on project

Table 3.2 Operationalisation

To observe these ways of enacting boundaries, it is helpful to distinguish (interrelated) dimensions on which actors express boundaries. Several typologies have been suggested. For example, Hirschhorn and Gilmore (1992) distinguish authority, political, task, and identity boundaries. Hernes (2004) distinguishes physical (formal rules and physical structures), social (social belonging, identity, inclusion), and mental boundaries (ideas important to groups). Sturdy et al (2009) identify physical (physical/technological things enabling/constraining interaction), cultural or cognitive/emotional (identification, cognitive distance), and political boundaries (influence relations and dependencies). Following Hernes (2004), we distinguish social (social relations between people), cognitive (ideas and meanings), and physical (material or territorial) dimensions. Whereas Hernes combines these with effects of boundaries on organisations into a framework to analyse boundary characteristics of organisations, we adapt this framework for our own purpose and use these dimensions together with boundary actions as a lens to map and interpret boundary (re)construction (see Table 3.1).

These dimensions are interrelated. Physical boundaries, for example, are also social and mental in the sense of physical closeness influencing social bonding, and different meanings objects may have for different actors (Sturdy et al, 2009). With these interrelations in mind, the three dimensions are useful to derive indicators of boundaries. Table 3.2 shows indicators on each of the dimensions on which boundaries may be expressed and for the four basic types of actions to deal with boundaries. Boundary stories may concern each dimension within one story line and are thus not specific to a dimension.

3.4 Exploring boundary dynamics in the Dakpark Rotterdam case

3.4.1 Data gathering and analysis

To explore boundary dynamics and study in depth the micro-interactions of boundary processes in action, we use a single case study research design. Consequently, it makes sense to choose an extreme situation in which the process of interest is ‘transparently observable’ (Eisenhardt, 1989; Pettigrew, 1990). We selected a case where actors integrate several functions involving a primary sea levee that is part of a major flood protection structure in The Netherlands. Given the important historical role and position of flood protection in The Netherlands, this provides a setting where boundaries as traces of past activities are strongly present. Moreover, the case is in a late stage of implementation, thus providing ample opportunity to study the emergence and dynamics of boundaries beyond the formulation of plans.

To map the boundary dynamics and to analyse structurally actors' actions and interactions, the decision-making and implementation process is reconstructed and analysed, focusing on sequences of events, as applied in innovation history analysis (Spielman et al, 2009; Klerkx et al, 2010). The process of developing and realising multifunctional land use in the Dakpark was studied from 1998 (the rise of the idea) to 2012. Data were collected by: (a) 16 semi-structured interviews with actors from different organisations and involved in different periods of time; (b) observations of actors' interactions in five meetings between (some of the) actors, between May and November 2012; and (c) complementary internal (e.g. project documents, contracts, minutes of city council meetings) and external documents (e.g. policy documents, news items). This approach facilitates data triangulation, thus preventing the risk of distortions in post-factual accounts and increasing internal validity. Interviews were transcribed, and reports were made of observed meetings. The data were processed into a detailed chronological case description. Subsequently, from the dataset developed under a) to c), occurrences were selected that indicated the articulation or contestation of a boundary, based on the definition of boundary action and indicators described in section 3. This was an interpretive act of the researchers.

3.4.2 Results

We first position the case within its overarching institutional context. Next, we crudely describe the case, and then focus on two sets of boundary actions. Multiple boundaries played a role, but we focus on two to get an in-depth understanding of how boundaries are constructed, negotiated, and evolve in actors' actions. Lastly, these boundary actions are related to the framework.

3.4.2.1 Context

Several aspects in the overarching context played a role in the development of multifunctional land-use in Dakpark. First, scholars have noted that multifunctionality in the Dutch context represents innovation in existing land-use practices, in which policy development is traditionally the responsibility of sectoral departments, and water management is governed by specialised public organisations called water boards (Louw and Bruinsma, 2006; Van Ark, 2006). Second, interest in multifunctionality and perceived pressure on space has risen in The Netherlands: in 2000 a national report concluded a large shortage of space; in 2000 a knowledge platform on multifunctionality started; in 2002 a national spatial planning report introduced the concept to policy (Projectteam Ruimtebehoefte, 2000; Van Ark 2006; VROM, 2002). Third, interest is rising in more integrated planning approaches, e.g. Rotterdam municipality reorganised its economic, planning, and engineering departments into one department of city development, and water management is increasingly related to other functions (see

Wiering and Immink, 2006). In sum, momentum for multifunctional developments has risen. The idea for Dakpark was born in 1998, predating the national interest in multifunctionality and thus a front runner at its inception.

3.4.2.2 Process description

The Dakpark is situated in the city of Rotterdam, The Netherlands, on a former train shunting yard between a harbour and a disadvantaged neighbourhood. When this train shunting yard was reduced in size, multiple claims were made on the future use of this location: the municipality and Port Authority envisioned harbour-related business development, whereas local residents had already for years been asking for a neighbourhood park. Several functions were already operating there, including a primary sea levee and city-heating infrastructure. This triggered some municipal actors to develop an innovative idea: to accommodate multiple claims by building a park on the roof of a commercial building, extending down to street level over four remaining rail tracks, the levee and the heating infrastructure (see Figure 3.1). The name of project, Dakpark, is Dutch for roof park.

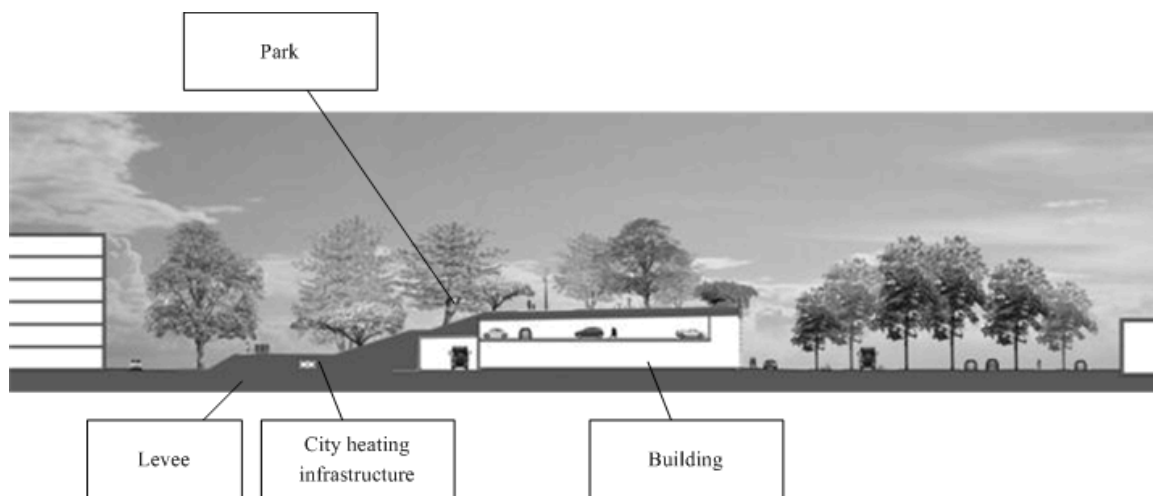


Figure 3.1 Final design for Dakpark Rotterdam (source: municipality of Rotterdam, adjusted by

Initially a far-fetched idea received sceptically, the initiators succeeded in creating support after receiving a nomination in a planning contest, comparing the idea with alternatives, and ‘mini-conferences’ with some stakeholders. An important event is setting-up intensive resident participation, giving the residents a voice in the development. After a €12 m. subsidy from the national government, doubts about financial feasibility disappeared. A project developer was selected to develop the building. Actors from the municipality and the developer proceeded with the design, closely involving the residents and, more distantly, stakeholders such as the water board, the energy company, the railroad company, the harbour authority. Between 2001 and

2004, actors discussed relocating the levee and the heating infrastructure, and alternatives such as heightening the levee or flood-proofing the building, but decided against these.

In 2004 it became clear that due to external circumstances activities in the harbour would decline. Consequently, 1) the railroad company decided to remove all rail tracks, and 2) there was no longer demand for a harbour-related commercial building. The municipality and the developer decided to continue the plan, designating the building for retail. This did not accord with municipal and regional retail policy and led to a discussion on retail designation within the municipality (2005–2007). In 2007 the required permit for the constructions near the levee was received but involved unexpected conditions, leading to an impasse. Finally, the municipality accepted the risk of having to remove the building and park if the levee needed to be heightened.

At the end of 2011 the building was finished and retailers opened their doors to the public. The construction of the roof park was started in 2012 but was stopped due to physical problems regarding the heating infrastructure, posing a risk for city heating and the levee. Figure 3.2 shows the main events.

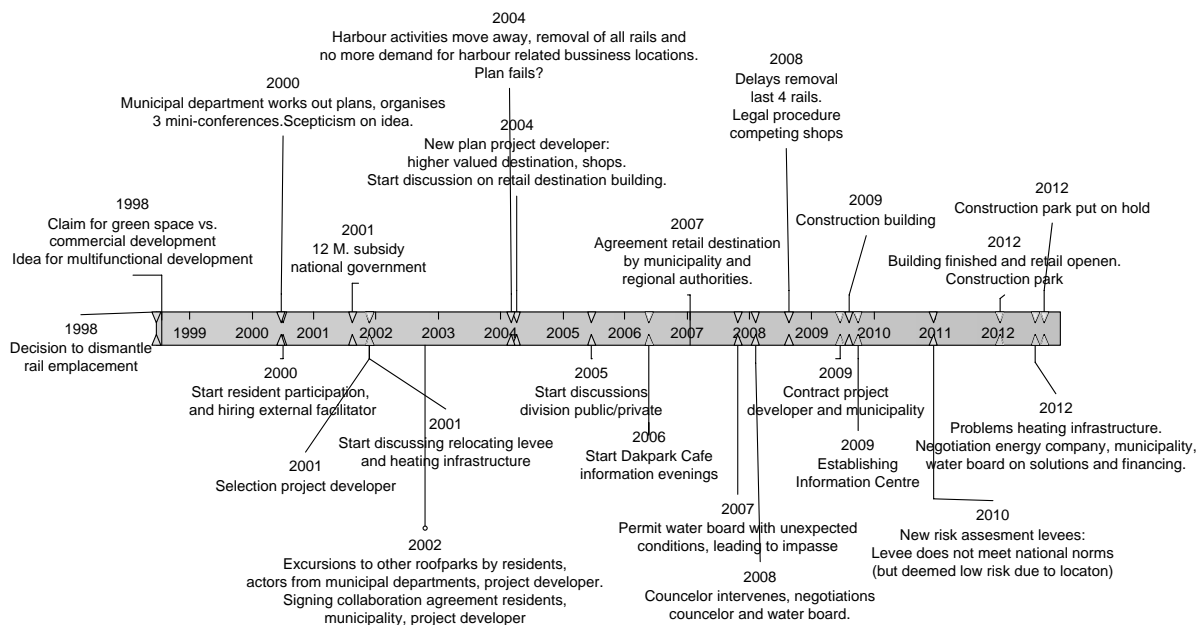


Figure 3.2 Timeline development and implementation of Dakpark with main events.

3.4.2.3 Two boundaries in depth

We present two sets of boundary actions, concentrated around 1) developing a public park on a private building and 2) combining the development and the existing levee. These were selected because they involve the most explicit articulations, actions, and interactions shaping demarcations as found in the data. We hence conclude that they indicate main boundaries as experienced by the actors involved.

Boundary 1: Park, Building

This multifunctional project originated from competing land-use claims: neighbourhood park vs. commercial building. The idea for a park on the roof of the building presents the different claims as not juxtaposed, but as adding value. Between 1998 and 2000, the municipal city planning department developed the plan for the so-called double land-use for all functions. In 2001 the municipality invited tenders for a private company to commercially develop the project. The winning company made a design comprising a building and a park. Actors within the municipality, however, drew a clear demarcation as to who would do what within the multifunctional project. A municipal project manager stated: *“They had put forward a design for the park as part of their vision. But part of the contest was that the municipality would design the park in the remaining process. And that the municipality would pay and construct it. And they had to allow that, that we would construct a park on their roof”*. And later: *“It was a public thing; it had to be a public park. So, we will do that”*.

Several activities facilitated the coordination between actors. To develop the plans, both organisations made their own plans for the building and park but also developed joint working groups on specific topics (e.g. engineering, park design). Various collective social activities were organised for the residents, also involving actors from various municipal departments and the project developer, namely, joint excursions to other roof parks (2001–2003), collaboration agreements (2002), jointly celebrating steps taken in the project, e.g. by symbolically removing the first rails (during the process). Actors thereby enhanced personal relations and created shared experiences in the process.

From 2005 discussions focused on allocating costs and making more definite agreements on responsibilities in a public–private contract. A municipal project manager stated: *“The excursions were over; we knew now what those roof parks looked like. It was about money, about contracts, about shops or no shops, and eventually, finally, about are you going to do it, yes or no?”* And later: *“We had to negotiate with Dura for two years on the question: what will the building cost you extra, because we want to build a park on top. We called this excessive development costs”*. This signals the redrawing of a

boundary. The costs allocation is made between the building and the park. One factor deemed to have facilitated this was the subsidy received by the municipality in 2001 which could, among other things, be used for the additional costs of realising the park on top of the building.

Respondents stated that detailed discussions arose about the parts where the building and the park (physically) meet each other. Another municipal project manager stated: *“The ... park on top of the building belongs to the municipality, but how do you organise that and establish that. That’s just complex. And both parties want to minimise risks. And both parties were having a romp for a long time. ... So then you are talking about a water- and root-proof layer that they would apply, but we would pay for those costs. Well, what then are the costs? But also things such as a lift, or stairs, or a fence. Yeah, whose is the fence? Because the fence belongs to the frontage [of the building] but also belongs to the park”*. Actors hence faced questions about how to deal with risks, costs, and responsibilities. The roof and possible leakage was a special point of discussion (2007–2009). The municipal engineering department stressed that the roof was to be carefully developed and demanded that it should be safe for at least 25 years. A solution was found by taking out joint insurance, and several measures were taken to minimise risk of leakage: multiple layers of roofing to establish water- and root-proof insulation; materials tested by the engineering department on quality; an external company hired to monitor that the roof was physically installed correctly. Similar discussion arose on other points where public and private meet (e.g. elevator, stairs, park fence). A municipal project manager stated: *“In negotiating the contract it was very difficult where you put the point of detachment. In that regard this is a unique project. A private building with a public park. ... And here you get a division in responsibilities. We have one joint insurer, so if there is leakage then we have the same insurer. But still you get of course: who pays for which layer of roofing, and what do you cause with your commercial building, and what do we as a municipality cause by wanting to develop a park?”*

‘Grey areas’ that initially arose were more and more delineated in terms of cost, ownership, and tasks. A project developer manager stated: *“For us it was very important that the buildings were closed off with a waterproof layer. So the top of the layer is for us the boundary. The municipality has to construct the park, so for them the bottom of the park is a clear boundary. ... So then there is a small layer of insulation left where there was some discussion about; where does the insulation belong to?”* A municipal project manager stated: *“Where you meet each other there have been large discussions. Look for instance at those stairs. ... You can walk up here [to the park] next to the building. That of course was also such an issue: who constructs the stairs, who is responsible for the stairs, who is the owner, where is the division? We prescribed natural stone according to*

Rotterdam style. I think the division in the stairs is under the coating of the steps". Actors hence work out divisions of tasks, costs, and ownership in detail in the physical shape of the project. These quotes show that respondents related the creation of these divisions to a need to deal with responsibilities, reach agreement on cost division, and minimise risks.

Collaboration and interaction on the social and cognitive dimension was at the same time actively sought, especially around the residents. From 2006 quarterly meetings were organised, called Dakpark café, where actors from both the municipality and the developer discussed the state of affairs regarding the project with the residents. In 2009 a jointly financed information centre on the project was opened, located next to the project area and a physical informal meeting space. In 2009 the agreements discussed in the previous years were set out in a public–private contract.

Table 3.3 summarises these boundary actions in the framework.

Enactment Dimension	Boundary stories	Actions challenging/destabilising	Stabilising/maintaining		Actions assuming but spanning
			Actions reconfirming or establishing	Actions regulating	
Physical		Perceived risk of leakage and roots damaging roofing	2001 Park = municipality, building = project developer 2005–2009 Ownership divisions in physical structure	2009 External company monitoring roof 2009 Testing of materials	2009 Joint insurance roofing 2009 Establishing Information Centre
Social		2000 Active involvement residents 2001 Involvement project developer	1998 City planning works out plans		2001 Working out own plans but joining working groups 2001–2003 Excursions, collaboration agreements During process, jointly celebrating steps
Cognitive		1998 Idea double land-use 2001 Vision project developer includes park	1990s Economy and park as competing claims 2001 Park is a public thing 2005–2009 Working out divisions tasks, roles, costs, risks		1998–2000 Comparing alternatives From 2006 Information evenings

Table 3.3 Boundary actions for Dakpark building and park.

Analysis boundary 1

Reflecting on this set of actions, we can observe that boundaries are changed and spanned, as well as drawn and jointly reconstructed. An initially perceived competition between green and economic development is changed by the multifunctional idea, and new actors are included. When the project developer joined, a physical and cognitive boundary was drawn dividing public and private tasks between the building and the park. Boundary spanning on the social and cognitive dimension through collective project activities enabled actors to enhance personal relations, create joint-ness, and exchange ideas, whilst tasks remained separately organised. A boundary was reconstructed when finances and the contract were being negotiated. Responsibilities, risks, and costs became unclear or collective in relation to parts where multiple actors wanted to play a role. Actors did not wish these to remain collective and so allocated costs, responsibilities, and risks to either the public or the private partner. Grey areas were delineated in the physical object by specifying who exactly had responsibility for what (physical dimension), and by dividing tasks and costs (cognitive dimension). Another issue was the minimisation and clarification of risks, especially seen with regard to the roof. This way, actors negotiated and mutually reconstructed cognitive and physical boundaries on which they both agreed. Interestingly, doing so seems instrumental in determining how to work together. Noticeably, parallel to this process of reconstructing boundaries, collective activities spanning boundaries on the social and cognitive dimensions continued.

Boundary 2: Levee

The plan developed by the municipality involved extending the park from the top of the building downwards over an existing levee and adjacent city-heating infrastructure. Levees in The Netherlands are governed by water boards. The board is perceived to regulate the levee strictly. An advisor commissioned by the municipality to organise the resident participation recounted: *“In 2000 at some point some residents had put a sign on the levee saying that they wanted a park. A week later in the mail came a court order from the water board: Where is the building permit, it is storm season. ... The levee is just from an entirely other world. That is why it stays as it is”*. A municipal project manager stated: *“From the start we have said: ‘You do not have to design with us. We respect your levee’. That is how we played it. We stay away from the levee if we need to, and we need to. It would have gone wrong if we had built in the levee. ... But every project leader knows, especially in Rotterdam, you do not touch the levees. You do not touch them. In this town. Because they are all around town, these things. And if you go tinkering with the civil works, as artistic as it may be, then you take on a heavy task. That*

is a lot of misery”. These quotes signal that actors perceived a strict boundary from the start.

Nevertheless, the municipality planned to develop the building and park close to and across the levee. In The Netherlands a levee and its surrounding area, a so-called protection zone, is regulated by the water board by decree¹. To realise the plans, a permit was needed from the water board. An engineering department employee stated: *“The decree is their law, their bible. ... So that decree is very important and you have to deal with that you stay outside of that. Well and we are driving piles in it you know. ... So yeah then in the design phase, on paper, they are very strict”*. This quote shows the dual position of perceiving a strongly defended boundary, whilst simultaneously intending to physically go across it by constructing in the levee protection zone.

With regard to the social dimension, interaction took place mainly bilaterally between the water board and municipal engineering department. The discussions focused on creating possibilities for the park and building to be built whilst retaining the dike. Discussions (2001–2004) were held on relocating the levee or designing the building so that it had a water safety function. This did not work out; contradictory reasons were given for this. A solution was sought by making changes in the decree about the levee, to allow the Dakpark to be realised. A main contact was the permits department. When difficulties arose in the interaction, municipal actors tried to solve these by meetings at directorate or political level. Both parties signalled a sometimes difficult interaction. An important point of discussion was the physical pressure on the city heating because of the park being constructed on it. The stability of the city heating was important for the water board because leakage from the heating could damage the levee. The water board required various calculations from the municipality to prove its stability.

In 2007 the water board provided the permit for Dakpark. It contained conditions that were unexpected by the municipality and the developer, creating an impasse in the process. One condition was that the water board at all times should be able to heighten the levee, entailing the removal of part of the park and the building. The project developer did not accept this condition for the building. The impasse was resolved after negotiations with the municipal alderman and the political head of the water board, and the municipality, after applying a risk calculation, decided to agree with this condition and to take over the risk from the project developer. Although this signalled a strict boundary, at the same time some respondents referred to a good relation on a personal level. One engineering department employee explained the difference between both sides

¹ A water board decree entails a set of orders and restrictions with respect to water management. When these are violated, an administrative enforcement or penalty provision can be applied. In Dutch: Keur.

as: “For me the project just needs to continue and you look for how. But he just looks from the perspective of the levee, from the permit”.

Several events led to problems. In 2010, a nationwide inspection found that this levee did not meet the national norms². In 2012, the city-heating infrastructure was found to be tilted, leading to the water pressure being too high. Building activities for the park were stopped on the authority of the energy company. Future solutions will require a new permit from the water board. The interaction led to negative feelings about the project and permit expressed by involved actors in the water board. Table 3.4 summarises these boundary actions.

Enactment Dimension	Boundary stories	Actions challenging/destabilising	Stabilising/maintaining		Actions assuming but spanning
			Actions reconfirming or establishing	Actions regulating	
Physical	Levee as very strict, from another world Explanation respondent tries to realise project, other just looks at the decree	Envisioned project area includes levee and protection zone 2000 Residents' sign in grass on levee 2012 Damaged city heating	2000 Court order in response to sign 2007 Permit with conditions	Decree A permit is required for any action in protection zone Calculations: pressure on levee	2004–2007 Seeking for changes in decree
Social			Bilateral contact, not via central project team Difficult interaction process		Meetings water board – engineering department, politicians 2008 Negotiations permit
Cognitive		2002–2004 Discussion on alternative solutions	Perceived need not to touch the levee		

Table 3.4 Boundary actions for Dakpark levee

Analysis boundary 2

This set of actions shows a boundary that is perceived as strict, is challenged by the project, and becomes maintained and defended. Noticeably the boundary was challenged and crossed on the physical dimension by developing the project in the protection zone,

² Please note that this inspection at the same time noted a low risk of flooding, due to the location.

but on the cognitive dimension a strict boundary was perceived and perpetuated, as the references to ‘another world’ or ‘their bible’ show. Actors did not succeed in finding alternatives that worked for both; the focus was on maintaining the existing situation and realising the project through exceptions to the decree. On the social dimension, interaction was mainly bilateral, and activities to facilitate coordination were more limited than those around the building and park. On the physical dimension, the territorial divisions were strict; any action in the protection zone requires a permit. Strong regulatory power enabled the water board to maintain the physical boundary. At the same time, space for manoeuvre was found, as shown by the willingness to discuss exceptions to the decree, apparently through a process of political negotiation. This created a temporary (physical) crossing effectively used to realise the multifunctional development, perhaps more than originally expected by the water board’s officials. The process led to an un-easy co-existence. The current physical problems led to a new problem of a levee at risk and regret about allowing this crossing. The negative reactions expressed in hindsight by employees of the water board show this. In this way, both groups kept at a distance in terms of views on the project and finding a multifunctional solution that provided synergy benefits for both, whilst at the same time the functions became physically connected.

3.5 Conclusions and discussion

When actors specify integration as their aim, they are confronted with boundaries. We analysed how boundaries were constructed, dealt with, and evolved in actors’ interactions in attempts to realise multifunctional developments. Our case analysis shows that in multifunctional developments actors actively (re)construct and defend boundaries, as well as span them. In addition, it provides insight into motivations behind boundary construction. In the Dakpark Rotterdam case, a new demarcation (i.e. not perpetuating an existing situation) between the park and building—representing the more fundamental division between public and private tasks—was actively constructed during the development process. One of the difficulties with which actors were dealing was that roles of actors previously acting separately overlapped in the multifunctional development. With this overlap, it became unclear who should bear what responsibilities, risks, and costs, or whether they should be shared where multiple actors desire a role. Actors did not wish to leave these as collective but allocated them to either the public or the private partner. In doing so, a detailed demarcation was negotiated in the physical structure. This is in line e.g. Brown et al (2000), who find that interdisciplinary work (in interdisciplinary health teams) is not only about blurring or removing boundaries between professions but can also actively encourage boundaries. The act of working together can encourage demarcating who does what, and what the one is distinct from the other.

Interestingly, and contrary to the traditional perception of boundaries as being problematic for cooperation, constructing this boundary seemed to facilitate establishing how to work together. It enabled actors to create a certain sense of order or clarity in terms of responsibility and accountability, and thereby facilitated realisation. We conclude that achieving effective integration is not only about crossing boundaries but can also be benefitted by jointly reconstructing boundaries. This reconstruction was a joint process in the sense that it was formulated in intensive two-way communication and negotiation, and embedded in spanning activities. Actors prior to, and simultaneous with, reconstructing boundaries also spanned boundaries, through collective project activities that enhanced personal relations and created a certain jointness. This created a dynamic integration of aims and solutions.

Interestingly, actors accepted some boundaries even before they attempted to challenge or reshape them. The status of the levee in the Dakpark case is a fascinating example: participants agreed beforehand that the levee should be respected. As a result, little attempt was made to really involve or integrate the levee in the project. Instead, actors sought exceptions from the existing decree. Although this can be interpreted as showing the enduring power of the water board on the levee—prioritising maintaining the integrity of the flood management system—the boundary was successfully crossed in the sense that the project was allowed in the protection zone of the levee. For the water board, however, the Dakpark remained a bother. The boundary remains a troublesome stumbling-block, with negative feelings about the permit and a new problem rising regarding the functioning of the levee. One may ask if it is not a logical expectation such historically well-established power over the levee is perpetuated. Yet, water managers may and do also decide to look for ways to cross this boundary. Indeed in this case the project was allowed. More generally, water management in The Netherlands seems increasingly to be related to other functions and there are various initiatives integrating water tasks with other functions (see for a reflection Wiering and Immink, 2006). We have attempted to contribute to the understanding of challenges and strategies for such attempts for multifunctionality by studying how boundaries are maintained, overcome or evolved.

We started this article stating an integrated approach is one way to enable more sustainable spatial development. The analysis shows, in line with other studies on integrated initiatives, this involves on-going tensions between actors with different views and orientations. What is good for one function is not always good for another. This is seen in the case analysis especially regarding the levee. We conclude that crossing boundaries is an important part of the story of achieving multifunctional developments, but not the whole story. Boundaries have an important function in creating clarity on

tasks and responsibilities, making it possible for organisations to fulfil their core business tasks into the future. The risk of boundary crossing at the same time is that, even if it generates intriguing results on multifunctionality in the short term, it will hinder organisations in their own tasks and thereby hinder achieving multifunctional solutions that keep their value for each function in the near future. This resonates with the idea put forward in studies on boundary work that managing boundaries is a balancing act involving the on-going construction and defence of demarcations to maintain the integrity or objectives of all those involved, as well as crossing or redefining them to coordinate activities (Hoppe, 2010; Robinson and Wallington, 2012).

With respect to the proposed framework, we found that mapping boundary actions enables identification of where (inherently ambiguous) boundaries became salient and the systematic analysis of their evolvment in complex governance processes. This approach may also be useful in researching other services provided by multiple actors, where multiple boundaries occur and their emergence hence is an empirical question. The typology of boundary actions enables the analysis of the dynamics involved in integrating across boundaries. Furthermore, the frame enables analysis of the simultaneous reconfiguration of multiple sets of boundary actions within a case study, enabling comparing them as nested case studies to see how actors deal with different boundaries and effects or antecedents thereof. With regard to the three dimensions (social, cognitive, physical), this analytical distinction has been useful as a way to identify boundary actions. What is interesting is that, regarding the interaction around the levee, we find that a territorial division which emerged during the process is crossed in the physical dimension, in the sense that actors agree the Dakpark will be constructed on top of the levee, whilst socially and cognitively a boundary is strongly perceived and relatively limitedly spanned. More research is required to clarify the relation between boundary dimensions and outcomes, and how different actions affect the integration process. The framework can be improved in several aspects. We propose that future research should take into account whether a boundary is well established or newly constructed. This is expected to affect how easily boundaries are spanned or reshaped, as also suggested by the studied sets of boundary actions. Furthermore, boundary stories are now used to identify how actors mark boundaries in their talk. Further analysis requires more detailed consideration, drawing on methods from narrative analysis.

It remains to be tested whether in other cases the role of (re)drawing boundaries in realising integrated or multifunctional developments is confirmed. Moreover, the mechanisms that lead to effective integration of land-use functions through both crossing and demarcating boundaries remain to be further understood.

Acknowledgements

This research is funded by the Dutch Knowledge for Climate Research Programme (<http://knowledgeforclimate.climate-research-netherlands.nl/>). We thank the two anonymous reviewers for their constructive comments and suggestions.

Author Contributions

Saskia van Broekhoven conducted the literature review, collected and analysed the empirical data of the case study, and was the lead author writing the manuscript. Saskia van Broekhoven and Frank Boons both contributed to the conceptual development of the framework to analyse boundary actions. Frank Boons moreover reflected on and made revisions to previous versions of the manuscript. Arwin van Buuren and Geert Teisman supervised the empirical research and reflected on previous versions of the manuscript.

References

- Abbott A, 1995, "Things of boundaries" *Social Research* 62(4) 857–882
- Ancona DG, Caldwell DF, 1992, "Bridging the boundary: external activity and performance in organizational teams" *Administrative Science Quarterly* 37(4) 634–665
- Barth F, 1969, *Ethnic Groups and Boundaries: The Social Organization of Culture Difference* (Little, Brown, Boston, MA)
- Barth F, 1999, "Boundaries and connections", in *Signifying Identities: Anthropological Perspectives on Boundaries and Contested Values* Eds A Cohen (Routledge, London, New York) pp 17–36
- Bressers H, Lulofs K, Eds, 2010, *Governance and Complexity in Water Management: Creating Cooperation through Boundary Spanning Strategies* (Edward Elgar Publishing, Cheltenham and Northampton, UK)
- Brown B, Crawford P, Darongkamas J, 2000, "Blurred roles and permeable boundaries: the experience of multidisciplinary working in community mental health" *Health & Social Care in the Community* 8(6) 425–435
- Churchman CW, 1970, "Operations research as a profession" *Management Science* 17(2) B–37–B–53
- Cohen A, Ed, 1999, *Signifying Identities: Anthropological Perspectives on Boundaries and Contested Values* (Routledge, London, New York)
- Cowell R, Martin S, 2003, "The joy of joining up: modes of integrating the local government modernisation agenda" *Environment and Planning C* 21(2) 159–180
- Degeling P, 1995, "The significance of 'sectors' in calls for urban public health intersectoralism: an Australian perspective" *Policy & Politics* 23(4) 289–301

- Derkzen P, Bock BB, Wiskerke JSC, 2009, "Integrated rural policy in context: a case study on the meaning of 'integration' and the politics of 'sectoring' " *Journal of Environmental Policy & Planning* 11(2) 143–163
- Dumez H, Jeunemaitre A, 2010, "The management of organizational boundaries: a case study" *Management* 13(3) 151–171
- Eisenhardt KM, 1989, "Building theories from case study research" *The Academy of Management Review* 14(4) 532–550
- Epstein CF, 1992, "Tinkerbells and pinups: the construction and reconstruction of gender boundaries at work", *Cultivating Differences: Symbolic Boundaries and the Making of Inequality* Eds M Lamont and M Fournier (University of Chicago Press, Chicago) pp 232–256
- Fennell ML, Alexander JA, 1987, "Organizational boundary spanning in institutionalized environments" *The Academy of Management Journal* 30(3) 456–476
- Friedman RA, Podolny J, 1992, "Differentiation of boundary spanning roles: labor negotiations and implications for role conflict" *Administrative Science Quarterly* 37(1) 28–47
- Gieryn TF, 1983, "Boundary-work and the demarcation of science from non-science: strains and interests in professional ideologies of scientists" *American Sociological Review* 48(6) 781–795
- Gieryn TF, 1999, *Cultural Boundaries of Science: Credibility on the Line* (University of Chicago Press, Chicago)
- Guston DH, 2001, "Boundary organizations in environmental policy and science: an introduction" *Science, Technology, & Human Values* 26(4) 399–408
- Helming K, Wiggering H, Eds, 2003, *Sustainable Development of Multifunctional Landscapes* (Springer, Berlin and Heidelberg)
- Heracleous L, 2004, "Boundaries in the study of organization" *Human Relations* 57(1) 95–103
- Hernes T, 2003, "Enabling and constraining properties of organizational boundaries", in *Managing Boundaries in Organizations: Multiple Perspectives* Eds N Paulsen, T Hernes, (Palgrave Macmillan, Hampshire, UK) pp 35–55
- Hernes T, 2004, "Studying composite boundaries: a framework of analysis" *Human Relations* 57(1) 9–29
- Hirschhorn L, Gilmore T, 1992, "The new boundaries of the 'boundaryless' company" *Harvard Business Review* 70(3) 104–115
- Hoppe R, 2010, "From 'knowledge use' towards 'boundary work': sketch of an emerging new agenda for inquiry into science-policy interaction", in *Knowledge Democracy* Eds R In 't Veld (Springer, Berlin Heidelberg) pp 169–186.
- Jones R, 2009, "Categories, borders and boundaries" *Progress in Human Geography* 33(2) 174–189

- Keast R, 2011, "Joined-up governance in Australia: how the past can inform the future" *International Journal of Public Administration* 34(4) 221–231
- Kellogg KC, Orlikowski WJ, Yates J, 2006, "Life in the trading zone: structuring coordination across boundaries in postbureaucratic organizations" *Organization Science* 17(1) 22–44
- Kerosuo H, 2006, *Boundaries in Action: An Activity-Theoretical Study of Development, Learning and Change in Health Care for Patients with Multiple and Chronic Illnesses* PhD thesis (Helsinki University Press, Helsinki)
- Klerkx L, Aarts N, Leeuwis C, 2010, "Adaptive management in agricultural innovation systems: the interactions between innovation networks and their environment" *Agricultural Systems* 103(6) 390–400
- Lamont M, Molnár V, 2002, "The study of boundaries in the social sciences" *Annual Review of Sociology* 28(1) 167–195
- Leifer R, Delbecq A, 1978, "Organizational/environmental interchange: a model of boundary spanning activity" *The Academy of Management Review* 3(1) 40–50
- Louw E, Bruinsma F, 2006, "From mixed to multiple land use" *Journal of Housing and the Built Environment* 21(1) 1–13.
- Mørk BE, Hoholm T, Maaninen-Olsson E, Aanestad M, 2012, "Changing practice through boundary organizing: a case from medical R&D" *Human Relations* 65(2) 263–288
- Nilsson M, Eklund M, Tyskeng S, 2009, "Environmental integration and policy implementation: competing governance modes in waste management decision making" *Environment and Planning. C, Government & Policy* 27(1) 1–18
- O'Farrell PJ, Anderson PM, 2010, "Sustainable multifunctional landscapes: a review to implementation" *Current Opinion in Environmental Sustainability* 2(1–2) 59–65
- Owens S, Cowell R, 2011, *Land and Limits: Interpreting Sustainability in the Planning Process*, 2nd edition (Routledge, London, New York)
- Pettigrew AM, 1990, "Longitudinal field research on change: theory and practice" *Organization Science* 1(3) 267–292
- Paulsen N, Hernes T, Eds, 2003, *Managing Boundaries in Organizations: Multiple Perspectives* (Palgrave Macmillan, Hampshire, UK)
- Priemus H, Nijkamp P, Dieleman FM, 2000, *Meervoudig ruimtegebruik; stimulansen en belemmeringen* [Multiple land use; incentives and barriers], (Delft University Press, Delft)
- Priemus H, Rodenburg CA, Nijkamp P, 2004, "Multifunctional urban land use: a new phenomenon? A new planning challenge?" *Built Environment* 30(4) 269–273
- Projectteam Ruimtebehoeften, 2000, *Rekenen met Ruimte. Vijfde Nota* [Calculating with Space. Fifth Report], (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer, Den Haag)

- Robinson CJ, Wallington TJ, 2012, "Boundary work: engaging knowledge systems in co-management of feral animals on indigenous lands" *Ecology and Society* 17(2) 16.
- Santos FM, Eisenhardt KM, 2009, "Constructing markets and shaping boundaries: entrepreneurial power in nascent fields" *Academy of Management Journal* 52(4) 643–671
- Spielman DJ, Ekboir J, Davis K, 2009, "The art and science of innovation systems inquiry: applications to Sub-Saharan African agriculture" *Technology in Society* 31(4) 399–405
- Star SL, Griesemer JR, 1989, "Institutional ecology, 'translations' and boundary objects: amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907–39" *Social Studies of Science* 19(3) 387–420
- Sturdy A, Clark T, Fincham R, Handley K, 2009, "Between innovation and legitimation— boundaries and knowledge flow in management consultancy" *Organization* 16(5) 627–653
- Tilly C, 2002, *Stories, Identities, and Political Change* (Rowman & Littlefield, New York)
- Tilly C, 2004, "Social boundary mechanisms" *Philosophy of the Social Sciences* 34(2) 211–236
- Tushman ML, 1977, "Special boundary roles in the innovation process", *Administrative Science Quarterly*, 22(4), 587–605
- Tushman ML, Scanlan TJ, 1981, "Boundary spanning individuals: their role in information transfer and their antecedents" *The Academy of Management Journal* 24(2) 289–305
- Van Ark R, 2006, "Meervoudig ruimtegebruik: dogma of eye-opener?", in *Meervoudig ruimtegebruik, enkelvoudig recht: de spanningsvolle relatie tussen recht en innovatie* ["Multiple land-use: Dogma or eye-opener?", in *Multiple Land-Use, Singular Law: The Stressful Relation between Law and Innovation*] Eds GMA van der Heijden, AFL Slob (Eburon, Delft) pp 11–22
- Van Buuren MW, Driessen PPJ, Van Rijswijk HFMW, Teisman GR, 2013, "Towards legitimate governance strategies for climate adaptation in the Netherlands. Combining insights from a legal, planning, and network perspective" *Regional Environmental Change* (forthcoming)
- VROM, 2002, *Ruimte maken, ruimte delen. Vijfde nota over de Ruimtelijke Ordening 2000/2020 (PKB Deel 2 en Deel 3)* [Making Space, Sharing Space. Fifth Report on Spatial Planning 2000/2020], (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer: VROM, Den Haag)

- Watson M, Bulkeley H, Hudson R, 2008, “Unpicking environmental policy integration with tales from waste management” *Environment and Planning C: Government and Policy* 26(3) 481–498
- Weick KE, 1995, *Sensemaking in Organizations* (Sage Publications, London)
- Wenger E, 2000, “Communities of practice and social learning systems” *Organization* 7(2) 225–246
- Wiering M, Immink I, 2006, “When water management meets spatial planning: a policy-arrangements perspective” *Environment and Planning C: Government and Policy* 24(3) 423–438.
- Wiggering H, Müller K, Werner A, Helming K, 2003, ‘The concept of multifunctionality in sustainable land development’ in *Sustainable Development of Multifunctional Landscapes* Eds K Helming, H Wiggering, (Springer, Berlin and Heidelberg) pp 3–18
- Williams P, 2002, “The competent boundary spanner” *Public Administration* 80(1) 103–124
- Yan A, Louis M, 1999, “The migration of organizational functions to the work unit level: buffering, spanning, and bringing up boundaries” *Human Relations* 52(1) 25–4

4 Managing boundaries over time in integrative planning processes: A process analysis of two cases of Multifunctional Land Use

Van Broekhoven, S.; Boons, F. Submitted.

Abstract:

Measures that integrate different social, economic and ecologic land use functions have increasingly raised the interest of scholars and practitioners concerned with sustainability. However, achieving effective integration involves important governance challenges. One challenge to realise effective integration is that integrative initiatives cut across social, cognitive and physical boundaries. The question how actors can manage boundaries in integrative planning processes has recently gained attention. Recent studies show that realising integration requires spanning as well as drawing and challenging boundaries. However, little is known about how actors can best manage boundaries *over time* during integrative processes. This article studies how actors manage boundaries over time, i.e. how they challenge, span, defend and construct boundaries during integrative processes, and what sequences of boundary actions help to realise effective integration of functions. It does so with a comparative longitudinal analysis of two cases of multifunctional land use in The Netherlands. We find three main patterns in the identified sequences: Firstly, to work across boundaries, boundaries first need to be created, strengthened and explicated, whilst also connecting where possible. Secondly, after a period of spanning and challenging boundaries, reconstructing boundaries can help to keep the process manageable, provide safety and maintain autonomy. Thirdly, challenging boundaries is often necessary to realise integration, but actors can and should expect this will lead to conflicts and internal discussions.

4.1 Introduction

Measures that integrate different social, economic and ecologic land use functions have increasingly raised the interest of scholars and practitioners concerned with sustainability. Examples of such measures are realising multifunctional urban squares which are used for recreation but also serve as water retention areas in times of high precipitation, and green-blue infrastructures combining waterfronts and flood management, green space, community development, and economic functions. This integration of land use functions allows for creating synergies between functions and providing ecological and socio-economical services simultaneously. Integration of land use functions thereby enables greater overall performance and more sustainable development (Lovell and Taylor, 2013; Selman, 2009). However, the implementation of such approaches, involving a multitude of stakeholders and high organizational and technological complexity, is challenging (O'Farrell and Anderson, 2010; Van Broekhoven and Vernay, 2018). Although multifunctional land use (MLU) usually sees wide support at the starting phase, its complexity ensures that only some endeavours are successful. This leads to excessively lengthy processes, cost-overruns, and projects that fail to be realised.

One challenge is that multifunctional and integrated processes cut across boundaries e.g. social boundaries between groups, cognitive boundaries in ways of thinking, and physical boundaries in geographical authorities. The question how actors can deal with boundaries in integrative processes has recently gained attention in spatial planning (van Broekhoven et al., 2015; Westerink, 2016). Realising integrative processes requires actors from different backgrounds to transcend well-established boundaries; of sectors, organizations, tasks, roles, ideas, in territories. At the same time, we know that effective integration is complicated by the need and/or desire to maintain boundaries, e.g. to ensure fulfilling functional tasks, divide responsibilities, maintain hegemony in the wider political-administrative environment. The process that unfolds after actors identify the potential of MLU is thus one of differentiation and integration.

Studies on boundaries show how working across boundaries can be facilitated by e.g. activities of boundary spanners (Noble and Jones, 2006; Williams, 2002), and joint construction of boundary objects (Klerkx et al., 2012; Star and Griesemer, 1989). Other studies however find actors predominantly engage in strategies to defend and maintain boundaries in integrative planning processes to protect established sectoral ways of working and interest, thereby hampering integration (Degeling, 1995; Derkzen et al., 2009). Yet others find drawing boundaries can also be good to divide tasks and keep complexity manageable (Hernes, 2003; van Broekhoven et al., 2015). Several recent studies analyse the enabling and constraining effects of different types of boundary actions and show that realising effective integration requires spanning boundaries as well

as challenging and drawing boundaries (Hernes, 2003; van Broekhoven et al., 2015; Westerink, 2016). Each can be beneficial for realising integration, but can also constrain it. This leads to the question when in integrative processes which types of boundary actions and configurations of actions are helpful to realise integration. When will spanning boundaries help or constrain the integrative process, and when will drawing boundaries help or constrain? Currently, little is known about how managing boundaries takes place *over time* in integrative processes. The aim of this paper is to analyse how actors manage boundaries over time in integrative planning processes, and what sequences of boundary actions help to realise effective integration of functions. To achieve this we conduct a longitudinal analysis of how actors manage boundaries during the integrative process in two cases of multifunctional land use in The Netherlands. More specifically, we analyse sequences of boundary actions over time in the case studies, i.e. how actors span, challenge, change, defend and construct boundaries during the process that unfolds when they engage in integrative planning processes. To do so, we build forth on earlier conceptualizations of boundaries and an approach for process analysis that compares empirical processes to theoretical expectations.

4.2 Conceptualising boundary management

The conceptual framework of this paper builds forth upon Van Broekhoven et al. (2015), and elaborates upon this by analysing how actors deal with boundaries *over time* in integrative processes. We conceptualize the interactions that result from the contradictory tendencies of differentiation and integration in terms of boundary actions; the practices that actors employ to manage social, cognitive and physical boundaries (Ancona and Caldwell, 1992; Kerosuo, 2006; Paulsen and Hernes, 2003; van Broekhoven et al., 2015; Yan and Louis, 1999).

4.2.1 Boundaries

Following Hernes (2003), Abbott (1995) and others, we view boundaries as socially constructed. They are enacted in interactions where they are made explicit, are shaped, enforced, or form a matter of contention. They do not exist independent of such enactment, and thus need to be studied through the interactions of the people that enact them (see (van Broekhoven et al., 2015)). Boundaries are recurring “*distinctions and differences between and within activity systems that are created and agreed on by groups and individual actors over a long period of time while they are involved in those activities. These distinctions and differences can be categorizations of material objects, people and practices*” (Kerosuo, 2006: 4). Boundaries hence are shaped by being acted upon over and over again. Paradoxically, they may at the same time be perceived as real by actors even before an integrated initiative is started, and shape their actions.

4.2.2 Boundary actions in integrative planning processes

The implication of the above conceptualization is that boundaries cannot be predefined by a researcher in terms of for instance organizational or sectoral boundaries. We view managing boundaries in integrative planning processes as emergent, done ‘in the making’. Given the intangible nature of boundaries, it is likely that actors at the start of an integrative process don’t completely know which boundaries are relevant or problematic. Therefore, rather than researching how interaction across predefined (e.g. sectoral) boundaries takes place, we analyse the enactment of boundaries by actors in specific empirical contexts. We do so by studying how actors manage boundaries by reconstructing boundary actions, defined as: *“A recurring set of articulations, actions, and interactions that shape a demarcation, taking place over a longer period of time”* (van Broekhoven et al., 2015, p. 5). In order to identify and study actors’ boundary actions, we specify three main types of boundary actions (van Broekhoven et al., 2015):

- 1) Spanning boundaries in integrative processes whilst respecting the distinction it entails, e.g. to facilitate coordinating practices or exchange information across boundaries. Spanning facilitates flow across a boundary without challenging its relevance or place. We distinguish actions that span boundaries through developing coordination structures (e.g. project groups) and through developing more dense relations.
- 2) Drawing and maintaining boundaries, e.g. to demarcate who or which problems and solutions are included, to protect or buffer something from conflicting interest, or to enable successful action within. We distinguish here actions that activate or defend boundaries and that are aimed at dividing tasks and responsibilities
- 3) Challenging and negotiating boundaries, e.g. by problematising existing ideas or divisions. Actors challenge boundaries to e.g. include new actors, ideas, or resources. This is different from spanning boundaries as actions here involve changing a previous demarcation. Multifunctionality generally implies challenging boundaries to realise integration.

The literature on organizational boundaries, boundary spanning and integrative work shows how actors may deal with boundaries in integrative processes, and how this can hamper or enable these processes. In Table 4.1 we summarize these insights from previous literature, using our categorization of boundary actions. While boundaries are often perceived as problematic for cooperation, recent studies have shown boundaries can also be helpful to organize activities, e.g. by specializing towards certain tasks or dividing responsibilities. The idea behind integrative planning processes is thus not to annihilate boundaries, but to connect the bounded subsystems in such a way that joint benefits are produced.

Type of action	Boundary actions	
Spanning	Developing more dense relations and shared meanings	<p>Communication and relationship building by boundary spanners who identify needs and facilitate shared problems and solutions (Klerkx et al., 2010; Tushman and Scanlan, 1981; Williams, 2002). Leaders or ‘reticulist’ can play important role; engaged and powerful individuals who can construct cross-boundary coalitions (Degeling, 1995).</p> <p>Making use of boundary objects that serve as means of translation and communication between actors (Star and Griesemer, 1989). By jointly producing boundary objects actors can develop a understanding of the integrative idea and a discourse and symbolism that transcend s the own interests (Klerkx et al., 2012).</p> <p>Using safe spaces that facilitate interaction by encouraging two-way communication between actors, e.g. excursions or field visits (Clark et al., 2010).</p>
	Coordinating structures	<p>Developing new categorizations (e.g. working group) through which actors can define themselves as a group in contrast to another, enable feelings of jointness and a shared sense of character of the group, and focus energy and resources on a collective task (Enayati, 2002; Epstein, 1992; Yan and Louis, 1999).</p> <p>Creating (formal) coordination structures that facilitate interaction (Marshall, 2003).</p> <p>Developing accountability arrangements as steering groups to make group decisions accountable to all (Clark et al., 2010).</p>
Maintaining	Activating or perpetuating boundaries	<p>Activating or drawing boundaries when groups meet, contrasting themselves with others (Tilly, 2002).</p> <p>Perpetuation of boundaries from earlier situations. Boundaries may be perceived as real even before an integrated initiative starts, and shape actors’ actions (van Broekhoven et al., 2015). This can reflect a process of stereotyping: by identifying someone as belonging to a certain group (e.g. water manager), a stereotypical image is activated which affects people’s perceptions, attitudes and behavior and hence the interaction. Stereotypes are often negative and can result in avoidance or exclusion and hamper collaboration (Enayati, 2002).</p> <p>Strategies to defend existing ways of working. Integrative initiatives as arenas where <i>“sectoral players do what-ever is necessary to protect their sector’s existing agendas, themes and patterns of resource allocation from threats that would arise if the concerns raised from within other sectors were taken seriously”</i> (Degeling, 1995; Derkzen et al., 2009).</p>
	Task division	<p>Functionalization/specialization to perform tasks more efficient by dividing them between units focusing on a specific set of skills, knowledge or ways of working geared towards this task (Doorn, 1956).</p> <p>Drawing boundaries as useful strategy in multi-actor interactions to keep complexity manageable and structure actions (Hernes, 2003; van Broekhoven et al., 2015), facilitate implementation by reducing dependencies (Sproule-Jones, 2002).</p> <p>Specialization as double edged sword: also creating differences, e.g. specific language and knowledge, leading to communication barriers (Tushman and Scanlan, 1981).</p>
Challenging and negotiating		<p>Challenging, changing and negotiating boundaries. Integrative initiatives often do not match with existing ways of working, policies, practices, and patterns of resource allocation (Janssen et al., 2015; van Broekhoven and Vernay, 2018; Derkzen et al., 2009).</p>

Table 4.1 Types of boundary actions

4.2.3 Sequences of boundary actions

We assume that how actors manage boundaries (i.e. perform boundary actions) over time during the planning process affects the extent to which they are able to realise effective integration of land use functions. We will therefore reconstruct and analyse the temporal sequence of boundary actions that actors take during the process in the two cases, and how this explains whether integration of functions was successful. Next, we will analyse what patterns we can identify in these sequences of boundary actions. To do so, we first assess the literature on earlier findings on temporal sequences of boundary actions, and on how particular sequences help or constrain realising effective integration. We use this to systematically compare the sequence of boundary actions in the case studies to theoretical expectations. Firstly, we find that how actors can best manage boundaries over time is often only implicitly reported in the literature, in the sense that the focus is often on identifying single tools or actions that enable actors to span boundaries, or in contrast how they do not succeed in this (e.g. how boundary objects or boundary spanners can facilitate interaction), rather than on how boundary management takes place over time during integrative or collaborative processes. Secondly, we nevertheless could draw six distinct sequences of boundary actions from the implicit descriptions in the literature. We discuss these below.

1) Joint approach spanning boundaries

Many governance studies focus on boundary spanning as strategy to come to alignment in integrative planning processes. Here effective integration is expected to develop when actors take a 'joint approach' throughout the process facilitated by activities of boundary spanners (Noble and Jones, 2006), jointly producing boundary objects (Klerkx et al., 2012), creating of safe spaces for interaction and formal coordination structures (Clark et al., 2010). Expected outcome: effective integration.

2) Maintaining boundaries in the multifunctional development

Other studies find that actors in response to an integrative initiative predominantly develop strategies to perpetuate and defend boundaries (Degeling, 1995; Derkzen et al., 2009). Here, the integrative initiative is expected to lead to discussions between actors with conflicting interests and views. Actors protect their policies, practices and desires. Consequently, little meaningful participation takes place, leading to little opportunities to develop alignment and conflict.

3) Living apart together

Some scholars state managing boundaries in integrated work is a balancing act between drawing boundaries and interacting across (Clark et al., 2010; Hoppe, 2010; van Broekhoven et al., 2015), or talk about the paradox of differentiation and integration

(Marshall, 2003; Tushman and Scanlan, 1981); actors need to change or cross boundaries to enable integration and coordinate activities as well as draw them to divide tasks and keep complexity manageable (Hernes, 2003; van Broekhoven et al., 2015). Here drawing and spanning takes place simultaneously during integrative processes. Expected outcome: effective integration.

4) Strengthening, bridging and transforming boundaries

Ernst and Chrobot-Mason (2010) and Lee et al. (2014) provide the most explicit description how boundaries can successfully be managed over time. They describe first boundaries need to be created or strengthened. By buffering (e.g. clarifying purpose, specialization) safety is created, and by reflecting across an understanding of boundaries is built that fosters respect. Next common ground needs to be forged, developing a shared goal and identity. Here actors form new networks and relations, and reframe boundaries to develop a new community. Last is transforming boundaries. Here established practices, norms and identities are crossed to enable innovation. This is about integrating and differentiating; groups keep distinct identities, expertise and resources but are ‘woven’, working on a shared strategy and vision. Expected outcome: effective integration.

5) Internal discussion

Some studies identify that integrative initiatives will lead to internal discussions (e.g. van Meerkerk, 2014). Actors working on an integrative project have to deal with the expectations and demands – and ensure support - of their own group and of those with whom they negotiate, making their position inherently ambiguous and leading to tensions (Long, 2001; Swan and Newell, 1998). Friedman and Podolny (1992) differentiate two types of boundary workers in this respect: ‘representatives’ bringing information from the organization to their environment and ‘gatekeepers’ regulating what comes in. These internal discussions are expected to hamper effective integration.

6) Negotiating change

Several studies show that when contradictions and conflict rise, leaders (e.g. politicians) acting as change agents can provide an essential push by supporting possible solutions and inducing change (Degeling, 1995; Klerkx et al., 2010). Developing a solution that suits all can moreover be facilitated by boundary spanning activities and creation of coordination structures. This process may take place both externally and between departments within organizations (Katz and Tushman, 1979). Expected outcome: effective integration.

4.2.4 Assessing effective integration

Lastly, we need to establish whether and how the sequences of boundary actions in the two case studies contribute to realising effective integration. However, the effects of sequences of boundary actions on an outcome of effective integration are not easy to assess. Both the process as whole, individual boundary actions, sequences of boundary actions together, as well as contextual factors which are not analysed in this study, all contribute to the outcome of the process. This outcome therefore cannot be simply reduced to causal effects of sequences of actions. Nevertheless, if we want to be able to better and more strategically manage boundaries in future integrative initiatives, it is important to gain better insight in how different ways to manage boundaries help realising effective integration. Here, we take first steps for this by assessing what sequences of boundary actions help to realise effective integration in two ways: Firstly, we analyse to what extent the process as a whole led to effective integration. To do so, we base ourselves on actors' contentment (Edelenbos and Klijn, 2006), commonly used to assess success in governance studies. We define effective integration as: *Functions are integrated with each other and are adequately fulfilled. This means the actors that use, own or manage these functions should be satisfied with the way functions relevant to them are fulfilled within the multifunctional development, and the integration as a whole.* Secondly, we analyse how specific sequences of boundary actions had intermediate effects during the process, by mapping the intermediate effects that are named by respondents in interviews and project documents. Together, these judgements of the involved actors are used to come to an informed interpretation of what that tells us about what sequences of boundary actions help to realise effective integration of functions.

4.3 Methods

We selected the cases following the principle of maximization, i.e. choosing a situation where the process of interest manifests itself most strongly and is 'transparently observable' (Boeije, 2009; Pettigrew, 1990). In the selected cases actors integrate a primary sea levee with other functions in The Netherlands. Given the important historical role and position of flood protection in The Netherlands, this provides a socially relevant setting where boundaries as traces of past activities are strongly present. Furthermore, to study actor's boundary actions over time we selected cases in a late stage of implementation.

Data is gathered by: (a) semi-structured interviews; (b) document analysis; (c) observation of actors' interaction; and (d) workshops with stakeholders (see Table 4.2). Using multiple data sources reduces the risk of distortions in post-factual accounts and increases internal validity. Documents were collected through respondents and websites of involved organizations, interviews were transcribed. To identify boundary actions over

time, a chronological database is developed by selecting from each interview, document and observation, articulations of incidents that indicate the activation, contestation or crossing of a boundary. This is an interpretive act of the researchers. These actions were then coded with the aim to identify occurrences of the types of boundary actions specified in section 4.2.2. Our chronological database consists of 55 boundary actions in Westduinpark and 197 in Dakpark. For each case a workshop was organized with the main stakeholders, end of 2014. In the workshops the reconstruction and analysis of boundary actions was presented, discussed, and validated with the participants.

	Case Dakpark	Case Westduinpark
Document analysis (e.g. project document, minutes of project group meetings, covenants between actors, documents of involved organisations on the project)	35 documents covering the studied period 2005-2014	48 documents covering the studied period 1998-2012
Observation of actors interaction	None	Observation of 5 meetings between May and November 2012
Interviews with actors from the different organization involved in the project	7	16
Validation	Workshop with involved actors	Workshop with involved actors

Table 4.2 Data Collection

Obviously, our reconstruction doesn't represent all boundary actions that occurred. Reconstructing all actions that happened over time is not humanly possible or desirable. Given our method of data collection we assume that we have captured at least the most significant boundary actions; also, there is no a priori reason to suppose our method biases a particular type of action.

To identify and analyse sequences of boundary actions we take the following two steps. Firstly we distinguish sets of boundary actions that take place in the case studies. Actors in integrative initiatives need to deal with multiple discussions on boundaries simultaneously. Not all boundary actions are directly related, e.g. technical discussions on a levee take place separate from residents' participation. We therefore distinguish sets of boundary actions that belong to each other and evolve around specific discussions on a boundary. To identify sets of actions we used a method developed by Spekkink and Boons (2016) that identifies network communities with an algorithm developed by Blondel et al. (2008). These sets were then validated by presenting them in the workshops. We asked participants if they could label what the sets were about. This led to some changes in attribution of actions to sets, discussed in appendix A. Secondly, we match the sequence of boundary actions that we find in the case studies to the sequences

identified in the literature. We thereby build on an approach developed in earlier process studies that analyses empirical processes by comparing them to so-called ‘event sheets’: theoretical expectations on how the process develops (Boons et al., 2014; Jiao and Boons, 2017; Spekkink and Boons, 2016). In our study, the event sheets are the sequences identified in section 2.3. This approach allows us to systematically compare the empirical process with theoretical expectations, and to compare multiple empirical processes with each other. The sequences identified in the literature are not intended to provide a complete description of the cases over time. Different sequences can follow each other or can occur simultaneously. Matching the empirical sequence in the case studies to the sequences in the literature was done manually, facilitated by colour codes. To systematically perform this comparison, we established a set of rules when a particular sequence was attributed. These are discussed in appendix A.

Lastly, to analyse actors’ contentment with the process as a whole, we conducted a short survey with the participants of the workshops. We asked them to score and explain how satisfied they are with the way functions relevant to them are fulfilled within the multifunctional development, and with the integration as a whole. To analyse intermediate effects of sequences of boundary actions, we identify what intermediate effects are named by respondents in the interviews and (project) documents. Based on these judgements of the actors involved in the integrative process we make an informed interpretation of what that tells us about what sequences of boundary actions help to realise effective integration of function.

4.4 Results

We first per case introduce the case, present the sequences of boundary actions found in the studied sets of boundary actions and their intermediate outcomes, and discuss actors’ contentment with the process as a whole. Next we identify patterns in these sequences by comparing them across both cases and matching them with the sequences derived from the literature.

4.4.1 Process analysis Westduinpark

4.4.1.1 Introduction

The Westduinpark is a 232 hectares former city park located in the coastal zone directly adjacent to the city of The Hague in The Netherlands. In the previous century this area was planted with trees and shrubbery to hold the sand of this dune area in place. In 2002, the municipality started a process to improve the natural quality of the area by bringing it back to its original state in which natural dune processes as sand drift return. This involved a significant transformation of the area including large scale removal of existing

flora. In 2003 the area was appointed as Natura 2000. In the area several other social-economic functions exist, next to the ecologic function. It is used intensively for recreation, with 1.9 mln. visits per year. On the west side lie beach restaurants, on the east side urban residential areas. The dunes moreover form a primary sea defence structure, governed by a water board and planted with grasses to stabilize the sand. Therefore, in order to realise nature goals and at the same time find a balance with these other functions, the municipality started a discussion with the stakeholders related to these functions. During the process several discussions rose on boundaries. In 2011 a Natura 2000 management plan was agreed upon and the removal of existing flora was started. In spring 2014, most measures were implemented, apart from those in the sea defence. Actors expected the targets in the Natura 2000 plan could be met mostly, but not completely.

4.4.1.2 Boundary actions during the process

We analyse four sets of boundary actions, which evolved around specific discussions on boundaries. Figure 4.1 presents a summary of the sequences of boundary actions (spanning, drawing and challenging boundaries) found in each set during the process. The process is reconstructed from 2002 (idea rose) till spring 2014 (largely implemented). Table 4.3 presents a further illustration of the boundary actions and involved actors.

2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		2012	2013	2014	
Set (1) Developing a management plan														
span and little drawing														
Set (2) Nature quality in relation to existing recreation														
				draw	span and draw					draw	span and draw			
Set (3) Preparing implementation: nature permits and communication														
					span		draw			span and draw				
Set (4) Dynamic coastal management in relation to water safety permit														
					span		challenge and draw / span, challenge and draw				span and draw			

Figure 4.1 Summary of boundary actions over time in Westduinpark

1. Developing a management plan

At the start of the process the municipality developed a nature management plan. Throughout this set, actors undertook mainly boundary spanning actions (e.g. developing a vision, excursions, installing a management platform). These activities were mainly limited to actors within the municipal organization, in order to reach agreement on a nature management plan between different sectors within the municipality. In addition, two actions were about claiming the nature function of the area (appointing it as Natura 2000, and making a zoning plan), and thereby established boundaries.

2. Nature quality in relation to existing recreation

In 2005-2013 a main issue was presenting and discussing the plans with residents using the area for recreation and local nature and resident organisations. Here we find a

sequence of boundary spanning and maintaining actions that take place interspersed and in reaction to each other. In reaction to the integrative plan quite some residents and resident organisations first opposed it, drawing boundaries. In response, municipal actors undertook various boundary spanning actions (e.g. setting up a working group, field trips, individual communication with critical residents). Whilst some residents became supportive of the plans, a few remained critical.

3. Preparing implementation: nature permits and communication

The discussion here rose during the implementation of the measures in the nature management plan, involving a drastic removal of vegetation in the park. We find here again boundary spanning and maintaining actions interspersed throughout the process, in reaction to each other. From early on, the municipality started a communication process for residents to gain support, spanning boundaries by e.g. information evenings, presentations, and excursions. Residents were critical at first, but became more positive over time. However, during the work bats were accidentally disturbed, leading to a discussion with national authorities. To proceed the municipality adjusted its plans. Hereafter, critique by residents rose again. To regain support, municipal actors undertook further boundary spanning activities.

4. Dynamic coastal management in relation to water safety permit

Municipal actors also needed to discuss the nature management plan with the water board - responsible for water safety provided by the dunes - and the province – responsible for the Natura 2000 goals. Noticeably, whilst actors early in the process span boundaries by involving the water board in meetings on the nature management plan, the permit department of the water board rejected the permit at a late stage of the process, because the plan didn't fit with water safety policy, thereby acting as gatekeeper. By aiming to realise sand drift the nature management plan challenged boundaries in existing policy, which determined a certain amount of sand should be present within a specific geographical dune area appointed as water safety structure. This came as a surprise for municipal actors and resulted in conflict between the organizations. Hereafter, internal discussion rose within the water board. Whilst some actors in the water board tried to find solutions to enable the nature management plan, others stood for the existing rules and practices. In the process to resolve this conflict, we find civil servants of the water board took boundary spanning activities to facilitate interaction with the municipality, but also to gain support internally to find a solution that enabled the nature management plan. In addition a politician of the water board supported and prioritized that a solution should be found, acting as change agent. Finally, a solution was developed that involved mutual adaptation of the water safety policy and the nature management plan. Noticeably, besides spanning boundaries, we find at the end of the process also actions that

reconstruct boundaries (e.g. the water board required the municipality to monitor the consequences of measures and if needed take mitigating measures, and they jointly established conditions under which sand drift was allowed).

Set of actions	Actors	Illustration of boundary actions
(1) Developing management plan 2002-2014	Municipality Residents Water board Province Local nature organizations Advisor	(2002) Municipality develops a new nature management vision, which should include stakeholders. (2005/2006) Municipality hires external advisor to help with nature quality improvement and organize process. (2005-2007) Workshops, vision development and excursions organized with municipal actors from different departments and advisor. Leads to change in municipal approach towards nature management. (2005-2014) Municipality starts a regular management platform with stakeholders (later this becomes a project group and advisory group). (2006-2010) Presentations and field trips with alderman to raise political support for the project.
(2) Nature quality in relation to existing recreation 2005-2013	Municipality Residents Province Local nature organizations	(2005) Formal oppositions (45) to management vision, mainly on allowing dogs in the area 'Bosjes van Poot'. (2006) Meetings in management platform and discussion group on Bosjes van Poot and dogs, aiming to come to a jointly supported proposal. (2009-2010) Excursion, field trips, discussing permit request cutting of trees, pressure through peers, to handle discussion with critical individual. (2010) Proposal for dog policy. Supported by most actors, but not by one involved organization. (2013) One-on one communication with critical individual and peer group pressure to address objections.
(3) Preparing implementation: nature permits and communication 2005-2011	Municipality Residents Province Local nature organizations National government	(2007-2010) Communication process with residents: presentations, excursions, resident evenings, via management platform. First received skeptically, discussions and resistance. Later more positive. (2011-2012) Start implementation measures. In advance excursions and presentations are held for residents. (2011-2012) Conflict with national government on possible disturbance of bats. (2012-2013) Tensions in relation with residents during implementation, despite participation in process still objections and escalations to media. (2012-2014) Yearly dozen excursions organized. Enthusiastic reactions residents. Municipality sees the role of employees in area changed from controllers to hosts.
(4) Dynamic coastal management in relation to water safety permit 2007-2012	Municipality Water board Province	(2007-2008) Meetings province and water board (2011) Water permit is rejected, as measures do not match with existent water safety policy. Surprise to municipality. (2011) Discussion on permit within water board: not all the right actors and departments were included. (2011) Meetings between municipality and water board. Discussion is escalated up. (2011) Support of politician water board to find a solution. Helps internally to prioritize finding a solution. (2011) Coordinating activities of project managers water board, internally and towards municipality and province. Actors look for solutions. (2011) Condition for the permit is that municipality must monitor consequences of measures and if needed take mitigating measures. Monitoring plan is developed by external expert to gain support water board.

Table 4.3 Illustration of boundary actions Westduinpark

4.4.1.3 Actors reflection and contentment regarding the whole process

Respondents reflected on the integration between functions and fulfilment of the own function as good to very good. They reflected nature goals were largely realised, and increased support for the plans was realised. At the same time, nature goals were not completely realised. Respondents reflected on the collaboration process as satisfactory or good. One respondent argued it was an achievement that something was realised at all, as working together was not easy due to the societal and institutional context. The discussion on the water safety permit was reflected upon as difficult, but respondents of different organisations stated that after a difficult start increased understanding and joint solutions were developed.

4.4.2 Process analysis Dakpark

4.4.2.1 Introduction

The Dakpark is a development of an 8 ha. park on the roof of a commercial building, extending down to street level over already existing rail tracks, a levee, and heating infrastructure. It takes place in the city of Rotterdam, The Netherlands. The plan first rose in 1998 when a former train shunting yard between a harbour and a disadvantaged neighbourhood was partly dismantled, and multiple claims on the future use of this area were made: residents asked for a neighbourhood park, while municipality and Port Authority wanted harbour-related business development. Moreover, several functions were already present in the area, including a primary sea levee and city heating infrastructure. To develop this idea the municipality started a complex interaction process involving a multitude of actors related to these functions. End 2011 the commercial building was delivered. Construction of the roof park started in 2012 but was stopped when physical problems regarding the city heating led to new discussions between municipality and energy company.

1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Set (1) From conflicting claims to a joint project	challenge, draw and span draw and span													
Set (2) Resident participation	draw and span span													
Set (3) (De)Rail	draw draw, some spanning													
Set (4) Demarcation, interfaces	span and draw challenge, span, draw span													
Set (5) Water	draw some actions change agent													
Set (6) Energy company	draw span and draw span and draw													
Set (7) Retail	challenge, draw and span draw													

Figure 4.2 Summary of boundary actions over time in Dakpark

4.4.2.2 *Boundary actions during the process*

We analyse seven sets of boundary actions. Figure 4.2 summarises the sequences of actions (spanning, drawing and challenging boundaries) found during the process in each set. The process is reconstructed from 1998 (idea rose) to 2012 (largely implemented). Table 4.4 presents a further illustration of the boundary actions and involved actors.

1. From conflicting claims to a joint project

In this set the two competing claims on the area were brought together in the integrative initiative: a long held demand of residents for a neighbourhood park versus plans of the municipality for business development. Here we find a sequence of boundary spanning and maintaining actions interspersed and in response to each other. The idea for Dakpark integrated both seemingly contradictory claims, thereby both bridging and changing these. To gain support municipal actors who developed the plan performed boundary spanning activities and hired a local advisor to communicate with and involve residents (e.g. by organizing mini-conferences, setting up an advisory group, meetings with resident groups, excursions). However, residents in response to the integrative plan criticised whether a park on a roof could become a ‘real’ park rather than just a grass rooftop, and established a resident organization to represent their interest, drawing boundaries.

2. Resident participation

From 2000 an intensive resident participation process started. Here, we find many spanning and drawing actions that took place simultaneously. Especially at the start (2000-2002) residents undertook activities to safeguard the plan met their interests. Residents amongst others developed ‘eight commandments’ for the park, which were formally presented to the alderman and were used throughout the further process as criteria to judge whether the park satisfied their wishes. One of the commandments for instance was that the roofpark should contain at least one meter of soil, so that ‘real’ trees could grow in it. This became a symbol for the residents to represent their demands for the park. By these activities residents reinforced boundaries in terms of their demands on the content of the project. In parallel the municipality undertook more boundary spanning actions. This interspersing of spanning and drawing continued for several years. Later in this sequence we find only boundary spanning. Respondents reflected that this process led to increased support for the plan.

3. (De)rail

This set is about removing a function rather than integrating. The decision to remove rail tracks triggered the idea for Dakpark Rotterdam. In the subsequent process, we observe actions that maintain boundaries, as discussions rose on how many tracks should be

removed and who should finance it. Later in the process, we find some action to span boundaries (meetings). However, municipal actors reflect boundary spanning was limited, e.g. there was no regular contact at the railroad company that was involved over time, and it was difficult to get information. In the end, municipal actors forced an agreement by scaling-up the discussion to the upper management level of both railroad company and national government. Respondents reflect on this process as difficult.

4. Demarcation, interfaces

This set involves the interaction between municipality and project developer to construct a public park on top of a private building. We find here again that actors both spanned and drew boundaries interspersed. We find that during their collaboration, municipality and project developer encountered unclarities in who does what for the parts where the park and building meet (e.g. the roofing between park and building, and the lift and stairs leading up to the park) and how to manage risks of the public park on the private building (e.g. leakage). Interestingly, to deal with this, actors in increasing detail constructed new boundaries by dividing public and private tasks and risks, in 2005-2009. They for instance demarcated in the physical structure of the roofing material exactly which layer of roofing belonged to the municipality and which to the project developer. Respondent reflect upon these demarcations between public and private as being needed and helpful to develop the integrative project. At the same time, they spanned boundaries by e.g. coordinating their activities in a joint project group. In addition, in 2008 an internal discussion rose within the municipal organization. This revolved around (technical) requirements put forward by specialized departments, which complicated the negotiations on a joint project agreement.

5. Water

This boundary discussion is about integrating the plan with an existing levee. Throughout this set we find activities to maintain boundaries (e.g. actors articulated little integration was possible with the levee, actors could not reach agreement on possibilities to include water safety measures in the structure of the building, water board did not participate in joint project group). Nevertheless, the municipality planned to construct the Dakpark across the levee, within a physical zone protected by water safety policy, hence challenging this boundary. In 2007 a conflict rose when the water permit was provided, but involved conditions unexpected and seen as impossible by municipality and project developer. Subsequently, distinct from the sequence of maintaining boundaries, an alderman played a crucial role by deciding the municipality would meet the conditions, acting as change agent. The process resulted in an un-easy co-existence, and was reflected upon as very sensitive by the respondents.

6. Energy company

Here we again find interspersed maintaining and spanning of boundaries. Similar to set 5, municipality and energy company communicated bilaterally. Noticeably, we found little boundary activities at all between 2001 and 2012, (only some meetings in 2006-2008). This changes when in 2012 the city heating infrastructure was found to be tilted, which necessitated municipality and energy company to work together. Subsequently, actors of both organisations spanned and drew boundaries in a process of negotiation. In the workshop participants reflected that they personally interact on good terms, but discuss on financing and responsibility. A municipal actor stated ‘We agree to disagree.’

7. Retail

This boundary discussion rose when due to changes in economic circumstances, actors changed the designation of the commercial building from harbour related business development to retail. However, this new destination didn’t fit with existing retail policy and we found gatekeeping activities by municipal actors responsible for this policy. Actors working on Dakpark tried to gain support for the new plan by various boundary spanning activities (e.g, organizing meetings and lobbying). In 2006 an alderman decided the Dakpark should be realised despite the retail policy, acting as change agent. In the subsequent process, actors tried to negotiate a compromise that enabled the Dakpark, whilst also retaining the retail policy as much as possible. To do so they define in detail the conditions under which the new retail destination is allowed, thereby redrawing boundaries.

4.4.2.3 Actors reflection and contentment regarding the whole process

Respondents reflected on the integration between functions as moderate, stating a unique park was realised, functions were stacked, and conflicting interests met. However, they criticized the relation between parts; the connection between park and building and neighbourhood and shops was seen as limited, the sum of the parts could be bigger, and a joint vision was lacking. One respondent argued too many interests were combined; making it vulnerable when one fails. Another questioned the need to stack functions. Respondents reflected on the fulfilment of the own function as satisfactory. The collaborative process was seen as moderately successful, raising two critiques: Firstly, the lack of time taken during the process to reflect on consequences of choices. Secondly, issues with large potential (financial) impact (e.g. levee, roofing) were dealt with too late in the process.

Set of actions	Actors	Illustration of boundary actions
(1) From conflicting claims to a joint project 1998-2000	Municipality Harbor company Residents External advisor	(1998) Lobbying by residents to develop a park instead of business development. (1998) Submission of idea to combine park and business destination to a planning contest. Presents the plan as connection between harbor and city. (1999) Municipality organizes 'mini-conferences' with residents, railroad company, harbor, civil servants and politicians. (1999-2000) Residents start a resident organization, which takes part in the discussions on the future use of the area. Residents feel everything needs to be fought for. (2000) External advisor is hired to facilitate the process and communication with residents. Start substantive exchange and reflection with residents and municipal departments.
(2) Resident participation 2000-2012	Municipality Residents External advisor Project developer Landscape architect	(2001) Residents provide an independent advice on three competing proposals of project developers. This advice is summarized into eight 'commandments' for the design of the park. The commandment that there should be one meter of soil later becomes a symbol for the residents. (2001) The developer's plan originally includes a design for the park. However the municipality decides the park will be a task of municipality, the building of the developer. (2002-2003) Meetings, presentations, workshops, debates on o.a. park design, choice for landscape architect. (2002) Two day excursion to Paris with municipality, developer, designers, and residents. (2003) Residents approve the masterplan sufficiently incorporates the eight commandments. (2006-2012) Start Dakpark Cafe, a regular information evening for residents. External advisor translates between 'professionals' (municipality and developer) and residents, e.g. through small interviews with professionals.
(3) (de)Rail 2000-2008	Railroad company Municipality Harbor company Harbor businesses	(2002-2004) Discussion how many rail tracks should be maintained. (2005) Decision all racks will be removed. Contracts will be annulated. One company is still not agreed. (2005-2007) Meetings municipality and rail company on removal of tracks, polluted spoil and financing, continuing over years.
(4) Demarcation/ interfaces 2001-2009	Municipality Project developer Municipal departments External advisor	(2001-2011) Start joint project group, involving municipal departments, project developer, locality, and advisor resident participation. Developer and municipality closely work together. (2001-2005) Discussions on what the 'excessive costs' (costs of having park on building) are. These are used as instrument to calculate the financial division between municipality and project developer. (2006-2009) Many meetings between developer and municipality to discuss the roofing between building and park. Central topic: how to deal with leakage. Actors divide responsibilities in detail, delineating who is responsible for which layer of roofing material. Similar discussions take place on the elevator and stairs. (2008-2009) Internal discussions on roofing in municipality.

(5) Water 2001-2011	Municipality Water board Project developer	(2001) Start meetings water board bilaterally with actors of engineering department municipality. Departmental project manager then informs the joint project group. (2001) Articulations that municipality perceived from the start that the levee needs to be respected, as the water board guards the levees and no work on it would be allowed. (2007) Water permit contains conditions: building and park must be removed if the levee should need to be heightened. (2007) Developer does not want to continue with project under these conditions. Leads to impasse. (2007) Meeting alderman and head of water board. Alderman takes over the risk of developer and guarantees that building will not be adjusted within 50 years
(6) Energy company 2001-2012	Municipality Energy company Water board	(2001) Bilateral meeting energy company and municipal departments. (2012) Meetings between energy company and municipal engineering department about possible solutions for city heating problem. Sometimes with water board. Focus is on jointly discussing technical problems and solutions. (2012) Discussions on financing. Energy company claims municipality should finance. (2012) Meetings between energy company and municipality are scaled up to managerial level. (2012) Municipality states energy company is responsible for consequences of city heating problems in time and costs.
(7) Retail 2005-2009	Municipality Project developer Province City region (REO)	(2005) Discussion on retail destination within municipality: new retail destination of building doesn't match retail policy. (2006-2007) Province and regional economic group (REO) need to agree with retail destination. Resistance and discussion in REO, and within municipality. (2006-2007) Decision alderman to enable Dakpark. Alderman convinces provincial politicians. (2006-2007) Discussion on possible solutions. Actors develop a detailed list of what type of retail is allowed, and work out conditions for this.

Table 4.4 Illustration of boundary actions Dakpark

4.4.3 Comparing sequences of boundary actions

Table 4.5 presents the sequences of boundary actions found in both cases and how they match with the sequences derived from the literature. It moreover presents the intermediate outcomes per set of actions. The comparison of the sequences shows that in many sets of actions we find a sequence of boundary spanning and drawing actions taking place interspersed and throughout the process, often in reaction to each other. We find this sequence at different moments in the process, in different orders (i.e. first spanning then drawing or vice versa), and with different intermediate effects.

Firstly, in the interaction with residents and local organizations in Westduinpark sets 2 and 3 and Dakpark sets 1 and 2, initiating actors spanned boundaries to gain support for the integrative idea (e.g. meetings, excursions). In reaction others reinforced boundaries to ensure the plan met their interests. Especially in the resident participation process in Dakpark, we found that residents undertook various activities to safeguard the plan met their interests (i.e. defending boundaries). This drawing, in combination with boundary spanning, didn't mean functions couldn't be combined or the interaction was negative, as

was expected in the sequence on maintaining boundaries derived from the literature. On the contrary, respondents stated these processes over time mostly led to increased support. We conclude that reinforcing boundaries in terms of demands on the design of the park enabled the residents to clarify and guard their interests and make clear what important boundaries were. For instance, by developing eight ‘commandments’ for the design of the park, residents made their wishes clear for others and ensured these were met. At the same time, municipal actors initiated many boundary spanning activities, which facilitated the interaction and enabled actors to reflect across boundaries (e.g. a joined project group, workshops, a formal agreement between actors, excursions, organising regular Dakpark café information evenings where actors could formally and informally interact). Together, this enabled an increased support for the integrative plan. It is important to note here that the boundary drawing and spanning actions only together – complementing each other - led to the effects discussed here. This matches with the first part of the sequence described by Ernst and Chrobot-Mason (2010) and Lee et al. (2014), that at the start of an interaction boundaries should first be strengthened and created, as by buffering (e.g. clarifying purpose, specialization) safety is created, and by reflecting across an understanding of boundaries is built that fosters respect. However, differing from this sequence, we find that in parallel to strengthening also the boundary spanning activities were important. This is furthermore underlined by sets 4 and 6 in the Dakpark case. In these sets actors also drew boundaries at the start of the process, but only later and limitedly combined this with boundary spanning actions. This led to a situation where the railroad company and energy company stood more at distance from the project (for instance they didn’t participate in the joint project group). The respondents were critical on these interactions. We conclude that to work across boundaries it is helpful to first identify and draw boundaries in order to clarify and guard interests and create an understanding and respect for the different viewpoints and interests that need to be taken into account. At the same time, this should be combined with connecting where possible to facilitate interaction and come to joint ideas on the project.

Secondly, we find the sequence of interspersed spanning and drawing of boundaries in the interaction between project developer and municipality regarding the public park and private building in Dakpark (set 4). Noticeably, here drawing activities focused on dividing tasks and responsibilities, rather than making demands clear. Interestingly, to deal with unclarities in who does what on the interface between public and private, actors choose to divide tasks and responsibilities for the parts where they met rather than keeping these issues collective. At the same time, actors closely collaborated and undertook boundary spanning activities such as coordinating their activities in a joint project group. Respondents reflected that reconstructing boundaries enabled them to deal

with unclarities between private and public responsibilities, and to keep the project manageable. We hence conclude that constructing a new boundary between public and private ownership in the physical structure was helpful to divide tasks, responsibilities and costs. This matches the sequence on ‘living together apart’, and elaborates upon earlier studies that show boundaries also have important functions to organise tasks and keep complexity manageable (Hernes, 2003). At the same time, respondent reflected that the relation between different functions in the Dakpark (e.g. park and building, neighbourhood and shops) could have been stronger. We conclude that drawing boundaries in both sequences described above facilitated realisation by providing actors a degree of safety, order, and autonomy, but also limited the degree of integration that was realised.

We also find interspersed drawing and spanning after the conflict that rose in Westduinpark (set 4). Here, the sequence matches with the sequence on internal discussions derived from the literature, followed up and modified by the sequence on negotiating change. Our findings underline the role of boundary spanning activities to come to a solution that suits all, and the role of change agents to provide an essential push by supporting possible solutions and inducing change (Degeling, 1995; Klerkx et al., 2010). However, while based on the literature we had expected that boundary spanning activities would be the final steps needed to bring about effective integration, here in addition we find actions redrawing boundaries at the end of the process (e.g. monitoring the consequences of measures and demanding mitigating measures if needed, and establishing conditions for allowing sand drift). Actors thereby redefined the conditions, responsibilities and new ways of working for the new situation - in effect reconstructing boundaries. Respondents from municipality and water board reflected that in this process of spanning and drawing they over time developed increased understanding of each other. In set 7 in Dakpark, actors in a similar manner in great detail define the conditions under which the new retail destination is allowed, in order to protect the retail policy.

The comparison of the cases also indicates that challenging boundaries is necessary to come to effective integration, but often leads to conflicts and internal discussions. In both cases, to enable actors working on the integrated initiative challenged and negotiated boundaries resulting in organisational change (e.g. in legislation, existing ways of working, or roles and tasks). In reaction, others within the organisation protected existing practices and policies, leading to discussions on whether to accommodate these changes. This is shown in the discussions on allowing sand drift within the protected water safety zone in Westduinpark (set 4), in the discussions on whether to allow retail (set 7), and the discussions between municipal actors on the (strictness of) requirements for the root- and

waterproof roofing (set 4) in Dakpark, and is in line with the sequence on internal discussions derived from literature (e.g. Long 2001; Van Meerkerk, 2014).

	Boundary discussion	Boundary actions over time				Matches with patterns from literature	Intermediate outcomes
Westduinpark	(1) Developing management plan	Span	little drawing			Spanning	
	(2) Nature quality in relation to existing recreation	Draw	Span + draw	Draw	Span + draw	Maintaining + spanning	+/- Increased support, but discussions continue over time, formal objections (one actor)
	(3) Preparing implementation: nature permits and communication	Span –	Draw	Span + draw		Maintaining + spanning	+/- Initial skepticism, later positive reactions residents. During implementation again criticism and later positive reactions.
	(4) Dynamic coastal management in relation to water safety permit	Span	Challenge + draw	Span + challenge + draw	Span + draw	Internal discussion + negotiating change + maintaining + spanning	+ Respondents state discussions move from 'talking to a wall' to more understanding of different positions and responsibilities.
Dakpark	(1) From conflicting claims to a joint project	Challenge + draw + span	Draw + span			Maintaining + spanning	+ Moving from competition to increased support for MLU idea
	(2) Resident participation	Draw + span	Span			Maintaining + spanning	+ Results in positive interaction process
	(3) (de)rail	Draw	Draw + some span			Maintaining + spanning	- Difficult interaction
	(4) Demarcation, interfaces	Span + draw	Challenge + span + draw	Span		Living together apart + internal discussion	+ Divisions of tasks seen as needed to develop project
	(5) Water	Draw	Draw + change agent	Draw		Maintaining	- Actors stay apart, sensitive topic
	(6) Energy company	Draw	Span + draw	Span + draw		Maintaining + Spanning	+/- Despite disagreement positive reflection on interaction
	(7) Retail	Challenge + draw + span	Draw			Internal discussion + negotiating change	

Table 4.5 Comparison of sequences and intermediate outcomes

A sequence of dominantly maintaining boundaries was found once, in the discussion regarding the levee in Dakpark. Consequently, actors kept apart, confirming the expectation that mostly drawing boundaries doesn't enable effective integration. Interestingly, functions were still physically stacked. This led to an uneasy co-existence and negative reflections. In contrast, we found mostly boundary spanning actions in set 1

of Westduinpark, mainly involving municipal actors. In contrast to the expectations, the fact that several further discussions on boundaries rose when the municipal plan was presented to other stakeholders implies that this sequence of boundary spanning alone was not enough to realise the plan.

The sequences discussed above show that whilst drawing boundaries is often seen as problematic for collaboration and whilst we do find that mostly drawing boundaries does not lead to a positive interaction (see Dakpark set 5, and the first years of set 3 and 6), we also find several sequences of boundary actions where drawing boundaries in complement to boundary spanning actions did not obstruct but in contrast seemed to be beneficial to realise effective integration (see Westduinpark sets 2, 3 and 4, and Dakpark sets 1, 2, 4 and 7). In addition, the fact that we find three different explanations for the occurrence of the sequences of interspersed drawing and spanning of boundaries (Dakpark set 1,2,4,7 and Westduinpark set 2,3,4) imply that to understand how managing boundaries takes place we need more insight than just the type of actions. To understand these sequences and their effects we needed to identify which actors drew or spanned boundaries, and with what aim. We conclude at least an actor based explanation is necessary as complement to a process analysis.

4.5 Conclusions and discussion

This research confirms earlier findings that integrating functions is not only about spanning boundaries. Making clear what hard boundaries are and (re)constructing boundaries are equally necessary, at different moments during the process. It moreover elaborates upon earlier work on enabling and constraining effects of different types of boundary actions (cf. Van Broekhoven et al. 2015; Westerink, 2016; Hernes, 2003), by providing further insight how actors manage boundaries over time and when during the process which sequences of boundary actions help to realise effective integration. Below we present three patterns in the sequences of boundary actions that we identified in the 11 sets of boundary actions within the two cases. As with any case study, these findings are contextually bound. They will need to be tested in further empirical studies.

1. To work across boundaries, boundaries first need to be created, strengthened and explicated, whilst also connecting where possible

Governance studies on integrated work have addressed the question how boundaries can be bridged in order to facilitate collaboration. Our findings underline earlier findings that boundary spanning actions are important to realise integrative initiatives by facilitating interaction and intermediating when conflicts rise. However in addition, this research highlights drawing boundaries also has an important role in integrative processes, occurring together with and complementing spanning. Paradoxically, we find that

drawing boundaries at the start of an interaction, in complement to spanning boundaries, can have beneficial effects for integrating functions, as it gives actors safety and comfort by clarifying and guarding their interests, and creates an understanding and respect for what different viewpoints and interests are that need to be taken in account. This is seen in the sequence of actions in the resident participation process in Dakpark (set 1 and 2) and Westduinpark (set 2 and 3), for instance in the use of the ‘eight commandments’. This pattern is in line with earlier finding by Ernst & Chrobot-Mason (2010) and Lee et al. (2014), indicating it is not only limited to the cases studied here. We however elaborate upon this by emphasising that the beneficial effects discussed here were a result of both boundary drawing and spanning actions together – complementing each other.

This pattern does not mean that actors should or can make all boundaries clear at the start of the process. This research has shown that what important boundaries are is not readily visible and can change over time.

2. After a period of spanning and challenging boundaries, reconstructing boundaries can help to keep the process manageable, provide safety and maintain autonomy.

The analysis furthermore reveals that it can be helpful to reconstruct boundaries after a period of boundary spanning and negotiating boundaries. One of the difficulties actors face in integrative projects is that by integrating functions tasks, risks, responsibilities become overlapping and blurred. By reconstructing boundaries such tasks, risks and responsibilities that have become collaborate during integrative process can be divided again. The analysis of the sequence of actions in set 4 in Dakpark shows that the municipality and project developer here preferred creating such divisions rather than keeping these issues collective. Here, constructing a new boundary between park and building – representing a division between public and private tasks— in the physical structure was helpful to divide tasks, responsibilities and costs. Furthermore, the research indicates that after a period of (internal) cross-boundary negotiation and making changes, redefining the conditions, responsibilities and new ways of working for the new situation enables actors to ensure the degree of change keeps within certain limits that they feel are important. This is seen set 4 in Westduinpark and set 7 in Dakpark, and is in line with some earlier findings (Kerosuo, 2006; Mørk et al., 2012). I conclude that (re)constructing boundaries after a period of working across boundaries provides a certain degree of order, safety and autonomy that is important for actors and organisations working in integrative initiatives in order to be comfortable with integrative measures.

3. Challenging boundaries is often necessary to realise integration, but actors can and should expect this will lead to conflicts and internal discussions during the integrative process

Actors often need to challenge boundaries to enable integrated initiatives, e.g. in legislation, existing ways of working, or roles and tasks. This research finds that whilst it is easily assumed in integrative initiatives that the important boundaries are those between sectors and organizations, by challenging boundaries the boundary discussion also moves towards the internal organisation (see set 4 in Westduinpark, and set 4 and 7 in Dakpark), confirming earlier studies (e.g. Van Meerkerk, 2014). In reaction to the changes required to enable the integrative initiatives, others within the organisation resist and protect existing practices and policies, leading to (internal) discussions on whether to accommodate such changes. In their daily actions, actors represent boundaries in their own ways. Different representatives have different roles within an organisation, and thereby may represent organisational interests differently and construct boundaries differently. This becomes especially clear in set 4 in Westduinpark, where actors for a long time seemed to jointly develop a plan no one was against, and only just before implementation it became clear that the idea that actors had on the possibilities to realise integrative measures did not match existing policy. Discussions on boundaries consequently and unexpectedly moved to within one of the organisations. This perspective on internal discussions elaborates upon earlier studies who highlight the ambiguous and difficult role of representatives working in integrative projects and who need to deal with the expectations and demands – and ensure support - of those with whom they negotiate as well as their own group (Long, 2001; Swan and Newell, 1998). An important lesson that we draw from the cases is that it is important to involve from early on not just those representatives who are good in working across boundaries (e.g. policy officers or strategists), but also those who are responsible for guarding boundaries to ensure the organizations' own tasks (e.g. enforcing body).

In both cases boundary spanning activities were important to resolve internal discussions. We found (political) change agents and boundary spanners played an important role to intermediate and enable or enforce organisational change, confirming earlier studies (e.g. Klerkx et al. 2010; Degeling 1995). In contrary to our expectations however, as discussed in pattern two presented above, we find that after a period of (internal) cross-boundary negotiation and making changes, actors redefined boundaries (see set 4 in Westduinpark and set 7 in Dakpark). This does not lead to conflict but rather seems to ensure the degree of change keeps within certain limits that actors feel are important. Actor in a sense thereby put boundaries on the degree to which boundaries can be changed.

Regarding the methodology, the approach to analyse the cases by comparing the empirical sequences of boundary action to sequences derived from the literature enabled us to systematically compare the empirical processes with the literature and across cases, and thereby provides better insight in the generality of the case study findings. However, the different explanations for the sequences of interspersed spanning and drawing show that to understand how managing boundaries takes place we need at least an actor based explanation as complement to the sequence of actions. The analysis leads to new questions for future research. First, obviously a study with two cases is limited in terms of generality. More research is needed to provide a broader basis for conclusions on sequences of boundary actions in integrated planning processes and their effects. Second, more insight is needed in the conditions under which specific sequences occur and have a certain outcome. For instance the prior history of relationships between actors, previously developed trust, and power relations, are likely to influence actors' boundary actions and their effects.

Author Contributions

Saskia van Broekhoven assessed the literature, developed the conceptual framework, collected and analysed the empirical data of the case studies, and wrote the manuscript. Frank Boons contributed to the conceptual and methodological development of the process analysis which compares empirical processes to event sheets, the analysis of the empirical data, and reflected on and made revisions to previous versions of the manuscript.

Appendix A: Specification sets of boundary actions and rules to establish patterns

Adjustments to sets of boundary actions

We identified sets of boundary actions with the use of an event graph (see methodology). In the event graph we identified network communities, with an algorithm developed by Blondel et al. (2008). Here network communities (the sets) are identified based on the number of linkages between actions, by identifying which actions are named as antecedents to other actions in the interviews and documents. The sets were validated by presenting them to participants of the workshops. This led to some changes in attribution of actions to sets. In addition, the researchers made some adjustments to the sets. These changes are discussed below.

Case Westduinpark

In Westduinpark two sets of boundary actions are omitted from the analysis because they involve too few events to analyse patterns, and the actions were only limitedly connected to each other and to a coherent boundary discussion.

Case Dakpark

In Dakpark we made three adjustments to the sets: First we joined two sets, because workshop participants emphasized their linkages (set 4). Second, we joined two sets because both evolve around resident participation (set 2), described as one process in documents and interviews, and validated as one process in the workshop. Third, we excluded one set, because it was reviewed as incomplete in the workshop. This is explained by the data collection: (1) it concerns park maintenance, which started when data collection stopped; moreover, (2) the participant stating this was not interviewed (due to 1).

Rules to establish patterns

Several quantitative methods exist for comparative analysis of sequences (Cornwell, 2015). As we have theoretical templates (the boundary action patterns from literature), the analysis consists of comparing these with each empirical set of boundary actions. We established the following interpretive rules for matching the empirical sequence and event sheets, similar to a logic using INDEL costs ('costs' of insertion (IN) or deletion (DEL) of elements, c.f. (Abbott, 1995) (E= empirical sequence, ES = event sheet):

1. If E = ES, the event sheet is allocated.
2. If E contains all elements of ES, but has additional actions, we check if this is explained by a parallel event sheet. If not all actions are explained, we used the interviews to assess the importance of additional actions. If they were flagged as crucial, we don't allocate ES.
3. If E has some, but not all actions of ES, we allocate ES flagging the omission.
4. If E has the actions of ES, but in a different order, we allocate ES flagging changed order.

References

- Abbott A (1995) Things of boundaries. *Social Research* 62(4): 857–882.
- Ancona DG and Caldwell DF (1992) Bridging the Boundary: External Activity and Performance in Organizational Teams. *Administrative Science Quarterly* 37(4): 634–665. DOI: 10.2307/2393475.
- Blondel VD, Guillaume J-L, Lambiotte R, et al. (2008) Fast unfolding of communities in large networks. *Journal of Statistical Mechanics: Theory and Experiment* 2008(10): P10008. DOI: 10.1088/1742-5468/2008/10/P10008.
- Boeije HR (2009) *Analysis in Qualitative Research*. SAGE.
- Boons F, Spekkink W and Jiao W (2014) A Process Perspective on Industrial Symbiosis. *Journal of Industrial Ecology* 18(3): 341–355. DOI: 10.1111/jiec.12116.
- Clark WC, Tomich TP, van Noordwijk M, et al. (2010) *Toward a General Theory of Boundary Work: Insights from the CGIAR's Natural Resource Management*

- Programs*. HKS Faculty Research Working Paper Series RWP10-035. John F. Kennedy School of Government, Harvard University.
- Degeling P (1995) The significance of ‘sectors’ in calls for public health intersectoralism: an Australian perspective. *Policy & Politics* 23(4): 289–301.
- Derkzen P, Bock BB and Wiskerke JSC (2009) Integrated Rural Policy in Context: A Case Study on the Meaning of ‘Integration’ and the Politics of ‘Sectoring’. *Journal of Environmental Policy & Planning* 11(2): 143–163. DOI: 10.1080/15239080902920126.
- Doorn JAA (1956) *Sociologie van de Organisatie: Beschouwingen over Organiseren in Het Bijzonder Gebaseerd Op Een Onderzoek van Het Militaire Systeem*. Kroese.
- Edelenbos J and Klijn E-H (2006) Managing Stakeholder Involvement in Decision Making: A Comparative Analysis of Six Interactive Processes in the Netherlands. *Journal of Public Administration Research and Theory* 16(3): 417–446. DOI: 10.1093/jopart/mui049.
- Enayati J (2002) The research: effective communication and decision-making in diverse groups. *Multi-Stakeholder Processes for Governance and Sustainability: Beyond Deadlock and Conflict*: 73–95.
- Epstein CF (1992) Tinkerbells and Pinups: The Construction and Reconstruction of Gender Boundaries at Work. In: Lamont M and Fournier M (Eds) *Cultivating Differences: Symbolic Boundaries and the Making of Inequality*. Chicago: University of Chicago Press, pp. 232–256.
- Ernst C and Chrobot-Mason D (2010) *Boundary Spanning Leadership: Six Practices for Solving Problems, Driving Innovation, and Transforming Organizations*. New York: McGraw-Hill Education.
- Friedman RA and Podolny J (1992) Differentiation of Boundary Spanning Roles: Labor Negotiations and Implications for Role Conflict. *Administrative Science Quarterly* 37(1): 28–47. DOI: 10.2307/2393532.
- Hernes T (2003) Enabling and constraining properties of organizational boundaries. In: *Managing Boundaries in Organizations: Multiple Perspectives*. Hampshire: Palgrave Macmillan, pp. 35–55.
- Hoppe R (2010) From “knowledge use” towards “boundary work”: sketch of an emerging new agenda for inquiry into science-policy interaction. In: *Knowledge Democracy*. Berlin Heidelberg: Springer, pp. 169–186.
- Janssen SKH, Tatenhove JPM van, Otter HS, et al. (2015) Greening Flood Protection—An Interactive Knowledge Arrangement Perspective. *Journal of Environmental Policy & Planning* 17(3): 309–331. DOI: 10.1080/1523908X.2014.947921.
- Jiao W and Boons F (2017) Policy durability of Circular Economy in China: A process analysis of policy translation. *Resources, Conservation and Recycling* 117.

- Resource Efficiency In Chinese Industry: 12–24. DOI: 10.1016/j.resconrec.2015.10.010.
- Katz R and Tushman ML (1979) Communication patterns, project performance and task characteristics: an empirical evaluation and integration in an R&D setting. *Organisational behavior and Human Performance* 23: 139–162.
- Kerosuo H (2006) *Boundaries in action. An Activity-theoretical Study of Development, Learning and Change in Health Care for Patients with Multiple and Chronic Illnesses*. Helsinki University Press, Helsinki.
- Klerkx L, Aarts N and Leeuwis C (2010) Adaptive management in agricultural innovation systems: The interactions between innovation networks and their environment. *Agricultural Systems* 103(6): 390–400.
- Klerkx L, van Bommel S, Bos B, et al. (2012) Design process outputs as boundary objects in agricultural innovation projects: Functions and limitations. *Agricultural Systems* 113: 39–49. DOI: 10.1016/j.agsy.2012.07.006.
- Lee L, Magellan Horth D and Ernst C (2014) *Boundary Spanning in Action: Tactics for Transforming Today's Borders into Tomorrow's Frontiers*. Centre for Creative Leadership.
- Long N (2001) *Development Sociology: Actor Perspectives*. Routledge.
- Lovell ST and Taylor JR (2013) Supplying urban ecosystem services through multifunctional green infrastructure in the United States. *Landscape Ecology* 28(8): 1447–1463. DOI: 10.1007/s10980-013-9912-y.
- Marshall N (2003) Identity and Difference in Complex Projects: Why Boundaries Still Matter in the 'Boundaryless' Organisation. In: Paulsen N and Hernes T (Eds) *Managing Boundaries in Organizations: Multiple Perspectives*. Hampshire: Palgrave Macmillan, pp. 35–55.
- Mørk BE, Hoholm T, Maaninen-Olsson E, et al. (2012) Changing Practice Through Boundary Organizing: A Case from Medical R&D. *Human Relations* 65(2): 263–288. DOI: 10.1177/0018726711429192.
- Noble G and Jones R (2006) the role of boundary-spanning managers in the establishment of public-private partnerships. *Public Administration* 84(4): 891–917. DOI: 10.1111/j.1467-9299.2006.00617.x.
- O'Farrell PJ and Anderson PML (2010) Sustainable multifunctional landscapes: a review to implementation. *Current Opinion in Environmental Sustainability* 2(1–2): 59–65.
- Paulsen N and Hernes T (2003) *Managing boundaries in organizations: Multiple perspectives*. Hampshire: Palgrave Macmillan.
- Pettigrew AM (1990) Longitudinal Field Research on Change: Theory and Practice. *Organization Science* 1(3): 267–292. DOI: 10.1287/orsc.1.3.267.

- Selman P (2009) Planning for landscape multifunctionality. *Sustainability: Science, Practice, & Policy* 5(2): 45–52.
- Spekkink WAH and Boons FAA (2016) The Emergence of Collaborations. *Journal of Public Administration Research and Theory* 26(4): 613–630. DOI: 10.1093/jopart/muv030.
- Sproule-Jones M (2002) Institutional Experiments in the Restoration of the North American Great Lakes Environment. *Canadian Journal of Political Science/Revue canadienne de science politique* 35(04): 835–857. DOI: 10.1017/S0008423902778463.
- Star SL and Griesemer JR (1989) Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science* 19(3): 387–420. DOI: 10.1177/030631289019003001.
- Swan J and Newell S (1998) Making sense of technological innovation: the political and social dynamics of cognition. In: Eden C and Spender JC (Eds) *Managerial and Organizational Cognition: Theory, Methods and Research*. London, Sage, pp 108-128.
- Tilly (2002) *Stories, Identities, and Political Change*. Rowman & Littlefield.
- Tushman ML and Scanlan TJ (1981) Boundary Spanning Individuals: Their Role in Information Transfer and Their Antecedents. *The Academy of Management Journal* 24(2): 289–305. DOI: 10.2307/255842.
- Van Broekhoven S and Vernay AL (2018) Integrating Functions for a Sustainable Urban System: A Review of Multifunctional Land Use and Circular Urban Metabolism. *Sustainability* 10(6): 1875. DOI: 10.3390/su10061875.
- van Broekhoven S, Boons F, van Buuren A, et al. (2015) Boundaries in action: a framework to analyse boundary actions in multifunctional land-use developments. *Environment and Planning C: Government and Policy* 33(5): 1005–1023. DOI: 10.1177/0263774X15605927.
- van Meerkerk I (2014) *Boundary Spanning in Governance Networks: A Study about the Role of Boundary Spanners and Their Effects on Democratic Throughput Legitimacy and Performance of Governance Networks*. Erasmus University Rotterdam, Rotterdam.
- Westerink J (2016) *Making a Difference: Boundary Management in Spatial Governance*. Wageningen University, Wageningen.
- Williams P (2002) The Competent Boundary Spanner. *Public Administration* 80(1): 103–124. DOI: 10.1111/1467-9299.00296.
- Yan A and Louis M (1999) The Migration of Organizational Functions to the Work Unit Level: Buffering, Spanning, and Bringing Up Boundaries. *Human Relations* 52(1): 25–47. DOI: 10.1023/A:1016968332082.

5 Climate adaptation on the crossroads of multiple boundaries. Managing boundaries in a complex programme context.

Van Broekhoven, S.; van Buuren, A. (2020) Climate adaptation on the crossroads of multiple boundaries. Managing boundaries in a complex programme context. *European Planning Studies*. DOI:10.1080/09654313.2020.1722066

Abstract:

Programme management is increasingly used in The Netherlands to realise more integrated regional development, where different sectoral policy objectives are combined. To understand how integration of different objectives is realised in programme management approaches, it is important to have in depth knowledge on how actors manage social, cognitive and physical boundaries. Therefore, this article analyses how actors manage boundaries in a regional integrative programme. Within this case we focus on two integration attempts: one which has succeeded relatively well and one which was less successful. The analysis shows the importance of boundary spanning actions, such as jointly working on strategy documents, organising events where actors can formally and informally interact, and the activities of a political change agent. Adding to previous insights, we find four additional explanations for successful integration which shed new light on how boundaries can be best managed in future programmatic approaches: the influence of contextual factors on boundary management and its success, the need to address both the social and cognitive dimension of boundaries, the need to make the programme attractive for the actors governing the issues it wants to integrate with, and the role of boundary drawing to create an understanding and respect for boundaries.

5.1 Introduction

Programme management is increasingly used to realise more integrated and multifunctional regional development, where different sectoral policy objectives are combined (e.g. nature conservation, regional economic development, water management (cf. Buijs, 2018; Busscher, 2014). Examples are the Dutch Room for the River programme (Herk, Rijke, Zevenbergen, Ashley, & Besseling, 2015) and Bluebelt Programme in New York (<https://www1.nyc.gov/site/dep/water/the-bluebelt-program.page>) that combine flood protection with ecological aims, the Dutch Deltaprogramme on climate adaptation (van Buuren & Teisman, 2014), the Inter-administrative Program Vital Countryside on integrated and sustainable regional rural development (www.werkplaatsvitaalplatteland.nl), or green infrastructure programmes that combine green space, urban development and climate adaptation such as the Programme for Promoting Urban Green Infrastructures in Barcelona. As many organisations past decades started organising their work largely through ‘projects’ and using project management, this led to a need to coordinate between different projects, use resources effectively, and work on more strategic goals, resulting in the rise of programmes (Pellegrinelli, 2011). In the context of regional development, programmes are not just about coordinating across projects, but also across different autonomous project organisations working side by side in a larger territorial system (van Buuren, Buijs, & Teisman, 2010). Programme management is seen as an approach that can help to achieve sustainable, coherent and integral regional development by developing a consistent and a shared focus around a programme among highly different yet interconnected issues and projects that need to be realised simultaneously, but which are often governed by different actors and organisations (ibid). However, we know from previous research that such integrative initiatives, involving a multitude of stakeholders, interests and perspectives, are hard to achieve (Degeling, 1995; Derkzen, Bock, & Wiskerke, 2009; Van Broekhoven & Vernay, 2018). Although integrative initiatives often see wide support at the starting phase, their complexity causes that only some endeavours are successful (O Farrel & Anderson, 2011; Van Broekhoven & Vernay, 2018).

To understand how integration of different issues and projects is realised in programme management approaches, it is important to address how actors manage boundaries (Lehtonen & Martinsuo, 2009; van Broekhoven, Boons, van Buuren, & Teisman, 2015). Integration requires actors to work across different boundaries; social boundaries between groups of people such as water managers, nature conservationist and farmers; cognitive boundaries between perspectives, ways of working, knowledge and language; and physical boundaries in physical objects and geographical jurisdictions (van Broekhoven et al., 2015). Actors participating in integrative programmes try to influence the multiple

boundaries they experience. They try to change or bridge boundaries that constrain them, and construct and maintain boundaries that enable them to pursue their goals, keep out external interferences, or divide tasks and responsibilities (ibid).

The question how actors can deal with boundaries in integrative and multifunctional processes has recently gained attention in spatial planning (Bressers, 2010; Opdam, Westerink, Vos, & Vries, 2015; van Broekhoven et al., 2015; Westerink, 2016; Westerink, Lagendijk, Dühr, Jagt, & Kempenaar, 2013). However, little is known on how actors can best manage boundaries specifically in programmatic approaches for integrated regional development, in contrast to a growing body of literature on how actors manage boundaries in the context of (multifunctional) projects (Van Broekhoven & Boons, in review; van Broekhoven et al., 2015; Westerink, Opdam, van Rooij, & Steingröver, 2017). As scholars emphasize the differences between programmes and projects, and state that programmes require a different type of management to succeed (Lycett, Rassau, & Danson, 2004; Pellegrinelli, 2011; Pellegrinelli, Partington, Hemingway, Mohdzain, & Shah, 2007), we can also expect differences in the type of boundary management between programmes and projects that contribute to success. For example, rather than emphasizing strict boundaries around the project and protecting it from interferences from outside that is often seen in projects, having strict boundaries is in conflict with the idea that programmes are about continuously establishing connections between multiple projects and issues (Lycett et al., 2004). In order to bring together different goals and interest and involve different stakeholders, boundaries between the programme and its environment need to be continuously shaped (Pellegrinelli et al., 2007). This suggests boundaries should not be defined too strict and static.

In this paper we address the following research question: *How do actors manage boundaries over time in an integrative regional programme, how do contextual factors shape how boundaries are managed, and what does this tell us about the kind of boundary management that helps to realise integration in programme management approaches?* We address this question with a longitudinal case study of a regional collaborative programme on climate robust water supply and spatial planning in The Netherlands: the Deltaplan Hoge Zandgronden (Deltaplan High Sandy Soils, DHZ). Within the case we focus on two integration attempts: one which has anchored relatively and one which was less successful. This enables us to explore why boundary management at the one integration attempt was more successful than at the other and what contextual factors shaped boundary management.

5.2 Conceptual framework

5.2.1 *Programme versus project management for integrated regional development*

Programme management can be described as an integrative management approach to coordinate multiple projects, related actors and project management activities, and realise synergetic benefits that could not be obtained separately. Several scholars argue programmes fundamentally differ from projects as they build on different assumptions and principles, and that their management requires different frameworks and tools (Lycett et al., 2004; Pellegrinelli, 2011; Thiry, 2004). Project and programme management differ in at least three respects. Firstly, whilst projects have a relatively clear set of goals and tasks, and a beginning and end, programmes are emergent and constantly shaped and reshaped in terms of contents, processes and structures, in order to bring together different goals and interest, make progress and involve different stakeholders (Pellegrinelli et al., 2007). Programme managers therefore need to be more aware of and responsive to external changes and changes in strategic goals than project managers, and programmes need a more flexible type of management that accommodates for complexity, ambiguity and risks in their environment (ibid). Secondly, whilst projects are often assumed to have a linear life-cycle, programmes develop incrementally in order to deal with external change (Lycett et al., 2004). Their management therefore is about both planning and coping (van Buuren et al., 2010; Pellegrinelli et al., 2007). Van Buuren et al. (2010) argue programme management in practice is often a hybrid between a planned or top-down implemented management tool and an emerging strategy shaped and given meaning by the strategies and interventions of participating actors. Thirdly, as a result of the above, programmes are significantly shaped by the context in which they take place, and programme management efforts are contextually bound (Lycett et al., 2004; Pellegrinelli et al., 2007).

5.2.2 *Managing boundaries in programmes*

To understand how integration of different issues, values and projects is realised in programme management approaches, it is important to address how actors manage boundaries. Boundaries are in essence sites of difference—ways of differentiating something from what it is not (Abbott, 1995; Hernes, 2004). We view boundaries as socially constructed. They are enacted in interactions where they are made explicit, are shaped, enforced, or form a matter of contention (van Broekhoven et al., 2015). Following Kerosuo (2006, page 4), we define boundaries as temporary stabilised “*distinctions and differences between and within activity systems that are created and agreed on by groups and individual actors over a long period of time while they are involved in those activities. These distinctions and differences can be categorisations of material objects, people and practices*”.

In this article we aim to contribute to our understanding of integration in programmes by studying the construction and reconstruction of boundaries: i.e. how boundaries are spanned, drawn, contested, defended and negotiated in the integrative processes. Previous studies provide valuable insights on how boundary spanners can facilitate collaboration across boundaries (e.g. Williams, 2002, Klerkx et al., 2010). However, integration is complicated by the need or desire to construct and maintain boundaries (Van Broekhoven et al., 2015). As boundaries have important social functions, actors actively construct and maintain them (Hernes, 2003; Lamont and Molnár, 2002). Moreover, the literature on boundaries draws attention to how boundaries as social constructs are constantly constructed, negotiated, and evolved when actors interact.

To study the (re)construction of boundaries we build forth on a framework developed by Van Broekhoven et al. 2015. We apply this to the context of complex programmes. Moreover, we develop this approach further by adding a focus on the role of contextual factors. As discussed in sector 2.1, programmes are significantly (and more than projects) shaped by the context in which they take place. Building forth upon Van Broekhoven et al. (2015) we study how actors manage boundaries by reconstructing boundary actions, defined as: *'A recurring set of articulations, actions, and interactions that shape a demarcation, taking place over a longer period of time'* (Van Broekhoven et al., 2015, p5). We assume that how actors manage boundaries (i.e. perform boundary actions) in programmes affects the extent to which they are able to develop integration. To identify and study actors' boundary actions, we specify three main types of actions through which actors manage boundaries:

- (1) Spanning boundaries by connecting people, processes and ideas across boundaries, in order to e.g. coordinate practices or exchange information. Spanning facilitates flow of e.g. information, knowledge and resources across a boundary without challenging its relevance or place. We distinguish actions that span boundaries through developing coordination structures (e.g. project groups) and through developing more dense relations. This can be facilitated by so-called boundary spanners i.e. people or organizations that act as intermediaries, identify needs and facilitate shared problem perceptions and solutions by communicating and building relations (Williams, 2002), and boundary objects i.e. objects that can serve as means of translation and basis for coordination between actors (Star & Griesemer, 1989). In programmes, permeability of programme boundaries is often emphasised over the benefits of demarcation and the focus on emphasizing strict boundaries and protecting the project from interferences from outside that is often seen in projects (Lycett et al., 2004). Boundaries need to be bridged in order to

coordinate and connect different projects and issues, an important aim in programmes. We can hence expect boundary spanning between the programme and its context to be an important boundary action.

(2) Drawing or defending boundaries, in order to e.g. protect something (e.g. interests, plans, established ways of working) from influences from outside, enable successful action within the bounded unit, divide tasks, or demarcate which problems and solutions are included. Drawing or defending boundaries is often seen as problematic for cooperation and constraining the capacity to integrate (Degeling, 1995; Derkzen et al., 2009). However, studies have also found drawing boundaries in integrative work can be useful to keep complexity manageable and divide tasks (Hernes, 2003; van Broekhoven et al., 2015). In programme management the main orientation is on coordination between projects and issues and on overcoming boundaries, over the benefits of demarcation (Lycett et al., 2004). We can therefore expect little drawing of boundaries. However, some studies find drawing of boundaries does occur and can also be useful to protect emerging programmes, e.g. by reserving time to work on them and to build momentum and readiness for change (Lehtonen & Martinsuo, 2009; Pellegrinelli, 2011). This demarcation was found to occur together with and complementary to boundary spanning efforts. As Lehtonen & Martinsuo (2009) show that the nature of boundary management changes during the course of programmes, an interesting question here is at what moments during the process drawing occurs and is useful.

(3) Challenging, negotiating and changing boundaries in order to e.g. include new actors, ideas, or resources. In integrative work, boundaries often become challenged as bringing about innovative integrative solutions often requires a deviation of previously established monosectoral practices, norms and identities (Van Broekhoven & Vernay, 2018). The emergent, adaptive, and non-linear nature of programmes, where effective programme management involves their continuous shaping in terms of content and structure, suggest boundary management will involve continuous challenging and changing of the boundaries of the programme itself in order to adapt to a changing environment and changes in strategic goals. Moreover, it is likely that integrative programmes will also involve changing or challenging established boundaries of the issues and projects with which they aim to integrate, in order to come to integration and develop synergetic benefits.

In order to systematically observe these ways of managing boundaries in our case study, we furthermore distinguish (interrelated) dimensions of boundaries that actors may address with their boundary actions: social boundaries between groups of people such as farmers, water managers, nature workers; cognitive boundaries such as between different perspectives, ways of working, knowledge and language, and physical boundaries such as between geographical jurisdictions (Van Broekhoven et al., 2015). We combine these dimensions with the specified boundary actions as a lens to map and interpret boundary (re)construction. Table 5.1 presents indicators on each of these dimensions and for the three types of boundary actions, which we use to analyse the case study.

Enactment Dimension	Spanning	Drawing		Challenging
		Reconfirming or establishing	Regulating	
Social (boundaries between groups of people, ‘us’ and ‘them’)	Building or enhancing connections with actors across a demarcation	In/excluding actors in decision making or group actions Use of language: We/us–they/them	Buffering or regulating the access of others across a demarcation	Problematizing / changing established demarcations about who is in/excluded in decision-making process
Cognitive (boundaries in conceptions of problems and solutions, possibilities or ideas taken in account)	Strategies enhancing flow of information or ideas across a demarcation, e.g. exploring other’s interests, developing ‘common ground’ shared stories on project	Demarcating limits on (im) possibilities or ideas taken into account Differing conceptions of problems or solutions Dividing who leads on what	Buffering or regulating the flow of information or ideas between social worlds	Problematizing / changing existing frames/ideas or (im)possibilities. Problematizing divisions of roles, tasks, or responsibilities
Physical (physical/ material or territorial boundaries)	Physical connections perceived by involved actors as not directly challenging a demarcation, boundary objects	Physical or territorial (ownership) divisions	Physical interfaces regulating or monitoring the physical flow across	Physical events or things that do not keep to the demarcation between social worlds

Table 5.1 Operationalization boundary actions. Source: van Broekhoven et al. 2015, modified by authors)

5.2.3 Contextual factors influencing how actors manage boundaries

To understand how programmes are managed successfully, knowing the context in which the programme takes place is crucial (Lehtonen & Martinsuo, 2009; Lycett et al., 2004; Pellegrinelli et al., 2007). We therefore analyse how contextual factors influence and explain the boundary actions that are employed and the integration that is achieved in the case study. Lehtonen and Martinsuo (2009) identify three main types of contextual factors:

(1) Factors related to the characteristics of the organisation or issue with which integration is sought. Integration is not just influenced by the programme itself, but the organisations or issues with which integration is sought also enable or constrain it. Building on Lehtonen and Martinsuo (2009) we distinguish the working culture (e.g. a project management culture, or a culture of dialogue), previous experiences with programme management and with the content of the programme, and the organisational structure and way in which departments are involved in the programme.

(2) Factors stemming from the nature of the programme itself, specifically the importance of the programme to top management and the involvement of top management. As we here study two integration attempts within a programme, we will specify these factors to the nature of the integration attempts, i.e. the importance of the integration attempt to top management and the involvement of top management in the integration attempt.

(3) Factors related to the individual characteristics of the programs' key actors, especially the programme managers. The literature on boundary spanning provides insights into factors influencing actors' capacity to span boundaries. Firstly, to be able to build connections actors need to know and be credible to people on both sides. They need to have strong links internally and externally, and be seen as competent, in order to gather information and translate it across (Levina & Vaast, 2005; Tushman & Scanlan, 1981). Scholars have identified leaders or 'reticultists' can play an important role in this, as important and powerful individuals who can construct cross-boundary coalitions (Degeling, 1995). Secondly, actors spanning boundaries furthermore need to be aware of the needs, norms and context on both sides of the boundary, in order to find relevant information and translate it to the other side (Williams, 2002; Tushman & Scanlan, 1981). In this respect it is also important actors know how and where to get information and who needs it.

5.2.4 Realising integration around a programme

To explore what kind of boundary management helps to realise integration in programmes, we need to assess the success of the integration efforts around a programme. To do so we build upon Pellegrinelli et al. (2007), who argue good programme management is about the *‘significant and on-going crafting of programme content, structures and processes to reconcile divergent aims and interests, to expedite progress in the face of adversity and to engage multiple sponsors, contributors.’* This suggests three important aims in programmes: 1) Reconcile divergent aims and interests (Do actors succeed to develop certain integration possibilities which they jointly want to work on in the programme?); 2) Expedite progress (Do actors succeed in realising intended integration possibilities, or making them more likely?); and 3) Engage multiple stakeholders (Are more stakeholders involved? Are existing stakeholders involved more closely? Is a group of actors developed that want to work on integration possibilities together?)

5.3 Methods

To study in-depth the micro-interactions of boundary management and explore boundary actions and configurations of actions over time we use a single longitudinal case study design. The case is selected using the principle of maximalisation, i.e. choosing a case where the topic of study manifests itself most strongly and is transparently observable (Boeije, 2009). We selected a regional collaborative programme where actors integrate several sectoral objectives including water management, spatial planning, agricultural development and nature conservation. Given the institutional and historical differences between water management and spatial planning (Wiering and Immink, 2006; Van Buuren et al., 2010; Van Broekhoven et al., 2015), and nature conservation and agriculture (Derkzen et al., 2009) in The Netherlands, this provides a setting where boundaries as traces of past activities are strongly present. Moreover, the case is an ongoing programme, providing ample opportunity to study boundary management in action through observations.

To map how boundaries were managed the development of the collaborative programme is reconstructed, from 2009 (idea for the programme rose) up to 2014 (programme is going into implementation phase). Data is gathered by: (a) semi-structured interviews; (b) document analysis; and (c) observations of actors’ interactions (see Table 5.2). Using multiple data sources reduces the risk of distortions in post-factual accounts and increases internal validity. We collected documents through respondents and websites of involved organizations, interviews were transcribed, and reports were made of observed meetings.

Document analysis	47 documents covering the studied period 2009-2014, e.g. project documents, minutes of steering group and project group meetings, discussion documents for steering and project group, covenants between actors, documents on the DHZ programme of involved organisations
Observations of meetings	One of the researchers has observed meetings of the project group, steering group, and symposia and workshops organised around the programme from 2012 – 2014, in total 14 meetings
Interviews	12 interviews with actors from the organisations involved in the DHZ (administrative and political level)

Table 5.2 Data Collection

To identify boundary actions over time, we developed a chronological database in Excel by selecting from each interview, document and observation, articulations of incidents that indicate the activation, contestation or crossing of a boundary, based on the definition of boundary actions and indicators in section 2.2. This led to 313 incidents. Next, incidents named by multiple sources were summarized into one, and coded with the aim to identify occurrences of the specified boundary actions (using colour coding to identify types of boundary actions and patterns over time). This resulted in 88 boundary actions. Obviously, this does not represent the entire population of boundary actions in the case. Reconstructing, observing and recording all possible incidents that happened over time is not humanly possible, or even desirable. Given our method of data collection, we assume that we have captured at least the most significant boundary actions. Also, there is no a priori reason to suppose our method biases a particular type of action.

We focus in this article on two sets of boundary actions within the case, which evolve around two integration attempts. The first set evolves around the ambition to integrate the DHZ with the national Deltaprogramme; the second around the ambition to integrate spatial planning issues in the programme. Many activities observed in the DHZ centred on these two ambitions. Of the total of 88 boundary actions, 47 were related to integrating with the Deltaprogramme, and 24 to integrating with spatial planning.

Next, we assessed the performance of the integration attempts on reconciling divergent aims and interest, expediting progress, and engaging stakeholders. Lastly, we analysed how contextual factors shaped how boundaries were managed by identifying the in section 2.3 specified contextual factors for both integration attempts, how these varied between both, and assessing how this explains differences in how actors managed boundaries and in the performance of both integration attempts. This is an interpretive act of the researchers.

5.4 Results

We first introduce the case. Next, we analyse the actions that actors employed to manage boundaries during the process for both integration attempts. We then analyse the integration reached for both attempts. Lastly, we analyse contextual factors that shaped how boundaries were managed. We observed no activities that addressed the physical dimension of boundaries in both integration attempts, perhaps fitting with the developmental stage the process was in. Activities stayed at writing documents and having meetings, and did not materialize into any actual physical activities or delineation to geographical boundaries (e.g. identifying the locations where measures will be taken) yet.

5.4.1 Introducing the case

The DHZ is a regional collaborative programme where various regional actors (four waterboards; two provinces; a nature organization; Rijkswaterstaat Noord-Brabant ; two agricultural organisations; and a drinking water company) work together to develop a climate robust water supply and spatial planning on the high sandy soils in South-Netherlands. The programme started in 2009. In the subsequent process actors developed a strategy and implementation programme, organised activities to gain support and attract more partners in the programme, and lobbied to get more recognition from a parallel national programme: the Deltaprogramme, which focusses on adaptation and water management, with various thematic and regional sub programs (see Van Buuren & Teisman, 2014).

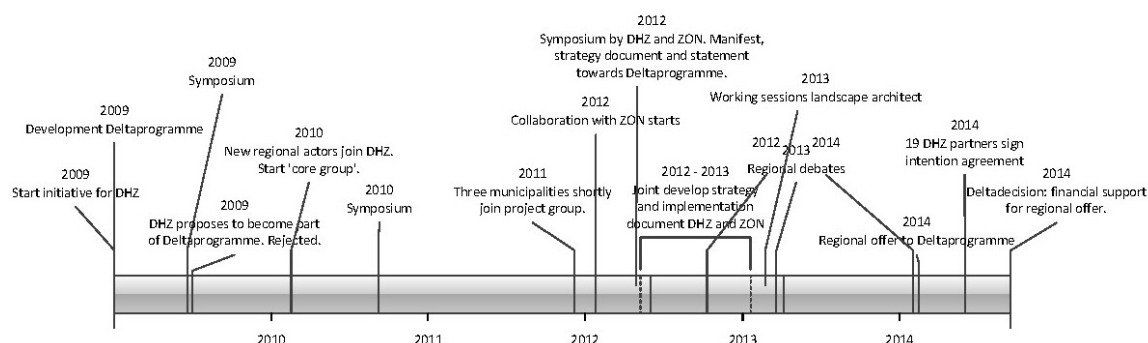


Figure 5.1 Timeline development Deltaplan Hoge Zandgronden with main events.

Summer 2014 19 regional organisations formally affirmed their collaboration by signing an intention agreement to realise the implementation programme and invest 106 million in the DHZ, if the Deltaprogramme would provide co-financing. September that year the national government formally decided upon five so-called Delta Decisions prepared by the Deltaprogramme: main choices on the approach to realise water safety, fresh water

supply, and a climate- and water robust organization of The Netherlands. As part of these Delta Decisions, a co-financing of 60 million euros was appointed to realise DHZ measures. Figure 5.1 shows the main events in this programme. These are further discussed below.

5.4.2 Boundary actions during the process of two integration attempts

5.4.2.1 Integrating with the Deltaprogramme

Here we analyse boundary actions that evolve around the interaction between the DHZ programme and the Deltaprogramme. Table 5.3 presents the most characteristic boundary actions that signal how boundary management developed.

At the start of the DHZ programme the initiating regional actor, led by a waterboard, undertook various boundary spanning actions aimed at bridging social and cognitive boundaries. One of their first big actions was to organize a symposium to get more support for regional issues of climate robust water supply and spatial planning. Here they invited national actors, in order to show that the regional ambitions and problems regarding drought and fresh water supply fitted well in the Deltaprogramme. In parallel actors also bridged boundaries towards regional partners on the social dimension (e.g. developing joint coordination structures including a project group and steering group) and the cognitive dimension (e.g. sending a strategy document to possible partners), strengthening the programme itself by attracting further support from regional actors.

Later in 2009 actors in the DHZ, led by the programme chair, proposed to the national Deltaprogramme that DHZ should be added as regional sub-programme to the Deltaprogramme. They thereby put the division between the regional DHZ programme and Deltaprogramme up for discussion. They argued that the Deltaprogramme mostly focussed on the Western parts of The Netherlands and did not pay enough attention to water issues in high areas of The Netherlands, and wanted the high areas of The Netherlands to be equally included. However, here the Deltaprogramme drew boundaries, deciding not to integrate the DHZ in the Deltaprogramme. Nevertheless, the DHZ steering group decided to continue the regional programme on their own and continued their attempts to bridge this divide. Moreover, they identified communication and lobbying with the Deltaprogramme as one of its core tasks.

In the subsequent process we observe many more boundary spanning actions. Actors doubled their efforts to connect with the Deltaprogramme. In the period of 2010-2012 actions were mainly aimed at developing more dense relations (bridging social boundaries), e.g. organizing another symposium inviting the Deltaprogramme, inviting

actors from the Deltaprogramme to join steering group meetings, a field visit in which actors could interact informally. Visa versa, the chair of the DHZ in 2011 gained position in a steering group of the Deltaprogramme. Representatives of the DHZ's project group and the Deltaprogramme also started collaborating on models analysing effects of climate change, bridging cognitive boundaries.

In 2012 the DHZ joined up forces with ZON, a regional initiative around drought in the East of The Netherlands. This broadened the scope of the programme and changed its boundaries. To collaborate actors spanned boundaries between DHZ and ZON socially (e.g. meetings, jointly organizing symposia), as well as cognitively (e.g. jointly developing an implementation and strategy plan). The main reason they did so was to strengthen their lobby towards the Deltaprogramme, and respondents in hindsight reflect this indeed had this effect. As one respondent stated: *'Eventually, due to the joined lobby efforts of ZON and DHZ, we gained a very clear place within the Deltaprogramme.'* Broadening the boundaries of the programme this way helped making it more relevant and thereby facilitated the integrative ambition towards the Deltaprogramme.

From 2012 the Deltaprogramme sought to engage regional actors (through regional consultations). For this, they needed regional partners. The actors in the DHZ and ZON, led by the programme chair, stepped up to organise this in their region. They thereby acted as intermediates for the Deltaprogramme towards other regional partners. Moreover, they framed their own implementation programme as the regional input towards the Deltaprogramme, and proposed to develop a 'regional offer' for the Deltaprogramme. Representatives of the Deltaprogramme became increasingly involved in the development of this regional offer. They e.g. commented on draft reports, bridging cognitive boundaries. Over time, the DHZ strategy became more and more part of the strategy of the Deltaprogramme itself, and the DHZ became a valuable partner for the Deltaprogramme. This shows a constant evolvement of the linkages between the DHZ and Deltaprogramme, and sometimes it was very difficult to determine which activities were part of which side. Along the process, as boundaries between the DHZ and the Deltaprogramme continued to be spanned, they became more and more undefinable. Eventually, this (partial) integration of both programmes reached a next level when the Deltaprogramme formally decided that the regional drought management goals and strategies outlined in the 'regional offer' would be taken up as element in the Deltaprogramme and receives co-financing from the Deltafund.

Enactment	Spanning	Drawing	Changing
Dimension			
Social	<p>2009, 2010, 2012 Symposia inviting regional partners and Deltaprogramme</p> <p>From 2010 Occasional visits of Deltaprogramme to DHZ (participating in steering group meeting, informal visit to region)</p> <p>2011 Involvement chair DHZ in steering group of subprogramme of Deltaprogramme</p> <p>2014 Intention agreement DHZ signed by 19 regional organisations</p>	-	<p>2009 Start DHZ steering group and project group consisting of regional partners</p> <p>2012 DHZ starts collaboration with ZON Programme, joint core team and sessions</p>
Cognitive	<p>2009 Strategy document on DHZ, send to potential partners</p> <p>2009 DHZ steering group decides to continue communication and lobbying towards the Deltaprogramme, keep looking for alignment</p> <p>2012, 2013 DHZ and ZON jointly develop strategy documents directed at the Deltaprogramme (manifest asking funding and acknowledgement, 'regional offer' towards Deltaprogramme)</p>	<p>2009 DHZ actors: drought problems get too little attention in Deltaprogramme</p> <p>2009 Deltaprogramme will not include DHZ as subprogramme, DHZ will continue by itself</p>	<p>2009 Proposal of DHZ to include itself as subprogramme in Deltaprogramme</p> <p>2012-2014 Deltaprogramme wants to consult regions. DHZ and ZON organise this for their region and discuss also own strategy documents with regional actors</p> <p>2013-2014 Representatives of the Deltaprogramme are increasingly involved in the development of the regional offer, e.g. commenting on draft versions</p> <p>2014 Deltaprogramme takes up regional offer in programme and provides co-financing</p>

Table 5.3 Illustration of boundary actions Deltaprogramme

5.4.2.2 Integrating DHZ programme and spatial planning issues

A second group of boundary actions evolves around the ambition to involve regional spatial planning issues more into the programme. This was seen an important issue because of the fact that concrete measures to safeguard fresh water supply also have spatial implications and only can be realised when they are anchored in spatial plans. Table 5.4 presents the most characteristic boundary actions.

Managing boundaries in a complex programme context

Enactment	Spanning	Drawing	Changing
Dimension			
Social	<p>2010-2013 Steering group wants to involve municipalities and other actors involved in spatial planning and urban environment in DHZ. The actors in DHZ are asked to each contact and inform their planning contacts.</p> <p>2012 Three municipalities join project group (but soon stop attending meeting)</p> <p>2012 Representatives of provinces join DHZ core team</p> <p>2013 Municipality joins project team as agenda member</p> <p>2014 Municipality signs intention agreement and joins a project group meeting</p>	<p>2010 Core team is set up with only water boards</p> <p>2012 The three municipalities stop attending meetings, stay on as agenda member</p>	-
Cognitive	<p>2013 Two day workshop to interactively develop spatial planning perspective on two areas</p> <p>2013 Written consultation of region on implementation programme, one municipality responds</p>	<p>2012 In their strategy document the DHZ actors reflect they have been too oriented on water management and too little on issues of space and place</p> <p>2013 Statement of municipality at regional consultation that the programme is mainly a technical story and '<i>a water board party</i>', and municipalities are not involved well in the programme</p>	-

Table 5.4 Illustration of boundary actions spatial planning

From 2010, the ambition to involve spatial planning issues and municipalities and provincial spatial planning departments that govern spatial planning issues more in the programme was recurrently articulated in meetings of the project and steering group. The project and steering group tried to do so by involving municipalities and planning departments in and informing them about the programme, spanning social boundaries. At the same time the programme substantively focussed on water and drought issues. Several actions enhanced this focus: In 2010 actors set up a core team consisting (only) of representatives of the water boards (who did not have responsibilities regarding planning, but only on water management). In addition, the steering group decided to divide tasks and appoint the provinces (responsible authority for spatial planning) as lead actor to realise integration with spatial planning issues, whilst the water board chairing the DHZ would lead the collaboration with the Deltaprogramme. However, the provinces were not part of the core team, and respondents reflected that at the start of the programme they did not take a very active role. Noticeably, by dividing tasks in this way, new boundaries emerged in the organisation of the programme. Respondents reflect that

establishing the core team increased the sense of ownership of the programme for the actors in it, but created a distance towards those that were not. In 2012 social boundaries became spanned when three municipalities joined the project group. However, the municipalities soon stopped attending meetings and continued as ‘agenda member’ (i.e. receiving documents but not attending meetings).

In 2012 the substantive focus on water management was articulated and criticized by the DHZ steering group. They stated the programme was too oriented on water issues, and too little on issues as economy and space and place, which resulted into very limited involvement of e.g. municipalities. Similarly, during a regional conference in 2013 a representative of a municipality stated that municipalities were not involved sufficiently because the programme was mainly oriented at technical and water related issues, referring to it as ‘a water board party’. Actors here hence articulated that they perceived and struggled with a cognitive boundary between the worlds of water and spatial planning, in line with earlier studies (Wiering and Immink, 2006; Van Buuren et al., 2010).

Noticeably, we didn’t observe actions that addressed cognitive boundaries in the first years of the programme. Hereafter, in 2012 and 2013, boundary management did address spanning cognitive boundaries. In order to deal with the above criticism and to stimulate a more active role for the provincial representatives, in 2012 representatives of the provinces joined the core team. In 2013 these representatives organised a two day integrative workshop led by a landscape architect, with the aim to develop an integrated design for two areas in the region. The idea was that spatial planning actors could be involved more if the programme worked more from a planning perspective. Noticeably, participants in the workshop were selected to represent different disciplines (like hydraulics, spatial planning, nature conservation), but the organisers explicitly chose not to include participants of the DHZ steering group, project group or core team. The workshop was hence aimed at bringing together different perspectives (spanning cognitive boundaries), but did not bring together actors inside and outside of the programme who had such perspectives (not spanning social boundaries).

In 2013 one more municipality joined the DHZ project group as agenda member. The formal intention agreement in 2014 was signed by one municipality. Noticeable here is that multiple municipalities became involved at different moments in time. No enduring group of actors was developed that could build forth (e.g. upon the ideas developed in the workshop) and come to a shared idea of the issues at stake in the DHZ. The limited involvement of municipalities was attributed by involved actors to the programme’s

substantive orientation on water issues. The boundary spanning attempts discussed above were apparently not powerful enough to bind municipalities to the programme.

Noticeably, although actors in the DHZ tried to bridge boundaries by involving municipal actors in the programme and organising an integrative workshop, we observed no actions that indicate that the relevance or place of a boundary was challenged or changed during the process. In line with this we found no activities to defend boundaries (for instance actions to shape the programme or statements that it doesn't fit with ideas or projects of municipalities), although both DHZ actors and municipalities did articulate that they experienced a problematic boundary by stating that the programme did not succeed in bridging the worlds of spatial planning and water management. This way, it remained unclear what different viewpoints and interests between the programme and spatial planning actually were. Moreover, this supports the idea that the programme remained focussed on water management and actors didn't manage to broaden its scope to include or affect spatial planning in such a way that it had effect on existing boundaries.

5.4.3 Analysis of programmatic integration

5.4.3.1 Integrating with the Deltaprogramme

The ambition to integrate with the Deltaprogramme was rather successful, when looking at the three criteria as suggested by Pellegrinelli (2014). With regard to reconciling divergent aims and interests, at the start both programmes were not in line. The actors collaborating in the DHZ felt the Deltaprogramme had insufficient attention for regional water issues. However, over time both programmes became more interwoven. Moreover, with the joint implementation programme and regional offer, actors specified regional measures and strategies, and how this related to the Deltaprogramme. As such, it became an offer that was easily adopted by the latter. With the Delta Decision the embedding of regional measures in the Deltaprogramme became formalised.

With regard to expediting progress, actors succeeded in making it more likely that intended integration possibilities would be realised. With the Delta Decisions, the connection between DHZ and the Deltaprogramme was formalised, and the DHZ received co-financing. Moreover, with the intention agreement regional actors formally bind themselves to the ambition to realise the proposed implementation programme. However, no concrete measures or projects were specified yet and actual realisation of measures hence remained to be done.

With regard to engaging stakeholders we found that actors of the Deltaprogramme over time became more closely involved, e.g. through inviting them to the regional symposia

and meetings of DHZ, sharing and discussing concept versions of the implementation programme and strategy. In addition, new regional actors became involved, e.g. by collaborating with ZON.

5.4.3.2 Integrating spatial planning issues in DHZ programme

The ambition to connect drought management goals with spatial planning was less successful in the studied period. With regard to reconciling divergent aims and interests we found no signs that the broad ambition to integrate with spatial planning was specified further into a concrete interpretation of possible topics or issues on which integration should be sought (for example, a possible further specification would be to identify how measures to safeguard fresh water supply have spatial implications in specific areas, or which spatial plans or projects have an impact on future water measures). Consequently, we also saw no signs that plans were made how this broad ambition should be realised. This is supported by statements of actors that the integration with spatial planning is difficult and remains to be developed.

With regard to the engagement of stakeholders we found that whilst some municipalities joined the project group, they did not remain involved throughout the process. No enduring group of actors is developed to jointly work on integration possibilities. Existing partners however did become more closely involved when representatives from province were added to the core team.

5.4.4 Analysis of contextual factors

Below we analyse how contextual factors explain the differences in how actors managed boundaries for both integration attempts and why one integration attempt was more successful than the other.

5.4.4.1 Factors related to the issue with which integration is sought

The Deltaprogramme is a high profile and concrete programme with a clear organization structure. The Deltaprogramme is led by an independent Deltacommissioner supported by a staff office, and consists of five sub programmes including one on fresh water supply. Thanks to this clear structure DHZ actors were able to specify and direct boundary actions at specific people, content and organizational structures. In addition, the Deltaprogramme is in terms of substantive focus and approach rather similar to the DHZ. The focus of the Deltaprogramme (although originally strongly on flood risk management) moreover became more and more on drought and water supply and thus came to cover the aim of DHZ quite well, in part due to the DHZ's lobbying efforts. Moreover, as the Deltaprogramme sought regional support and input, the DHZ over time became a valuable partner for them.

In contrast, the spatial planning issues that actors sought to integrate in the programme remained of a fluid, amorphous nature throughout the process. The broad ambition to integrate the regional spatial planning issues of municipalities and provinces into the programme was not specified further into concrete integration possibilities. So, the question ‘what to integrate’ remained rather vague and elusive. Consequently, DHZ actors directed boundary spanning activities at a very broad group of actors. In the region targeted by the DHZ programme there are two provinces and 97 municipalities, each with their own spatial planning issues and projects. These rather general boundary spanning attempts were not powerful enough to bind them to the program and come to successful integration.

In addition, actors working on spatial planning are focused on a different subject than water managers. For both water managers and spatial planners it is difficult to think beyond their own discipline and to recognize that the tasks of the other has implications for their own task (Wiering & Immink, 2006). It is thus difficult to interest actors working on spatial planning for the DHZ. Surprisingly however we found only limited activities to make the DHZ more attractive for these actors and to communicate its relevance for planners. This can in part be explained by the focus of actors on the Deltaprogramme, leaving less time for the integration efforts regarding spatial planning. We further discuss this in the next section.

5.4.4.2 Factors related to the two integration attempts

In addition, the difference in efforts to span boundaries is also explained and amplified by the organization of the DHZ programme and the two integration attempts themselves. Firstly, the importance of the integration attempt to top management and their commitment shaped how boundaries were managed. In the case, the integration with the Deltaprogramme over time became the dominant issue on the agenda of the DHZ steering group. The Deltaprogramme is a high profile programme and the actors in the DHZ see a connection with this programme as highly relevant, not in the last place due to the possible financial support of the Deltafund. The Deltaprogramme included a Deltafund consisting of a large yearly budget to realise climate adaptation measures. By putting the regional problems with drought and fresh water supply on the agenda of off the Deltaprogramme, the DHZ wanted to be able to make a claim for (co)financing from the Deltafund. Secondly, the task division made in the organisation of the programme (discussed in section 5.4.2.2), reinforced the positive bias to the integration with the Deltaprogramme. The attention and efforts of the programme chair were on the Deltaprogramme. He puts this issue high on the agenda of the steering group, and informs the participants regularly about lobbying initiatives and results of meetings with the Deltaprogramme. The politicians of the provinces had the lead when it comes to

integrating with spatial planning issues. However, at the start of the DHZ climate change was in both provinces not an important political issue. Provincial politicians took a much less active role in the programme and in putting this issue on the agenda of the steering group. The provinces also took a less active role at the administrative level and provincial civic servants were during the first years not part of the core team, which did most of the work in terms of writing strategy documents and preparing the agenda for the working group and steering group. This task division resulted actually in new boundaries within the DHZ programme. Noticeably, the increasing and large attention for the integration with the Deltaprogramme (dominating the discussion in steering group and project group meetings) leaves less room for other issues. One respondent reflected: *'We operated on many levels at the same time, the attention was sometimes at one issue and other times at another. [The programme chair] felt it was important to act upon the Deltaprogramme [...], that led to less focus on whether we were ambitious enough within the region.'* The programme chair reflected: *'We were so busy with the way in which we should get recognition from the Deltaprogramme that this consumed much of our energy.'* We conclude that the attention bias for one integration attempt can hence push aside other issues in complex programmes where multiple issues and projects need to be integrated.

5.4.4.3 Factors related to individual characteristics

The differences in how boundaries were managed were further enlarged as the programme chair possessed many capabilities that facilitated successful boundary spanning. Respondents describe him as a respected, visionary and charismatic leader and very enthusiastic and energetic about the programme and integrating with the Deltaprogramme. He had strong contacts regionally and nationally, and acted as a 'reticultist' to interest and bind actors together in the programme and on the issue of drought and fresh water supply. The civic servant chairing the project group and core team took a similar role on the administrative level, leading both the programme as a whole and the integration with the Deltaprogramme. Many respondents reflect on the role of the chair as crucial for successfully connecting with both national and other regional actors and initiatives, as well as for the progress of the programme as a whole. He effectively used these skills to span boundaries with regard to the Deltaprogramme. But due to the division of tasks, he was only limitedly involved in integrating with spatial planning issues. A political leader bridging boundaries was not similarly supporting the provincial civic servants responsible for this issue. In addition, spanning boundaries here is further complicated as all participants in DHZ (including those from provinces) are working on water management within their organization, and hence look at the programme from a water perspective, making it difficult to connect the programme to perspectives and tasks of spatial planners.

5.5 Discussion and conclusions

The analysis shows the importance of boundary spanning actions to realise integration of different issues and projects in a programmatic approach, such as jointly working on strategy documents (bridging cognitive boundaries), organising events where actors can formally and informally interact (e.g. symposia, workshop), and the activities of a political change agent. In line with our expectations, we find that to manage boundaries actors predominantly undertake boundary spanning actions during the process of both integration attempts (e.g. Lycett et al., 2004). However, actors undertook many more boundary spanning actions in the process to integrate with the Deltaprogramme than in the process to integrate with spatial planning issues. This partially explains why integration was more successful regarding the Deltaprogramme. As shown in previous studies, activities to span boundaries facilitate interaction (Klerkx, Aarts, & Leeuwis, 2010; Tushman & Scanlan, 1981; Williams, 2002). In addition, and we consider this an important contribution of this paper, we find four further explanations why actors were better able to integrate with the Deltaprogramme than with spatial planning issues, that have not received much attention in the literature before. These explanations shed new light on how boundaries can be best managed in future programmatic approaches:

1) Contextual factors influence boundary management

We find that several contextual factors explain why actors put more effort into spanning boundaries regarding the Deltaprogramme than spatial planning issues. The first contextual factor relates to the clarity of the issue with which integration was sought. In the Deltaprogramme, DHZ actors were able to specify and direct boundary actions at specific people, content and organizational structures. On the contrary, the lack of further specification of the specific issues or projects with which integration was sought resulted in actors undertaking rather general boundary spanning activities directed at a very broad group of actors in the spatial planning attempt. As a result, in the latter case the boundary spanning attempts were not powerful enough to bind them to the programme. The second contextual factor is the focus of top management, in the sense that they dedicate a substantial share of their time and energy on the Deltaprogramme. The task division made in the organisation of the DHZ programme, with the programme chair being in charge of the integration with the Deltaprogramme, reinforced this attention bias. The third contextual factor is the individual characteristics of key programme actors. In our study we see that the programme chair played a crucial role in spanning boundaries with regard to the Deltaprogramme, acting as a ‘reticulist’ or political change agent to interest and bind actors together in the programme and on the issue of drought and fresh water supply. This is in line with earlier findings of the role of political change agents (Klerkx

et al. 2010; Degeling 1995). However, due to the division of tasks, his skills were not used to facilitate integration with spatial planning issues.

Summing up the above, we conclude that these contextual factors influence how actors manage boundaries and how well integration succeeds, in line with Lehtonen and Matinsuo (2009). This adds to our understanding how programmes and the type of management needed are shaped by the context in which they take place (Pellegrinelli, 2011; Pellegrinelli et al., 2007). This triggers the question how programme managers can deal with the demands from context in future programmes. We put forward three suggestion based upon this research: 1) Consider consciously and strategically how attention is divided between the multiple issues with which integration is sought in complex integrative programmes. As a result of the contextual factors discussed above a positive feedback loop seems to develop on multiple levels, leading to an attention bias in favour of the Deltaprogramme. Although beneficial for this integration attempt, the inevitable result was that actors had less time left for spatial planning issues. As such, we conclude that the attention bias for one integration attempt can push aside other issues, as also found in complex multifunctional projects (Van Broekhoven & Boons, in review). This is problematic as an important element of programme management is continuously establishing connections between multiple projects and issues in its environment (Lycett et al., 2004). By being aware of this, practitioners can make a more conscious and strategic choice when to give which issues attention. 2) Strategically use the skills of key programme actors to span boundaries and make use of actors who can act as political change agents. 3) Aim to clarify/specify the issue with which integration is sought and make the own programme attractive to the actors governing the issues with which integration is sought. This is further elaborated upon below.

2) Making the programme attractive

The second explanation why the integration regarding the Deltaprogramme was more successful is that actors succeeded better in making the DHZ programme attractive for the Deltaprogramme by continuously changing and shaping their boundaries in terms of content, geographical area, involved actors and governance structures. For instance, actors collaborated with ZON, changing the scope of the programme drastically, to make themselves a more attractive and important partner for Deltaprogramme. This changing of boundaries is related to overcoming differences on the cognitive dimension. This is illustrated by the development of the joint implementation programme of DHZ and ZON, in which representatives of the Deltaprogramme become involved as they comment on concept versions. Over time this becomes an important input for the Deltaprogramme, and brings both programmes closer together. Noticeably, we did not observe challenging and changing of boundaries in the integration attempt with spatial planning. This can be

explained by the limited effort to communicate the programme's relevance for planners, and limited involvement of perspectives and actors from spatial planning in the programme. Apparently, for neither water managers nor spatial planners it was very attractive to bring together their plans and interests in this programme. The above elaborates upon earlier findings that continuous shaping of programmes and their governance environment is important in programme management in order to bring together different goals and interests, make progress and involve different stakeholders (Pellegrinelli, 2007). We conclude that actors need to make their programme attractive for the actors governing the issues and projects they want to integrate with in order for them to be willing to connect.

3) Addressing both the social and cognitive dimension of boundaries

The third explanation is that boundary spanning and changing activities regarding the integration with spatial planning issues only limitedly, and only later in the process, addressed the cognitive dimension of boundaries. We know from previous studies that water managers and spatial planners in The Netherlands traditionally have different visions on water issues and the position of water in the planning process (Immink, 2005; van Buuren, Edelenbos, & Klijn, 2010; Wiering & Immink, 2006). Indeed, the expectation that differences between the worlds of water and spatial planning would lead to discussions on boundaries was one of the reasons to select this case. Hence, effort is needed to span cognitive boundaries, which we only limitedly found in the case. In addition, and adding to the literature, we conclude that spanning and changing of the social and cognitive dimension of boundaries should go hand in hand in order to successfully work across boundaries. In the process to integrate with spatial planning, actors in the first years undertook some activities to span social boundaries but substantively kept a strong focus on water management. Only later actors also addressed the cognitive dimension, by organising an integrative workshop. However as the participants of the DHZ weren't at this workshop, social boundaries are not spanned here. This in turn has consequences for cognitive boundaries, as actors cannot build forth upon the ideas developed in the workshop and together over time come to a shared idea of the issues at stake. In contrast, the integration with the Deltaprogramme illustrates how boundary spanning and changing actions that address the social dimension (e.g. inviting representatives of the Deltaprogramme to symposia, meetings, field visits) and the cognitive dimension (e.g. commenting on concept reports) together facilitate the integration of the DHZ and the Deltaprogramme.

How then can actors manage boundaries at both the social and cognitive dimension in future programmes? Previous studies identified various strategies, including joint construction of boundary objects, through which actors can develop an understanding of

the integrative idea and a discourse and symbolism that transcends the own interests (cognitive dimension) (Star and Griesemer, 1989; Klerkx et al., 2012; Westerink 2017); activities of boundary spanners to build cross-boundary relations (social dimension) and identity and facilitate building shared problems and solutions (cognitive dimension) (e.g. Williams, 2002); and creating formal coordinating structures (e.g. project groups) and informal meetings (e.g. excursions, field visits) that facilitate interaction and through which actors can define themselves as a group, enabling feelings of ‘jointness’ (social dimension) (Epstein, 1998, Marshall 2003).

4) The role of drawing boundaries

Lastly and interestingly, we find that in addition to boundary spanning, boundary drawing activities also play a role in realising integration in a programme. This is in contrast with the idea that boundaries should not be defined too strict in programmes. While drawing boundaries is often seen as problematic for integrative initiatives, the analysis shows that the decision not to make the DHZ a sub-programme of the Deltaprogramme (drawing boundaries at an early stage in the process) does not result in the integration attempt stopping or failing. Instead, the initial ‘no’ of the Deltaprogramme urged DHZ actors to double their efforts and continue to look for alignment, resulting in further actions spanning, and in effect challenging, previously defined boundaries. Drawing the line seems to have been helpful to create an understanding and respect for boundaries. The occurrence of boundary drawing with a positive effect, complementing boundary spanning, is in line with previous findings on programme management by Lehtonen and Martinsuo (2009). However, in our case the role of boundary drawing is not - as they find – to protect the emerging programme. It is more in line with a mechanism discussed by Ernst & Chrobot-Mason (2010) and Lee et al. (2014) that in order to work across boundaries first boundaries need to be created or strengthened. By buffering (e.g. clarifying purpose, dividing tasks) safety is created, and by reflecting across an understanding of boundaries is built that fosters respect (ibid). The opposite is illustrated in the integration with spatial planning where boundaries did not become defended. Here it remained unclear what different viewpoints and interests were, making it difficult to get a grip on how boundaries could be crossed.

Summing up what the above means for the type of boundary management needed in programmatic approaches, we conclude that boundary spanning activities are important to come to integration in programmatic approaches. Moreover, continuously shaping the boundaries between the programme and its environment helped to make the programme attractive for the actors governing the issues and projects they want to integrate with. However, we highlight this does not mean actors should not draw boundaries at all in programmatic approaches. The analysis showed that also in a complex programme

context drawing boundaries can be beneficial when actors want to work across boundaries, by creating an understanding and respect for what important boundaries are and for the other's position.

Author Contributions

Saskia van Broekhoven assessed the literature, developed the conceptual framework, collected and analysed the data of the empirical case study, and wrote the manuscript. Arwin van Buuren supervised the research, contributed to the empirical study, and reflected on and made revisions to previous versions of the manuscript.

References

- Abbott, A. (1995). Things of boundaries. *Social Research*, 62(4), 857–882.
- Boeije, H. R. (2009). *Analysis in Qualitative Research*. SAGE.
- Bressers, H. (2010). *Governance and complexity in water management: creating cooperation through boundary spanning strategies*. Cheltenham: Edward Elgar.
- Buijs, J.M. (2018). *Capacity for Complexity: Evolving connective capacities of program management in complex governance processes*.
- Busscher, T. (2014). *Towards a programme-oriented planning approach: Linking strategies and projects for adaptive infrastructure planning* (University of Groningen).
- Busscher, T., Tillema, T., & Arts, J. (2013). Revisiting a programmatic planning approach: managing linkages between transport and land use planning. *Planning Theory & Practice*, 14(4), 492–508.
- Degeling, P. (1995). The significance of 'sectors' in calls for public health intersectoralism: an Australian perspective. *Policy & Politics*, 23(4), 289–301.
- Derkzen, P., Bock, B. B., & Wiskerke, J. S. C. (2009). Integrated Rural Policy in Context: A Case Study on the Meaning of 'Integration' and the Politics of 'Sectoring.' *Journal of Environmental Policy & Planning*, 11(2), 143–163.
- Epstein CF, 1992, "Tinkerbells and pinups: the construction and reconstruction of gender boundaries at work" In: Lamont, M & M Fournier (Eds), *Cultivating Differences: Symbolic Boundaries and the Making of Inequality*, Chicago: University of Chicago Press, pp 232–256.
- Ernst, C., & Chrobot-Mason, D. (2010). *Boundary Spanning Leadership: Six Practices for Solving Problems, Driving Innovation, and Transforming Organizations: Chris Ernst: 9780071638876*.
- Herk, S. van, Rijke, J., Zevenbergen, C., Ashley, R., & Besseling, B. (2015). Adaptive co-management and network learning in the Room for the River programme. *Journal of Environmental Planning and Management*, 58(3), 554–575.

- Hernes, T. (2003). Enabling and constraining properties of organizational boundaries. In *Managing boundaries in organizations: Multiple perspectives* (pp. 35–55). Hampshire: Palgrave Macmillan.
- Immink, I. (2005). Established and recent policy arrangements for river management in The Netherlands: an analysis of discourses. *Frontis*, 387–404.
- Kerosuo H, 2006, Boundaries in Action: An Activity-Theoretical Study of Development, Learning and Change in Health Care for Patients with Multiple and Chronic Illnesses. PhD thesis. Helsinki: Helsinki University Press
- Kerzner, H. (2009). *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*. John Wiley & Sons.
- Klerkx, L., Aarts, N., & Leeuwis, C. (2010). Adaptive management in agricultural innovation systems: The interactions between innovation networks and their environment. *Agricultural Systems*, 103(6), 390–400.
- Marshall N (2003) Identity and Difference in Complex Projects: Why Boundaries Still Matter in the 'Boundaryless' Organisation.
- Lee, L., Magellan Horth, D., & Ernst, C. (2014). *Boundary Spanning in Action: Tactics for Transforming Today's Borders into Tomorrow's Frontiers*. Centre for Creative Leadership.
- Lehtonen, P., & Martinsuo, M. (2009). Integrating the change program with the parent organization. *International Journal of Project Management*, 27(2), 154–165.
- Levina, N., & Vaast, E. (2005). The Emergence of Boundary Spanning Competence in Practice: Implications for Implementation and Use of Information Systems. *MIS Quarterly*, 29(2), 335–363.
- Lycett, M., Rassau, A., & Danson, J. (2004). Programme management: a critical review. *International Journal of Project Management*, 22(4), 289–299.
- O'Farrell PJ and Anderson PML (2010) Sustainable multifunctional landscapes: a review to implementation. *Current Opinion in Environmental Sustainability* 2(1–2), 59–65.
- Opdam, P., Westerink, J., Vos, C., & Vries, B. de. (2015). The role and evolution of boundary concepts in transdisciplinary landscape planning. *Planning Theory & Practice*, 16(1), 63–78.
- Pellegrinelli, S. (2011). What's in a name: Project or programme? *International Journal of Project Management*, 29(2), 232–240.
- Pellegrinelli, S., Partington, D., Hemingway, C., Mohdzain, Z., & Shah, M. (2007). The importance of context in programme management: An empirical review of programme practices. *International Journal of Project Management*, 25(1), 41–55.

- Star, S. L., & Griesemer, J. R. (1989). Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science*, 19(3), 387–420.
- Thiry, M. (2004). "For DAD": a programme management life-cycle process. *International Journal of Project Management*, 22(3), 245–252.
- Tushman, M. L., & Scanlan, T. J. (1981). Boundary Spanning Individuals: Their Role in Information Transfer and Their Antecedents. *The Academy of Management Journal*, 24(2).
- Van Broekhoven, S., & Boons, F. (in review). *Managing boundaries over time in integrative planning processes: A process analysis of two cases of Multifunctional Land Use*.
- van Broekhoven, S., Boons, F., van Buuren, A., & Teisman, G. (2015). Boundaries in action: a framework to analyse boundary actions in multifunctional land-use developments. *Environment and Planning C: Government and Policy*, 33(5), 1005–1023.
- Van Broekhoven, S., & Vernay, A. L. (2018). Integrating Functions for a Sustainable Urban System: A Review of Multifunctional Land Use and Circular Urban Metabolism. *Sustainability*, 10(6), 1875.
- Van Buuren, A., Buijs, J.-M., & Teisman, G. (2010). Program management and the creative art of coopetition: Dealing with potential tensions and synergies between spatial development projects. *International Journal of Project Management*, 28(7), 672–682
- Van Buuren, A., Edelenbos, J., & Klijn, E. H. (2010). *Gebiedsontwikkeling in woelig water: over water governance bewegend tussen adaptief waterbeheer en ruimtelijke besluitvorming*. Den Haag: Boom Lemma uitgevers.
- Van Buuren, A., & Teisman, G. R., Verkerk, J., Elderling, M. (2014). *Samen verder werken aan de Delta*. Rotterdam: Erasmus University.
- Westerink, J. (2016). *Making a Difference: Boundary Management in Spatial Governance* (Wageningen University).
- Westerink, J., Lagendijk, A., Dühr, S., Jagt, P. V. der, & Kempenaar, A. (2013). Contested Spaces? The Use of Place Concepts to Communicate Visions for Peri-Urban Areas. *European Planning Studies*, 21(6), 780–800.
- Westerink, J., Opdam, P., van Rooij, S., & Steingröver, E. (2017). Landscape services as boundary concept in landscape governance: Building social capital in collaboration and adapting the landscape. *Land Use Policy*, 60, 408–418.
- Wiering, M., & Immink, I. (2006). When water management meets spatial planning: a policy-arrangements perspective. *Environment and Planning C: Government and Policy*, 24(3), 423 – 438.

Chapter 5

Williams, P. (2002). The Competent Boundary Spanner. *Public Administration*, 80(1), 103–124.

6 Conclusions

6.1 Introduction

The previous chapters have analysed initiatives for multifunctional land use from the perspective of boundary management. When actors specify integration as their aim, they will be confronted with boundaries, e.g. between sectors, between organisations, between governments and citizens, between groups of people, in geographical authorities and physical structures, in tasks, responsibilities, and ideas. Integrative initiatives involve multiple actors related to particular functions (e.g. water safety, spatial planning, recreation) and require actors to work across, change, and negotiate boundaries. At the same time, the idea of effective integration is complicated by the need or desire to construct and maintain boundaries. How then is effective integration possible, and what is needed for it?

This thesis addresses the following research question: *How do actors manage boundaries in initiatives for multifunctional land use, and what kind of activities and sequences of activities to manage boundaries are helpful to realise effective integration of land use functions?* This main question is addressed with the following sub-questions:

1. *What are the challenges and strategies for realising initiatives for multifunctional land use in the wider literature concerning integration of functions?*
2. *How can boundaries and boundary management in initiatives for multifunctional land use be conceptualised and studied?*
3. *What kind of activities and sequences of activities do actors employ to manage boundaries during the process of initiatives for multifunctional land use?*
4. *What kind of activities and sequences of activities to manage boundaries are helpful to realise effective integration of land use functions?*

To answer these questions the following studies are performed: A literature review on challenges and strategies for integrating functions, a conceptual framework to systematically map in depth the dynamics of boundary (re)construction in action during integrative processes, and three case studies that analyse how boundaries are managed during the integrative process.

In this concluding chapter I synthesise the insights gained on managing boundaries in initiatives for multifunctional land use. In section 6.2 I present the conclusions of the literature review on challenges for integrating functions and introduce the perspective of managing boundaries to gain further insight into integration challenges and find new solutions. Moreover, I reflect on the use of this research for current integrative

approaches. In section 6.3 I present the conclusions of this research regarding what boundaries are, what boundary management means, and how it can be studied. Section 6.4 presents the conclusions on what activities and sequences of activities to manage boundaries are helpful to realise integration. It thereby further addresses the question what strategies can help realise integrative initiatives. Next, I reflect on the contribution to the scientific debate (section 6.5), the policy implications of this thesis (section 6.6), and the research approach and methodology (section 6.7). Lastly, I will make suggestions for further research (section 6.8).

6.2 Challenges for integrative initiatives and the perspective of managing boundaries

*Where you stand depends on where you sit
(Nelson Mandela)*

Chapter 2 reviews the literature on integrating functions, focussing on two integrative solutions to realise sustainable urban development; MLU and circular urban metabolism (CUM). Both identify the challenges and strategies for realising integration of functions identified in earlier studies and provide answers to sub-question 1: *What are the challenges and strategies for realising initiatives for multifunctional land use in the wider literature concerning integration of functions?*

The review shows that integrative initiatives face many challenges. It shows that collaboration between actors related to particular functions (water safety, recreation, wastewater treatment) is needed and is of concern for realising integration of functions. Collaboration across disciplines, sectors, government levels, and - more specifically - city and legal-jurisdictional boundaries, is most often identified as a challenge in the reviewed articles. Integration is complicated as it requires collaboration between actors with different epistemological backgrounds who have differing perceptions on problems and solutions. Moreover, integration challenges find their origin in fragmented and monofunctional institutional settings, which shape actors' actions. The review furthermore identifies that both high investment costs and uncertainties about costs and benefits for different actors hamper realisation. Moreover, it finds that legislation that does not support integrated initiatives hampers integration of functions in MLU and CUM initiatives. A lack of knowledge is also identified as challenging, as both approaches are still not often practiced. Strategies to overcome integration challenges that are proposed in the literature are aimed at involving all relevant actors in the planning process and facilitating their collaboration, e.g., by using workshops, scenario's, visualization techniques, integrated assessment methods of amongst others costs and benefits, and learning or transdisciplinary approaches.

The literature on collaborative governance on other topics provides further insights on what complicates the collaboration between actors and what strategies might facilitate collaboration. Studies here find collaboration challenges to include diverging perceptions of actors with different backgrounds on problems and solution, differing institutional logics, and power imbalances (Ansell & Gash, 2008; Bryson, Crosby, & Stone, 2006). Strategies found to facilitate collaboration include building up trust and commitment, developing a shared understanding of the problem, the role of leadership and legitimacy to come to such shared understandings, as well as managing inevitable conflicts and forging initial agreements throughout the collaborative process (ibid). Despite these insights, we still have a limited understanding of what lies behind such differing perspectives and logics, and what this concretely entails when actors aim to integrate functions. One possible perspective to gain more insight into the underlying perspectives, interests, rules and ways of working that lead to integration challenges and explore new solutions, is to focus on how actors span, defend, challenge and discuss boundaries during the process that unfolds when actors initiate an integrative initiative. Based on the review I conclude that integrating functions is not just a matter of facilitating collaboration between actors, nor just of changing regulation, finding financial means, developing knowledge on technological feasibility or design, or gaining public support. I highlight that integrative processes require actors to bridge the boundaries of previously separate ‘worlds’, and that the different institutional backgrounds and logics of actors related to particular functions require further attention in future studies. Integrating functions brings together more or less autonomous actors dominantly organised according to the principals of bureaucracy: well divided into task units specialised and responsible for one function. As discussed by Van Ark (2006), many challenges can be attributed to the underlying institutional structures where functions cannot be seen separate from the sectors to which they belong, and of which boundaries are hard to cross.

This thesis shows that managing boundaries is a central issue for actors that work on initiatives to integrate functions. The story of the water- and rootproof layer in the Dakpark, presented in the first chapter of this thesis, illustrates this. When actors specify integration as their aim, they are confronted with boundaries. Actors in integrative processes will need to work across boundaries, will run into others drawing boundaries, will define or defend boundaries that are helpful for their own actions and will need to deal with boundaries becoming blurred in their collaborative efforts. This research identifies boundaries as in essence sites of difference; ways of differentiating something from what it is not (Abbott, 1995; Hernes, 2004). When actors in integrative processes try to bridge, change, or maintain such differences, they become salient and boundaries are

constructed. The way in which actors construct and manage boundaries influences the collaborative process. For instance, by drawing boundaries actors define what is taken along and what not, who is included, and which actions are considered legitimate. Boundaries thereby have a quality which separates and alienates, as well as includes, creates groups, and generates feelings of similarity. They are sites of difference but also link two sides together, they are about interaction between both. Differences between groups can make collaboration difficult, creating e.g. differences in how we view things and what we find important, leading to misunderstandings. At the same time, boundaries can also have positive effects. For instance, by drawing boundaries actors can create order and make the process more manageable. More generally, boundaries have constraining and enabling properties. I will discuss this further in section 6.4.

The literature review also shows that whilst the concept of MLU has received much attention in The Netherlands last decennia, it has lost in popularity in more recent years. Integrative approaches nevertheless remain high on the political agenda in The Netherlands and other Western European countries, now using other related concepts such as integrated water management, nature-inclusive agriculture, nature-combinations (combining nature conservation with socio-economic functions), integrated regional development programmes, and integrated initiatives for sustainable urban development such as green-blue urban grids and nature-based urban innovations. In The Netherlands, integrative approaches are currently very relevant. The new Environment and Planning Act (Omgevingswet) requires multiple governmental actors across different sectors (including municipalities, water boards, provinces, and national government) to work in an integrative manner in order to ensure a sustainable development of the living environment. Governmental actors are under this legislation required take in account the relationships between different aspects of the physical environment and related interests, and are required to take in account the duties and powers of other actors. Moreover, the Dutch Council for the Environment and Infrastructure (Raad voor de Leefomgeving en Infrastructuur) advises the government in a recent study that a more integrated, coherent and coordinated approach is needed to deal with major policy tasks that need to be addressed in order to make the necessary transition to a more sustainable society and economy: a transition of the energy system, a transition of the food system, a transition of the system of production and consumption, and a transition towards climate and water robust water system and spatial planning (climate adaptation) (RLI, 2019). It argues that especially at the regional level these tasks and ‘own’ regional tasks cannot be seen separate, and require an integrative approach. To realise these current integrative approaches, the insights developed in this thesis are highly relevant. Just as in MLU initiatives, actors that work on these integrative approaches will be confronted with boundaries. They will need to work across boundaries, challenge existing boundaries,

deal with others that defend boundaries, and define or defend boundaries that are helpful to perform their own tasks adequately.

6.3 Conclusions on managing boundaries

I understand now that boundaries between noise and sound are conventions.

All boundaries are conventions, waiting to be transcended.

One may transcend any convention if only one can first conceive of doing so.

(Cloud Atlas)

Based upon insights from especially management and organisational studies, chapter 3 of this thesis conceptualises boundaries, studies how boundaries are created in action, and develops a typology to systematically map and analyse in depth the dynamics of boundary (re)construction in action during integrative processes. It thereby addresses sub-question 2: *How can boundaries and boundary management in initiatives for multifunctional land use be conceptualised and studied?*

This research identifies four important characteristics of boundaries from the literature: Firstly, boundaries are social constructs; they exist in the minds of social actors as part of their mental maps/frames or boundary judgments. Secondly, actors act within a set of multiple, permeable, ambiguous boundaries. Thirdly, boundaries are never finished or fixed. They are constantly interpreted, shaped by being acted upon, and discussed and struggled upon by groups of actors with different views. Fourthly, boundaries have constraining and enabling properties. Whereas integration suggests that boundaries need to be overcome to join skills and resources, the idea of bureaucratic order stresses that boundaries have important functions. They enable complexity reduction, structure, and specialisation. In line with these insights, I argue it is useful to view boundaries as dynamic and to study how they are maintained or evolved when actors interact, rather than thinking of boundaries as fixed divisions. However, if we do not predefine boundaries, how then can we observe them? Boundaries in integrative work are not readily visible. In governance systems, most boundaries are subtle, invisible, or at best blurred, like boundaries in the way problems and solutions are conceived (Hernes, 2004). I propose to study boundaries by analysing how boundaries are (re)constructed and evolve by identifying and observing or reconstructing the boundary actions of the involved actors in specific empirical contexts. I define a boundary action as: *a recurring set of articulations, actions, and interactions that shape a demarcation, taking place over a longer period of time.*

To identify actors' boundary actions, I develop a typology of boundary actions, building upon earlier typologies. This typology distinguishes three dimensions on which

boundaries can be expressed and three main types of boundary actions. Following Hernes (2004), I distinguish social (social relations between people), cognitive (ideas and meanings), and physical (material or territorial) dimensions of boundaries. These dimensions are interrelated.

- (1) The social dimension concerns social relations between actors. This relates to the social bonding between actors, who is considered inside and outside, sets limits that mark social groups (Barth, 2000; Hernes, 2004). This is reflected in e.g. loyalty, trust, identity, and norms (Hernes, 2004). It also involves the emotional connection established in personal relationships, e.g. who is involved or taken into account in decision making, who is referred to as 'us' and 'them'.
- (2) The cognitive dimension concerns ideas, interpretations, and beliefs. Explanations and interpretations can be valid inside certain boundaries but not hold outside of them (Weick, 1995). Boundaries here are differences of kind; both sides see different issues as being at stake, or their perceptions of issues may be incompatible (Cohen, 1999), e.g. differing conceptions of problems or solutions, limits to what is seen as possible or not, boundaries in flow of information and ideas.
- (3) The physical dimension concerns material, technological, or spatial arrangements providing distinctions between actors. This relates to ownership or authority over territories or objects, appropriating something as yours enduring over time (Barth, 1999). Actions here tend to be tangible and have instrumental purposes, but can also have symbolic effects (Hernes, 2004), e.g. physical or territorial divisions or connections, boundary objects (Hernes, 2004; Sturdy, Clark, Fincham, & Handley, 2009).

I furthermore distinguish three main types of boundary actions:

- (1) Challenge boundaries, referring to problematising existing ideas or divisions. Actors challenge boundaries to, for example, include new actors, ideas, or resources. Distinct from spanning, this entails intending to change a previous demarcation. Multifunctionality generally implies challenging boundaries to realise integration.
- (2) Stabilise or maintain boundaries, referring to strategies to defend or draw demarcations. This may occur to demarcate who or which problems and solutions are included, to protect or buffer something from conflicting interest, or to enable successful action within. We subdivide actions to draw boundaries and regulate flow of information or resources. In processes of

integration, drawing boundaries can be a response to being challenged by the idea to integrate.

- (3) Span a boundary whilst respecting the distinction it entails, referring to, for example, scouting or spanning. This may occur to facilitate coordinating practices or exchange information across boundaries. This is a distinct action, as spanning facilitates flow across a boundary without challenging its relevance or place but rather reconfirm it as active. The boundary is not directly changed.

Recently, in governance literature on integrative work interest has risen in how boundaries can best be managed, in order to understand how the integrative approaches for sustainable development that have emerged last decennia can best be governed. This has led to important insights on how boundary spanning can facilitate the collaboration between actors in integrative work, e.g. through activities of boundary spanners (Noble & Jones, 2006; Williams, 2002), through joint construction of boundary objects (Klerkx et al., 2012; Star & Griesemer, 1989), how political change agent can play an important role to intermediate when conflict rises and induce organisation change (Klerkx, Aarts, & Leeuwis, 2010), and what important conditions and strategies are that enable boundary spanners to act successfully (Meerkerk & Edelenbos, 2018; van Meerkerk, 2014). However, studies have so far mainly focussed on the question how boundaries can be spanned. Many studies predefine boundaries which are assumed to be rather static (e.g. sectoral or organisational boundaries), and study what enables boundary spanning across these boundaries. What boundaries are and how they are constructed, challenged, defended and negotiated in integrative processes has received less attention in the governance literature. The conceptualisation of boundaries developed in this research contributes to this literature by developing a better understanding of what boundaries are and what boundary management entails, drawing from literature on the formation of boundaries from other fields. Moreover it provides new insights into the functioning of boundary management in integrative processes by studying how boundaries are (re)constructed and negotiated in actors interactions during the integrative process, rather than focussing on boundary spanning across predefined boundaries.

The case analysis corroborates the theoretical idea that what relevant boundaries are in complex initiatives to integrate functions is not readily visible, not clear on forehand, and changes during the process. Moreover, the analysis shows that in multifunctional initiatives actors need to juggle multiple discussions on boundaries simultaneously, underlining one cannot rely on assumptions about what boundaries are relevant.

6.4 Conclusions on realising effective integration

*We need to have a talk on the subject of what's yours and what's mine.
(Stieg Larsson, The Girl with the Dragon Tattoo)*

Chapters 3, 4 and 5 address sub-questions 3: *What kind of activities and sequences of activities do actors employ to manage boundaries during the process of initiatives for multifunctional land use?* and 4: *What kind of activities and sequences of activities to manage boundaries are helpful to realise effective integration of land use functions?*

Enactment Dimension	Social	Cognitive	Physical
Maintain/ Draw	Enable identifying what important boundaries are, gain position Constrain inclusion of actors in decision making or group actions	Enable safety, protect interests, ensure wishes are met, building understanding for/across boundaries Constrain flow of information or ideas between social worlds and what possibilities or ideas are taken into account, and thereby constrain developing joint conceptions of problems or solutions	Enable ordering tasks, risks, responsibilities, finances, what activities are legitimate Constrain activities of others within demarcated zone, can hamper integrative solutions
Span	Enable positive interaction, building relations with new actors Constrain efficiency (e.g. of meetings, decision making) by including a multitude of actors	Enable finding joint idea of problems and solutions Constrain clarity/manageability of work by blurring tasks, responsibilities	- -
Challenge	Enable new coalitions, changing who is in/excluded in decision-making process Constrain the degree to which actors of the own organisation or group are involved.	Enable new possibilities, changing existing frames/ideas or impossibilities Constrain ability to realise monofunctional/group demands and ideas	Enable changing what activities are legitimate (including integrative measures) Constrain continuation of monofunctional activities or regulations

Table 6.1 Enabling and constraining effects of boundary actions

Table 6.1 summarises the analysis of the case studies according to the conceptual framework developed in chapter 3. I will now explain Table 6.1. Next, I will discuss the findings with regard to when during the process of initiatives to integrate functions which sequences of boundary actions are helpful to realise effective integration.

6.4.1 Maintaining/drawing boundaries

Whilst drawing boundaries is often seen as problematic for collaboration, a main and intriguing conclusion of this research is that drawing boundaries can also be beneficial to realise effective integration. Paradoxically, I conclude that to work across boundaries, boundaries first need to be created, strengthened and explicated. The idea to integrate functions challenges existing practices and monofunctional interests. Drawing boundaries is helpful for actors working in integrated initiatives as it provides safety and comfort by clarifying and guarding their interests and ensuring their wishes are met. Moreover, drawing boundaries can be helpful to create an understanding and respect for what important boundaries are in the integrative process, and what different viewpoints and interests are that need to be taken in account. This is seen in the resident participation process in Dakpark, where for instance developing a list of 8 commandments helped residents to make their wishes for the design of the park clear for others and ensure that these were met. In combination with boundary spanning activities which facilitated the interaction and enabled actors to reflect across boundaries (e.g. the joined project group, Dakpark café, and excursions) this enabled an increased support for the integrative plan. It is important to note here that the boundary drawing actions identified in the cases are preceded and followed-up by boundary spanning actions, and that this only together – complementing each other - led to the effects discussed here. This is further discussed in section 6.4. Another example is found in the DHZ case, where drawing boundaries in terms of the decision not to make the DHZ a sub-programme of the Deltaprogramme seemed to have been helpful to create an understanding and respect for boundaries. The opposite is shown in the integration with spatial planning issues in the DHZ, where boundaries did not become drawn and it remained unclear what different viewpoints and interests were.

Creating boundaries can also be helpful to make complex integrative processes more manageable, by creating a certain sense of order or clarity in terms of responsibility and accountability. This can facilitate realisation. In integrative processes actors' tasks, risks, and responsibilities become overlapping and blurred. By reconstructing boundaries, such tasks, risks and responsibilities that have become collective during integrative process can be divided again. Chapters 3 and 4 showed that the municipality and project developer in the Dakpark case preferred creating such divisions rather than keeping these issues collective. Here, constructing a new boundary between park and building –

representing a division between public and private tasks— in the physical structure was helpful to divide tasks, responsibilities and costs.

The enabling effects of drawing boundaries have been shown by others before (Ernst & Chrobot-Mason, 2010; Hernes, 2004; Lee, Magellan Horth, & Ernst, 2014; Westerink, 2016). However, the enabling effects of drawing boundaries do seem to have been sidelined by the focus on boundary spanning in integrative work, especially in the governance literature. Scholars stress how currently people and organisations work more and more in networks. Organisation (including governments) work more and more beyond their own boundaries and in collaboration with other actors. Scholars suggest we are now in the era of the ‘boundaryless organisation’. Organisations have permeable boundaries to give flexibility and use processes as outsourcing and various collaborative structures such as strategic alliances to organise work. Recently, in Dutch policy practice the term “boundary-denying collaboration (grensontkennend samenwerken)” has risen in multi-actor and multi-level collaborations³. In order to understand how these collaborative and joint-up ways of working can be facilitated, scholars have focussed on boundary spanning strategies. This thesis in contrast brings back attention to how drawing boundaries can also have enabling effects. These effects have been researched here for integrating land use functions, but the insights developed here are also useful for other integrative and collaborative processes.

However, drawing boundaries can also constrain integrating functions. By drawing boundaries actors demarcate and limit who is included in the decision making process and other group activities, what activities are legitimate, and what ideas or solutions can be developed. Drawing social boundaries, e.g. by demarcating who is involved in the coordinating structures such as a project group or other group activities (e.g. excursions, presentations, workshops), can constrain building relations across groups. This, in turn, can constrain possibilities to come to a joint idea of problems and solutions. Moreover, drawing boundaries on the cognitive dimension, e.g. by limited exchange of information or ideas between social worlds, can lead to communication difficulties and further complicates the ability to come to joint perceptions of problems and solutions. Regarding the physical dimension, instruments as the decree of the water board regulate which activities can be undertaken within certain physical or geographical boundaries and can hence restrict the possibility to realise integrative initiatives and what solutions can be developed. Actors may also make assumptions on boundaries from earlier experiences, limiting the integration possibilities beforehand. This is shown in the interaction on the levee in the Dakpark case. These constraining effects are well identified and often named

³ See for instance www.werkplaatsvitaalplatteland.nl/home/over-ibp-vitaal-platteland/ibp-vitaal-platteland/

in literature. In this thesis the constraining effects of drawing boundaries are especially seen in these interactions concerning the levee in both cases however also in the discussion on removing the rail track in the Dakpark and the integration with spatial planning issues in Deltaplan Hoge Zandgronden.

6.4.2 Spanning boundaries

Whilst studies often focus on the benefits of spanning boundaries, the analysis reveals that spanning boundaries can also have constraining effects. One of the difficulties that actors need to deal with in integrative processes is that by crossing boundaries the roles of actors previously acting separately become overlapping in the multifunctional development. This makes it unclear who should bear what responsibilities, risks, and costs, as shown in the interaction between private and public actors in the Dakpark. Moreover, actors struggle with a dilemma of inclusiveness versus effectiveness. Whilst research has shown the importance of inclusivity and meaningful participation (Clark et al., 2010), the amount of actors and issues involved in integrative processes makes intensive participation of all stakeholders impractical and inefficient.

Boundary spanning activities at the same time facilitate a positive interaction between groups and enable actors to come to a joint idea of problems and solutions. This research supports the findings in earlier studies on this role of boundary spanning strategies (Tushman & Scanlan, 1981; Williams, 2002). Chapters 3, 4 and 5 show how boundary spanning activities such as communicating on the plans, organising meetings between actors, setting up coordination structures such as a project group and steering group, organising activities where actors can informally interact such as excursions or a regular information evening (e.g. the Dakpark café), and activities of skilled boundary spanners, can all facilitate interaction between groups. Moreover, when conflicts arise in discussions on boundaries, boundary spanning activities can help actors to find solutions. In line with earlier studies, this study finds that political change agents can play an important role by intermediating and by enabling or enforcing changes in established practices that help the integrative initiative, confirming earlier studies (Degeling, 1995; Klerkx et al., 2010). Such boundary spanning activities are not only important to facilitate interaction between organisations, but also to resolve internal discussions. This role of boundary spanning activities is found in all three cases.

In the studied cases, I have not found activities that cross physical boundaries without eventually challenging or changing the place or meaning of boundaries (i.e. challenging boundaries). For instance, in the Dakpark, despite that actors tried to maintain established boundaries with regard to the levee, constructing the building and park within the protected zone of the levee did have consequences in the sense that actions of the water

board, energy company, project developer and municipality now have increased impact on each other. In the Westduinpark, a pilot was started where sheep were allowed to graze in an area specified for water safety and controlled by the water board. This was allowed as a pilot without changing existing regulations (which prohibit this), but did fuel discussions on its effects and on possibilities to change regulation.

6.4.3 Challenging boundaries

The idea to integrate functions challenges existing practices and monofunctional interests. To achieve integration, actors will need to negotiate and change boundaries that hamper multifunctionality. The literature review shows that e.g. existing practices and legislation can hamper integration of functions. Challenging and changing boundaries can enable actors to include new actors, ideas, or resources. By challenging boundaries actors can form new coalitions, change existing ideas or possibilities, and change which activities are legitimate.

However, changing boundaries has consequences. Making exceptions with regard to the retail policy in Dakpark can act as a precedent for others and result in different retail in the city than desired. Allowing sand drift in the Westduinpark has consequences for the amount of sand that is available to guaranty water safety. Creating a park on top of a roof has consequences for what the park can look like, e.g. whether it still can have trees. In short, changing boundaries has consequences and can constrain whether and how functional activities and tasks, and demands of the own organisation or group can be fulfilled. Realising integrative initiatives often requires changing established (monofunctional) activities and regulations and changing boundaries defined by others. Actors can and should expect this will lead to conflicts. Moreover, internal discussions can arise on whether such change should be allowed, as also found in earlier studies (e.g. van Meerkerk, 2014). When actors engage in new coalitions to collaborate on an integrative initiative, such as a joint project group, typically one or a few representatives of each organisation or group is involved. This means that others within the own organisation come to stand at more distance of the ideas developed in the joint group. When organisational change is needed to enable an integrated initiative, others within the organisation, such as actors that have the tasks of licencing and control of existing policies, may resist and protect existing practices and policies.

6.4.4 Power relations and role powerful actors in integrating functions

*A border is an idea decided by the lucky.
(Messiah)*

How boundaries are drawn and evolved in actors interactions during the integrative process is shaped by the power relations between the involved actors. For instance, a water board has the authority to regulate what actions are possible in the physical area around water safety infrastructures. It hence has a strong power position to defend boundaries or decide how boundaries are changed, and thereby what type of integration with other functions is possible. Although the power relations between actors and the political process are not the focus of this research, the analysis of how boundaries are constructed, negotiated and changed does provide some insights into how power relations shape how boundaries are drawn and evolved and consequently what kind of integration is possible. In all three cases the involved water boards hold a strong power position. In the Dakpark and Westduinpark the initiating actors aim to realise activities for other functions within the protected area of a levee. This established boundary is in both cases defended and largely maintained. What then should we think of the role of such powerful actors, such as water boards in integrative initiatives that involve a water safety structure? Maintaining established boundaries makes realising integration impossible. How then can we make water boards – which are in the position to defend boundaries - willing to change its practices for the benefit of initiatives for integrated land use? And should we want to? Seen from a sectoral perspective such initiatives may be rather unattractive, as they often require additional investment of resources or require compromises. In that light, a defensive position of water boards is good as it is its primary responsibility to ensure water safety. In the end this comes down to balancing of interests which has to be custom made for every specific situation. Based on the case studies I do draw three lessons: Firstly, more may be possible than actors see from a sectoral perspective. Interestingly, in both Dakpark and Westduinpark actors over time do manage to realise some form of integration. Secondly, actors who wish to change boundaries defined by powerful actors will need to first gain the position to negotiate such boundaries. In the Westduinpark case actors working on nature conservation gain a stronger position to challenge and change previous ideas on boundaries as the area is appointed as protected Natura 2000 area. This illustrates how a change in power relations – in this case giving nature conservation a more equal power position to water management - can open up possibilities to challenge and change boundaries and redefine what activities are possible around the levee. Thirdly, as boundaries with regard to which activities are allowed within the protected zone of the levee are recorded in formal regulation, it is important to involve at an earlier point in the process also those actors who are responsible for ensuring this regulation is met (e.g. enforcing body).

6.4.5 Patterns in sequences of boundary actions during the process

The previous sections show that realising effective integration requires both spanning, challenging and drawing boundaries. Each can be beneficial for realising integration, but can also constrain it. So where will spanning help or in contrast take you in, and where will drawing help or take you in? Always building new coalitions is not helpful, but never building new coalitions is also not helpful. Where then can we find the dynamic balance that is needed to realise integration? When in integrative processes are which boundary actions and sequences of actions helpful? To get a better understanding of this, this research analyses how actors manage boundaries over time in integrative planning processes, and what that tells us about what sequences of boundary actions help to realise effective integration of functions.

Below I present four patterns in the sequences of boundary actions and how these can be helpful to realise effective integration of functions that are found in this research. These patterns and their effects are identified in the 13 sets of boundary actions that are studied within the three cases. As with any case study, these findings are contextually bound. I put forward these patterns here as a first step towards a ‘theory of boundary management’. They will need to be tested in further empirical studies.

1. To work across boundaries, boundaries first need to be created, strengthened and explicated, whilst also connecting where possible

Paradoxically, we find that drawing boundaries at the start of an interaction, in complement to spanning boundaries, can have beneficial effects for integrating functions. Section 6.4.1. has discussed that drawing activities can give actors safety and comfort by clarifying and guarding their interests, and creates an understanding and respect for what different viewpoints and interests are that need to be taken in account. This is seen in the sequence of actions in the resident participation process in Dakpark and Westduinpark, for instance in the use of the ‘eight commandments’. This pattern is in line with earlier finding by Ernst & Chrobot-Mason (2010) and Lee et al. (2014), indicating it is not only limited to the cases studied here. We however add upon these earlier findings by emphasising that this strengthening of boundaries should be combined with connecting where possible to facilitate interaction and come to joint ideas on the project. Only together - complementing each other - boundary drawing and spanning actions had the beneficial effects discussed here.

The cases also show the opposite: Situation where – for various reasons - boundaries are kept vague. It is tempting to involve an actor that is perceived as difficult or unwilling less closely in the process. Or to postpone, keep vague, ignore or neglect possible conflicts between functional interests in order to keep the integrative initiative going.

Why poke the bear unless you need to? Moreover, actors who are not very enthusiastic about the integrative initiative may in turn be tempted to ignore it or keep boundaries vague. The risk here is that blind spots and unexpected challenges will rise during the integrative process. But also that the interests of a particular function are not secured sufficiently and the integration has undesired and unexpected effects on a function governed by actors less involved in the integrative process. This is for instance seen in the Westduinpark case, where at a very late stage of the process unexpectedly a water permit was rejected and it became clear there was still a discussion to be held within the water board. Moreover, when it remains unclear what different viewpoints and interests are, it is rather difficult to get a grip on how boundaries can be crossed. This is seen in the DHZ case, regarding the integration attempt with spatial planning issues.

This however does not mean that actors should or can make all boundaries clear at the start of the process. This research has argued boundaries cannot be predefined, not by researchers studying integrative processes nor by the practitioners involved in them. The cases show that what the relevant boundaries are that actors will need to deal with during integrative processes is not readily visible and changes during the process. Moreover, this research shows that actors need to juggle multiple boundary discussions at the same time.

2. After a period of spanning and challenging boundaries, reconstructing boundaries can help to keep the process manageable, provide safety and maintain autonomy.

This research underlines earlier findings that boundary spanning actions are important to realise integrative initiatives by facilitating interaction and intermediating when conflicts rise, as discussed in section 6.4.2. However boundary spanning alone is not sufficient. This research analysis reveals that it is helpful to reconstruct boundaries after a period of boundary spanning and negotiating boundaries. Constructing (new) boundaries in terms of who does or owns what after a period of boundary spanning can help actors to deal with task and responsibilities that become blurred, overlapping and shared in the integrative initiative. Dividing tasks and responsibilities can make the project more manageable. This is seen in the interaction between municipality and project developer in Dakpark. Furthermore, this research indicates that after a period of (internal) cross-boundary negotiation and making changes, redefining the conditions, responsibilities and new ways of working for the new situation enables actors to ensure the degree of change keeps within certain limits that they feel are important. This is seen in the discussion on allowing sand drift in the protected zone of the levee in the Westduinpark, and the discussion on allowing retail in the Dakpark and is in line with some earlier findings (Kerosuo, 2006; Mørk, Hoholm, Maaninen-Olsson, & Aanestad, 2012). I conclude that constructing boundaries after a period of working across boundaries provides a certain

degree of order, safety and autonomy that is important organisations in order to be comfortable with integrative measures.

3. Challenging boundaries is often necessary to realise integration, but actors can and should expect this will lead to conflicts and internal discussions during the integrative process

Actors often need to challenge boundaries to enable an integrated initiative (e.g. in legislation, existing ways of working, or roles and tasks) and realise organisational change, as discussed in 6.4.3. Actors can and should expect this will lead to conflicts. The case studies and the literature review on integrating functions show that integration entails compromises and conflicts between actors with not only different but partly incompatible interests, views and orientations. Integrating does not only imply benefits. What is good for one function is not always good for another. Using the best boundary spanning strategies will not mean there are no more conflicts of interest or painful decisions. Such conflicting interests especially play a role in how boundaries are maintained or challenged. Striking is that in the case studies in multiple occasions conflicts only become clear at a late stage in the process. For instance, both in Westduinpark and Dakpark only at a very late stage of the process, when after years of interaction about the integrative project the water permit is issued, it becomes clear that important aspects of the integrative plan are not allowed in the water permit. This comes as a surprise to the involved actors and leads to an impasse and conflict in both cases. Only at this point, the discussion is really started with regard to which compromised can be made between functional interests, and what kind of new solutions can be found to enable the integrative plan. At the core of these conflicts lie conflicting sectoral interests which could have been addressed earlier in the process. For instance, in the Dakpark case actors for a long time try not to challenge but work around and avoid established boundaries regarding the levee. However the project in the end does involve building in the protected zone of the levee. This leads to a rather unhappy marriage, reflected upon negatively by actors in the water board. Moreover, it is likely such negative experiences will have impact on next projects. The lesson that I draw from this – further supporting the conclusions on the benefits of drawing boundaries - is that actors can better strive to make clear what hard boundaries are and address such conflicting interests and tensions at an early stage, rather than keeping these quiet or trying to avoid them. Making clear what is at stake can be hard, as it addresses potential conflicts head on. However, studies show that conflicts in collaborative projects are not per definition negative but can also be valuable, as they can fuel creativity needed to find new solutions, and addressing them early can prevent escalation of the conflict later on in the process (Wolf and Van Dooren, 2017). Moreover, conflicts can deepen the relation between actors. From the perspective of boundaries, as shown above, drawing hard boundaries early on in the process enables

actors to better understand each other's positions. This way, making clear what hard boundaries are and why, can enable actors to identify where space for manoeuvre can be found and create new solutions.

In addition, this research finds that whilst in integrating functions it is easily assumed the important boundaries are those between sectors and organizations, after a period of challenging boundaries the boundary discussion also moves towards the internal organisation. In reaction to the changes required to enable the integrative initiatives, others within the organisation resist and protect existing practices and policies, leading to discussions on whether to accommodate such changes. This is shown in the discussions on allowing sand drift within the protected water safety zone in the Westduinpark, and on whether to allow retail, as well as in the different positions of municipal actors on the (strictness of) requirements for the root- and waterproof roofing in the Dakpark case. Such internal discussions are also found in other studies on integrative initiatives (e.g. Van Meerkerk, 2014). These discussions touch upon the paradoxical nature of boundaries. I have conceptualised boundaries as constantly (re)constructed by actors in their daily practices. However at the same time, actors construct boundaries based upon more general ideas on boundaries that have become institutionalised in the larger system e.g. in legislation, in existing practices, or in the general discourse. In their daily actions, actors represent such general ideas on boundaries in their own ways. Different representatives have different roles within an organisation, and thereby may represent organisational interests differently and construct boundaries differently. This becomes clear in the Westduinpark, where a conflict rose when the idea which actors had on the possibilities to realise integrative measures did not match existing policy. Discussions on boundaries consequently and unexpectedly moved to within one of the organisations. This perspective on internal discussions elaborates upon earlier studies who highlight the ambiguous and difficult role of representatives working in integrative projects and who need to deal with the expectations and demands – and ensure support - of those with who they negotiate as well as their own group (Long, 2001; Swan and Newell, 1998).

In both cases boundary spanning activities were important to resolve internal discussions. We found (political) change agents and boundary spanners played an important role to intermediate and enable or enforce organisational change, confirming earlier studies (e.g. Klerkx et al. 2010; Degeling 1999). In contrary to our expectations however, as discussed in pattern two presented above, we find that after a period of (internal) cross-boundary negotiation and making changes, actors redefined boundaries. This does not lead to a new conflict but rather seems to ensure the degree of change keeps within certain limits that actors feel are important. Actor in a sense thereby put boundaries on the degree to which boundaries can be changed.

4. The different dimensions of boundaries need to be addressed together and in a coherent manner to successfully manage boundaries in integrative processes

This research also indicates a pattern that concerns the different dimensions of boundaries that boundary actions can address: the social (relations between groups of people), cognitive (perceptions and ideas on problems and solutions) and physical (material or territorial) dimension. It indicates that in order to successfully manage boundaries in integrative processes the different dimensions of boundaries need to be addressed together and in a coherent manner. The integration with the Deltaprogramme in the DHZ case illustrates how boundary spanning and changing actions that address the social dimension (e.g. inviting representatives of the Deltaprogramme to symposia, meetings, field visits) and the cognitive dimension (e.g. commenting on concept reports) together facilitate the integration of the DHZ and the Deltaprogramme. This is in line with findings by Westerink (2016) and Termeer and Bruinsma (2016) on how boundary spanning strategies that address the physical, social and cognitive dimension mutually reinforce each other. However, actors' boundary actions on different dimension can also contradict each other. The cases show several instances where actors maintain boundaries at one or more dimension(s) whilst challenging it or trying to span it at others. This does not result in effective integration. In the integration attempts with the levee in both Dakpark and Westduinpark, actors seemingly maintained or kept in line with existing social and cognitive boundaries, whilst at the same time the integrative initiative did challenge previously defined physical boundaries. For example, the interaction between water board and the initiating actors was limited (e.g. bilaterally rather than joining the project group, or just between a few persons), and ideas for a more integrative design that combined water safety function in the building of the Dakpark were quickly dismissed. However when the permit needed to be supplied, at a late stage in the process, it became clear the integrative plan did have physical consequences seen as unwanted by the water board which were not identified earlier. In the DHZ case, in the integration with spatial planning issues actors attempted to involve municipalities by inviting them for meetings (bridging social boundaries). However they substantively kept a strong focus on water management and only limitedly and only later in the process tried to include the perspectives of spatial planning actors more in the programme (addressing the cognitive dimension of boundaries). This provides one explanation why boundary spanning was not very successful here. I conclude that spanning, drawing and changing of the different dimensions of boundaries should go hand in hand in order to successfully work across boundaries.

6.4.6 Boundary management in project and programmatic approaches and the impact of context

In addition to the findings above, another interesting question is whether integrative initiatives that take a programmatic approach require a different type of boundary management than project approaches. In this research I analyse two different types of initiatives to integrate functions: two cases are more or less concrete projects that aim to integrate functions on a dedicated area of land, and one case is a complex collaborative programme on the nexus of water and spatial planning. The research indicates in the context of the programme the benefits of boundary spanning are especially helpful to realise integration, underlining some earlier studies that stress the importance of bridging boundaries in programmes over the benefits of demarcation (Lycett, Rassau, & Danson, 2004). The analysis of the DHZ case identifies the fact that actors have put much more effort in spanning boundaries regarding the integration with the Deltaprogramme as an important explanation why integration was more successful here than regarding the integration with spatial planning issues. More in general, in the DHZ case actors undertook a greater share of boundary spanning activities in the than in the two ‘project’ cases. However, this does not mean actors should put all effort on boundary spanning and not draw boundaries at all in programmatic approaches. The analysis at the same time shows that similar to the findings in the context of integrative projects, also in a complex programme context drawing boundaries can be beneficial when actors want to work across boundaries, by creating an understanding and respect for what important boundaries are and for the other’s position.

In addition, in the analysis of the programme in chapter 5, I have added the role of context on actors’ boundary actions to the conceptual framework. The analysis shows that contextual factors influence how actors manage boundaries and how well integration succeeds. It shows that the characteristics of the issues with which integration was sought, whether top management is focussed on the integration attempt, and the individual characteristics of key programme actors all influence boundary management, in line with Lethonen and Martinsuo (2009). In the DHZ case these contextual factors together provide one of the explanations why the integration attempt with the Deltaprogramme was rather successful, whilst the integration with spatial planning issues had not yet succeeded. Here, the clarity of the Deltaprogramme enabled DHZ actors to specify and direct boundary actions at specific people, content and organizational structures, whilst the lack of further specification of the specific issues, project and actors with which integration was sought led to rather general boundary spanning action directed at a very broad group of people in the integration attempt with spatial planning. Moreover, the top management was mainly focussed on integration with the Deltaprogramme, in the sense that they dedicate a substantial share of their time and

energy on the Deltaprogramme. Furthermore, the programme chair played a crucial role in spanning boundaries with regard to the Deltaprogramme, acting as a ‘reticultist’ or political change agent to interest and bind actors together in the programme and on the issue of drought and fresh water supply. However, due to a division of tasks within the DHZ programme, his skills were not used to facilitate integration with spatial planning issues. As a result of these contextual factors a positive feedback loop seems to develop on multiple levels, leading to an attention bias in favour of the Deltaprogramme. Although beneficial for this integration attempt, the inevitable results was that there was less time left for actors to spend on spatial planning (and other issues). Summing up the above, these findings show that context really matters.

6.5 Contribution to the scientific debate

To the literature on integrating functions I contribute an overview of the challenges actors face and the strategies they can use when they aim to integrate functions for a more sustainable development, based on a literature review. Moreover, this research provides a further understanding of integration challenges and strategies by studying initiatives for MLU from the theoretical perspective of managing boundaries. In the literature on multifunctional land use, the perspective of boundary management has not often been applied before. This research shows that managing boundaries is a central issue for actors that work on multifunctional or integrative initiatives.

In the wider governance literature on integrative approaches for a more sustainable development, interest in boundary spanning strategies has risen recently. The boundaries themselves have however received less attention. This research contributes a better understanding of what boundaries are and what boundary management entails, drawing from literature on the formation of boundaries from other fields, specifically organisational and management studies. Many studies on boundary management in integrative work focus on identifying boundary spanning strategies, and predefine boundaries across which boundary spanning is studied. I propose to study boundary management through studying actors’ boundary actions in the empirical context. By doing so, rather than predefining boundaries, this thesis shows how actors not only span but also construct, defend, and negotiate boundaries and effects thereof on realising integration. The perspective applied in this research thereby provides new insights into the functioning of boundary management in integrative processes.

To the literature on integrative work and the boundary literature I contribute a typology of boundary actions and dimensions that enables scholars to analyse boundary management through reconstructing actors’ boundary actions in their daily practices, as presented in section 3.3. This typology is based on earlier typologies by Hernes (2004)

and Sturdy (2009). However the combination of a typology of boundary dimensions with a typology of boundary actions, and its operationalisation to map and interpret boundary (re)construction is new. This typology can be used as an instrument or lens to map and interpret boundary actions, and can be applied to study boundary management in other integrative and collaborative processes.

Moreover, I contribute to the literature on integrative work and boundary management an elaboration of the current understanding of enabling and constraining effects of boundaries, as summarised in table 6.1. More specifically, this research showed that drawing boundaries, in complement to boundary spanning, also has an important role in realising integration. The enabling effects of drawing boundaries have been shown by others before (Hernes, 2003). However in recent studies on integrative and collaborative work the focus has been on spanning boundaries. This research brings back attention to how drawing boundaries can also have enabling effects for integrative processes.

To the literature on integrative work and boundary management I furthermore contribute first insights on how actors manage boundaries over time in integrative processes, how this changes over the course of a particular process, and what that tells us about what sequences of boundary actions help to realise effective integration of functions. This has only limitedly been studied before, and was useful to gain further insight in the dynamic balance needed between spanning, drawing and challenging boundaries during integrative processes. This research identified from the case studies four patterns in the sequences of boundary actions and their effects on the integrative process, to be further studied and tested in future studies.

6.6 Policy implications

This research points out that many of the struggles actors face in the process of initiatives to integrate functions relate to boundaries. When actors specify integration as their aim, they are confronted with boundaries. Actors in integrative processes will need to work across boundaries, will run into others drawing boundaries, will define or defend boundaries that are helpful for their own actions, and will need to deal with boundaries becoming blurred in their collaborative efforts. This research has described a variety of boundary actions and sequences of boundary actions over time which actors may undertake during integrative processes, and gives insight in their effects. This can help practitioners involved in these processes to better understand integration challenges and find further solutions. Consequently, practitioners can manage boundary discussions more consciously and strategically. Below I highlight the most notable insights that I deem helpful for practitioners.

Firstly, whereas practitioners in integrative initiatives may tend to focus on how they can span the boundaries they encounter, this study provides the intriguing and paradoxical insight that integrating functions does not mean all efforts of practitioners need to be on spanning boundaries. Although boundary spanning is important to facilitate interaction between actors and connect different interests, this is not enough and needs to be accompanied by making clear what important boundaries are and (re)constructing boundaries. This research shows how drawing boundaries, in complement to spanning, can enable integration in several ways: At start of the interaction making clear what important or hard boundaries are and strengthening boundaries can be helpful to guard interests and ensure wishes are met, and create an understanding and respect for boundaries. This is relevant for instance in making the design of integrative measures, where actors can make more clear what their wishes are and what is and is not possible, rather than expecting that all different wishes can be included in the integrative plan. But also for the roles and expectations that actors have of each other. For instance in the Westduinpark different actors expressed conflicting expectations on the role of watermanagers in accomplishing Natura 2000 goals. After a period of boundary spanning and negotiating boundaries, reconstructing boundaries can enable dividing tasks and responsibilities that have become shared and blurred. Moreover, redefining the conditions, responsibilities and new ways of working for the new situation after a period of cross-boundary negotiation and change enables actors to ensure the degree of change keeps within certain limits that they feel are important. This way, constructing boundaries after a period of working across boundaries provides a certain degree of order, safety and autonomy that is important for actors and organisations in order to be comfortable with integrative measures.

Secondly, this research makes clear that integrating functions is not an easy process. In fact, I take a critical standpoint on when it should be pursued. The central idea in integrating functions is that it will lead to positive effects for multiple socio-economic and ecologic functions by creating synergies between functions. Integrating or coupling ('meekoppelen') functions is often expected to lead to various positive effects; it can facilitate the realisation of measures as it provides a solution for spatial scarcity, enable coupling multiple financial sources and may lead to broader support by providing multiple societal services. Although these potential benefits do make integration attractive, the governance challenges of integrative processes are often underestimated. Different and partly incompatible actors, interests, ideas, tasks and institutional backgrounds need to be brought together. The expectation that integrating functions creates only win-win situations and can be realised by 'merely' optimising boundary spanning strategies is not realistic. Integrating does not only imply benefits. It also entails compromises and conflicts. Not everything can be combined. Managing boundaries in the

best way possible will not make integrative processes free of conflict or painful decisions. In integrating functions actors sometimes need to defend their interests and draw hard boundaries. Other times, a sector needs to take a painful loss. In the end a water board is judged on water safety. Likewise a province will need to accomplish nature development goals. Integrating functions requires practitioners to address inevitable tensions between interests and make clear what hard boundaries are at an early stage, rather than keeping these quiet or trying to avoid them. Making clear what is at stake can be hard, as it addresses potential conflicts head on. However, studies show that conflicts in collaborative projects are not per definition negative but can also be valuable. From the perspective of boundaries, as shown above, drawing hard boundaries early on in the process enables actors to better understand each other's positions. This way, making clear what hard boundaries are and why, can enable actors to identify where space for manoeuvre can be found and create new solutions. This might well be a better option than muddling through in an attempt to meet all wishes, leading to a suboptimal compromise or postponing painful decisions. Moreover, an important insight that I draw from this research is that the significant challenges discussed above imply that practitioners would do well to only pursue integrative initiatives if the integrative benefits are really worth pursuing and well outweigh the integration challenges. Huxham and Vangen (2005) coined the terms 'collaborative advantage' and 'collaborative inertia' to describe the difficult process involved in collaborative initiatives, and identified that seeking collaborative advantage is very time and resource intensive.

Thirdly, whilst in integrating functions it is easily assumed the important boundaries are those between sectors and organizations, after a period of challenging boundaries the boundary discussion also moves towards the internal organisation. In reaction to the organisational changes required to enable integrative initiatives, others within the organisation may resist and protect existing practices and policies, leading to internal discussions on whether to accommodate such changes. Based on the cases I conclude that in order to deal with internal discussions it is important to involve from early on not just those representatives who are good in working across boundaries (e.g. policy officers or strategists), but also those who are responsible for guarding boundaries to ensure the organizations' own tasks are fulfilled (e.g. enforcing body). This is needed to incorporate from early on different views on boundaries and ensure sufficient support for the solutions developed by the group of representatives working on the integrative initiative.

Lastly, how attention is divided between multiple issues with which integration is sought in complex integrative processes requires careful attention in future integrative initiatives. This research shows that what the relevant boundaries are that actors will need to deal with during integrative processes is not readily visible and changes during the process.

Moreover, actors need to juggle multiple discussions on boundaries simultaneously in integrative processes. However, including all actors constantly in the process is impractical and leads to a dilemma on efficiency versus inclusivity for practitioners. This is problematic, as we have identified above that when not all relevant boundary discussions are considered and are given sufficient attention this may lead to blind spots. Moreover, actors should be aware of a crowding out effect. In the Westduinpark case and the DHZ case a dominant issue took up much of actors' attention and inevitably left less time for other issues. By being aware of this, practitioners can make a more conscious and strategic choice when to give which issues attention and review the balance in the load of their agenda. A solution may be to create multiple moments during the process where actors take stock, review what are relevant discussions on boundaries at hand, and who should be more involved or can be less closely involved. The actors related to relevant discussions on boundaries at that point in time should be meaningfully and timely involved. That is, they should be involved more closely in the collaboration than just bilaterally or incidentally (e.g. such as the energy company and water board in Dakpark, and municipalities in DHZ). This way, actors can together build a joint idea of problems and solutions (which may also be to decide to divide parts or draw certain hard boundaries in terms of specifying impossibilities).

6.7 Reflections

6.7.1 Usefulness of the theoretical perspective

Reflecting on the theoretical perspective of managing boundaries, I find this perspective was very useful to come to a more in-depth understanding of integration challenges and identify patterns in the practices how actors deal with integration challenges across different cases and discussions on boundaries. Moreover, the decision to study actors' enactment of boundaries in the empirical context by analysing boundary actions, rather than predefining boundaries, has enabled me to study how actor not only span but also construct, defend, and negotiate boundaries and effects thereof on realising integration. This led to new insights on managing boundaries, and highlighted the role of drawing boundaries in realising integration. A challenge of this perspective is however that, as stated in chapter 3, the boundaries that I studied are not easily visible like a countries boundaries. Most boundaries are more subtle, invisible, or at best blurred, e.g. boundaries in the ways problems or solutions are conceived or in routines (Hernes, 2004; Jones, 2009). Consequently it can become abstract what exactly is meant boundaries. More practically, it is not straightforward how boundaries can be observed and studied. In this research I have dealt with this by developing a conceptualisation of boundary management and framework to systematically identify and analyse how actors manage boundaries.

Instead of the perspective of managing boundaries, alternatively a research on the complex governance process in integrating functions could have involved a network analysis (focussing on the actors involved in integrative processes and how they relate to one another, and looking for strategies to facilitate negotiating different interests); a discursive analysis (focussing on the views and narratives of the actors involved, and looking for strategies to facilitate a shared understanding and a framing of problems and solutions), or an institutional analysis (focussing on the values, practices and rules that structure actors' actions, which become challenged when actors want to work across sectors). Each of these perspectives would have provided additional insights on the integration challenges that were identified in the literature review in chapter 2. The choice for the perspective of boundaries in this thesis has however enabled incorporating and combining elements of each of these perspectives in the analysis, rather than choosing one.

6.7.2 Reflection on research design and methodology

I have conceptualised boundaries as socially constructed entities. Because I aimed to understand how people construct, span, defend and negotiate boundaries through their actions and interactions in integrating functions, I chose a case study approach researching three cases. Choosing a case study approach has enabled an in-depth understanding of how practitioners manage boundaries in integrating functions. Choosing an approach with three case studies enabled comparing multiple sets of boundary actions in different context. However, reconstructing and trying to understand actors' boundary actions on a micro-level in three case studies - in part through non-participative observations – and analysing this in a structured manner was very time consuming. I estimate that I have invested at least half of my full-time period as a PhD in data collection, transcription of interviews and observations, and coding of this large base of data. This inevitably went at the expense of time to write up the findings. Researchers interested in this topic are hence well advised to (better) take in account the time involved in reconstructing boundary actions at a micro-level in a structured manner in their research design. One option would be to shorten the extent of the data collection, either by studying less cases or by collecting data less extensively, for instance involving fewer observations. This especially comes to mind as I inevitably have had to make choices what aspects of this rich data I could present in the articles that make up this thesis. Specifically in chapter 4, I have chosen to focus on comparing sequences of boundary actions at the expense of a more in-depth description of the cases. On the downside however, a more streamlined and limited data collection would also create less room to come to new insights.

The cases were all Dutch cases of integrating land use functions. Whilst this gives a good insight into the practices of integrating land use functions in The Netherlands, it limits the applicability of the findings to other regions. Case study research is context dependent. Nevertheless, such research can still lead to insights that are more generally relevant, as elaborated in section 6.2.

Lastly, I have questioned how it is possible that I find such clear evidence of beneficial effects of drawing boundaries, whilst this has not received much attention in recent studies. Have I been specifically interested in beneficial effects of drawing boundaries and therefore put the spotlight on this in all cases, instead of analysing all boundary actions equally? However, this explanation does not fully hold, as my interest was a result of the research on the Dakpark case (as described in the introducing story). Another explanation is that Dutch cases are more prone to highlight these beneficial effects, as a counterweight to the large focus on collaboration in the Dutch culture of policy making (polderen) which can easily tip over to too much collaboration. Or that recent research has just not looked at boundary drawing actions, due to the focus on improving strategies to span boundaries. Whichever explanation holds, this outcome is notable and should be further studied by other researchers and in other context.

6.8 Suggestions for further study

A main future research opportunity is to delve into the conditions under which certain sequences of boundary actions develop or have a specific outcome. Chapter 5 has shown that context really matters. It identified that in programmatic approaches several contextual factors influence how actors manage boundaries and how successful boundary management is. These contextual factors concerned the issues with which integration was sought, whether top management is focussed on the integration attempt, and the individual characteristics of key programme actors. The question remains how such factors play a role in boundary management in project oriented approaches. Moreover, this research has given first insights how the power relations between actors and the previous history of relations influence how actors manage boundaries and consequently what kind of integration is possible. An important future research opportunity is to delve further into these more political aspects of integrating functions.

As with any case study, the findings in this research are contextually bound. More research on sequences of boundary actions and their effects in integrative processes is needed to create a broader basis that confirms, corrects or elaborates the findings of this research. Especially the beneficial effects of drawing boundaries should be further studied by other researchers and in other context. More research on how actors not only span boundaries, but also construct, defend, negotiate and challenge boundaries in

processes to integrate functions will enable a better understanding of integration challenges. Moreover, more research on which sequences of boundary actions enable successful integration will enable finding further solutions for these challenges.

Lastly, future research can focus on a further understanding how actors can address the different dimensions of boundaries together. This research has developed a conceptual framework that specifies three dimensions of boundaries: social, cognitive and physical dimension. It also led to first insights that these dimensions need to be addressed together in a coherent manner to successfully manage boundaries in integrative processes. However, the question how actors can do so deserves more attention than could be given in this thesis. Moreover, one could distinguish other dimensions of boundaries which have not been used as separate category here, such as the institutional dimension. A better understanding of the construction, contestation and spanning of boundaries at different dimensions of boundaries, how these work together, and how actors can address them in a coherent manner can enable practitioners to more consciously and strategically address each of the different dimensions of boundaries during the integrative process.

References

- Abbott, A. (1995). Things of boundaries. *Social Research*, 62(4), 857–882.
- Ansell, C., & Gash, A. (2008). Collaborative Governance in Theory and Practice. *Journal of Public Administration Research and Theory*, 18(4), 543–571. <https://doi.org/10.1093/jopart/mum032>
- Barth, F. (2000). Boundaries and connections. *Signifying Identities: Anthropological Perspectives on Boundaries and Contested Values*, 17–36.
- Bryson, J. M., Crosby, B. C., & Stone, M. M. (2006). The Design and Implementation of Cross-Sector Collaborations: Propositions from the Literature. *Public Administration Review*, 66, 44–55. <https://doi.org/10.1111/j.1540-6210.2006.00665.x>
- Clark, W. C., Tomich, T. P., van Noordwijk, M., Dickson, N. M., Catacutan, D., Guston, D., & McNie, E. (2010). *Toward a General Theory of Boundary Work: Insights from the CGIAR's Natural Resource Management Programs*. HKS Faculty Research Working Paper Series RWP10-035. John F. Kennedy School of Government, Harvard University.
- Cohen, A. (1999). *Signifying Identities: Anthropological perspectives on boundaries and contested values*. Routledge.
- Degeling, P. (1995). The significance of ‘sectors’ in calls for public health intersectoralism: an Australian perspective. *Policy & Politics*, 23(4), 289–301.

- Ernst C and Chrobot-Mason D (2010) *Boundary Spanning Leadership: Six Practices for Solving Problems, Driving Innovation, and Transforming Organizations*. New York: McGraw-Hill Education.
- Hernes, T. (2003). Enabling and constraining properties of organizational boundaries. In *Managing boundaries in organizations: Multiple perspectives* (pp. 35–55). Hampshire: Palgrave Macmillan.
- Hernes, T. (2004). Studying Composite Boundaries: A Framework of Analysis. *Human Relations*, 57(1), 9–29. <https://doi.org/10.1177/0018726704042712>
- Kerosuo, H. (2006). *Boundaries in action. An Activity-theoretical Study of Development, Learning and Change in Health Care for Patients with Multiple and Chronic Illnesses*. Helsinki University Press, Helsinki.
- Klerkx, L., Aarts, N., & Leeuwis, C. (2010). Adaptive management in agricultural innovation systems: The interactions between innovation networks and their environment. *Agricultural Systems*, 103(6), 390–400.
- Klerkx, L., van Bommel, S., Bos, B., Holster, H., Zwartkruis, J. V., & Aarts, N. (2012). Design process outputs as boundary objects in agricultural innovation projects: Functions and limitations. *Agricultural Systems*, 113, 39–49. <https://doi.org/10.1016/j.agsy.2012.07.006>
- Lee, L., Magellan Horth, D., & Ernst, C. (2014). *Boundary Spanning in Action: Tactics for Transforming Today's Borders into Tomorrow's Frontiers*. Centre for Creative Leadership.
- Lehtonen, P., & Martinsuo, M. (2009). Integrating the change program with the parent organization. *International Journal of Project Management*, 27(2), 154–165. <https://doi.org/10.1016/j.ijproman.2008.09.002>
- Long, N. (2001). *Development Sociology: Actor Perspectives*. Routledge.
- Lycett, M., Rassau, A., & Danson, J. (2004). Programme management: a critical review. *International Journal of Project Management*, 22(4), 289–299. <https://doi.org/10.1016/j.ijproman.2003.06.001>
- Mørk, B. E., Hoholm, T., Maaninen-Olsson, E., & Aanestad, M. (2012). Changing Practice Through Boundary Organizing: A Case from Medical R&D. *Human Relations*, 65(2), 263–288. <https://doi.org/10.1177/0018726711429192>
- Noble, G., & Jones, R. (2006). The role of boundary-spanning managers in the establishment of public-private partnerships. *Public Administration*, 84(4), 891–917. <https://doi.org/10.1111/j.1467-9299.2006.00617.x>
- RLI (2019). *De som der delen. Verkenning samenvallende opgaven in de regio*.
- Star, S. L., & Griesemer, J. R. (1989). Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907–39. *Social Studies of Science*, 19(3), 387–420. <https://doi.org/10.1177/030631289019003001>

- Sturdy, A., Clark, T., Fincham, R., & Handley, K. (2009). Between Innovation and Legitimation— Boundaries and Knowledge Flow in Management Consultancy. *Organization*, 16(5), 627–653. <https://doi.org/10.1177/1350508409338435>
- Swan, J., & Newell, S. (1998). Making sense of technological innovation: the political and social dynamics of cognition. In: Eden C and Spender JC (Eds) *Managerial and Organizational Cognition: Theory, Methods and Research*. London, Sage, pp 108-128.
- Termeer, C.J.A.M. & Bruinsma, A., (2016). ICT-enabled boundary spanning arrangements in collaborative sustainability governance. *Current Opinion in Environmental Sustainability*, 18, 91-98.
- Tushman, M.L., & Scanlan, T. J. (1981). Boundary Spanning Individuals: Their Role in Information Transfer and Their Antecedents. *The Academy of Management Journal*, 24(2), 289–305. <https://doi.org/10.2307/255842>
- van Ark, R. (2006). Meervoudig ruimtegebruik: dogma of eye-opener? In *Meervoudig ruimtegebruik, enkelvoudig recht: de spanningsvolle relatie tussen recht en innovatie* (pp. 11–22). Delft: Eburon.
- van Meerkerk, I. (2014). *Boundary Spanning in Governance Networks: A study about the role of boundary spanners and their effects on democratic throughput legitimacy and performance of governance networks*. (Erasmus University)
- van Meerkerk, I., & Edelenbos, J. (2018). Facilitating conditions for boundary-spanning behaviour in governance networks. *Public Management Review*, 20(4), 503–524. <https://doi.org/10.1080/14719037.2017.1302248>
- Weick, K. E. (1995). *Sensemaking in organizations*. SAGE.
- Westerink, J. (2016). *Making a Difference: Boundary Management in Spatial Governance*. Wageningen University.
- Wolf, E., & Van Dooren, W. (2017). *De waarde van weerstand: Wat Oosterweel ons leert over besluitvorming*. Pelckmans Pro.
- Williams, P. (2002). The Competent Boundary Spanner. *Public Administration*, 80(1), 103–124. <https://doi.org/10.1111/1467-9299.00296>

Summary

1. Introduction, research questions and research approach

Measures that integrate different social, economic and ecologic land use functions have increasingly raised the interest of scholars and practitioners concerned with sustainability. Integrating functions can potentially create synergies between functions and provide ecological and socio-economical services simultaneously and thereby lead to a more sustainable development (Lovell and Taylor, 2013; Selman, 2009). However, whilst its' potential benefits make integration attractive and initiatives for multifunctional land use (MLU) often see wide support, previous research shows that integrative initiatives are hard to achieve (O'Farrell and Anderson, 2010; van Broekhoven and Vernay, 2018). A main challenge is that it requires involving multiple policy sectors and governmental, private and civic actors who need to act collectively, but who each act upon different and possibly incompatible interests, perspectives, and institutional settings (van Broekhoven and Vernay, 2018; Priemus et al, 2000; Van Ark, 2006; Wiering and Immink, 2006). This leads to excessively lengthy processes, cost-overruns, and projects that fail to be realised. It is therefore important to understand the underlying perspectives, interests, institutional structures and ways of working that lead to integration challenges, and explore new solutions. One possible perspective to research this is to focus on how actors deal with boundaries during the integrative process. I do so in this thesis. When actors specify integration as their aim, they are confronted with boundaries. They will need to work across boundaries, will run into others drawing boundaries, will define or defend boundaries that are helpful for their own actions and will need to deal with boundaries becoming blurred in their collaborative efforts.

The question how actors can deal with boundaries in integrative initiatives for sustainable development has recently gained attention (Bressers and Lulofs, 2010, Warner et al., 2010; Van Meerkerk, 2014; van Broekhoven et al., 2015; Opdam et al., 2015; Westerink, 2016). Many studies focus on boundary spanning strategies, providing valuable insights on this. The boundaries themselves have however received less attention. Studies often predefine boundaries which are assumed to be rather static (e.g. sectoral or organisational boundaries). The literature on boundaries has however drawn attention to how boundaries are constructed, negotiated, and evolved or maintained when actors interact (e.g. Heracleous, 2004; Kerosuo, 2006; Mørk et al, 2012; Paulsen and Hernes, 2003; Santos and Eisenhardt, 2009). Moreover, it has shown boundaries do not only constrain but also have enabling properties (Hernes 2003). Building upon this, the aim of this research is to contribute to theories on effective integration by analysing where boundaries emerge and are spanned, but also are drawn, contested, defended and negotiated in integrative processes, and what kind of boundary management helps to realise integrating functions.

In this thesis I address the following main research question and sub-questions: *How do actors manage boundaries in initiatives for multifunctional land use, and what kind of activities and sequences of activities to manage boundaries are helpful to realise effective integration of land use functions?*

1. *What are the challenges and strategies for realising initiatives for multifunctional land use in the wider literature concerning integration of functions?*
2. *How can boundaries and boundary management in initiatives for multifunctional land use be conceptualised and studied?*
3. *What kind of activities and sequences of activities do actors employ to manage boundaries during the process of initiatives for multifunctional land use?*
4. *What kind of activities and sequences of activities to manage boundaries are helpful to realise effective integration of land use functions?*

To answer these questions the following studies are performed: a literature review on challenges and strategies for integrating functions, developing a conceptual framework to systematically map and analyse the dynamics of boundary (re)construction, and three longitudinal case studies in which this framework is applied. A qualitative approach using case study research suits with the type of questions I aim to answer, as it allows to study in-depth the micro-interactions of actors in MLU initiatives. The cases are selected following the principle of maximization (Boeije, 2009; Pettigrew, 1990). In the selected cases actors integrate multiple functions, including water management. Given the important historical role and position of flood protection and water management in The Netherlands, this provides a socially relevant setting where boundaries as traces of past activities can be expected to be strongly present. Data is gathered by a combination of semi-structured interviews, document analysis, non-participatory observation of actors' interaction and workshops with stakeholders.

2. Research results and conclusions

Challenges for integrative initiatives

The literature review shows that integrative initiatives face many challenges. The collaboration that is needed between actors related to particular functions (water safety, recreation, wastewater treatment) is identified as the main challenge. It furthermore shows that both high investment costs and uncertainties about costs and benefits for different actors hamper realisation. Moreover, legislation that does not support integrated initiatives was found to hamper integration of functions. However, integrating functions is not just a matter of facilitating collaboration between actors, nor just of changing

regulation, finding financial means, developing knowledge on technological feasibility or design, or gaining public support. Based on the review I highlight that integrative processes require actors to connect across previously separate ‘worlds’, and that the different institutional backgrounds and logics of actors related to particular functions require attention in future studies. Integrating functions requires bridging boundaries of more or less autonomous actors dominantly organised according to the principals of bureaucracy: well divided into task units specialised and responsible for one function. One possible perspective to further understand integration challenges and find new solutions is to focus on how actors deal with boundaries during the integrative process.

Conclusions on managing boundaries

This thesis shows that managing boundaries is a central issue for actors that work on initiatives for MLU. Boundaries are in essence sites of difference; ways of differentiating something from what it is not (Abbott, 1995; Hernes, 2004). Building on literature on the formation of boundaries I conceptualise boundaries as socially constructed, complex and dynamic constructs (Abbott 1995; Heracleous, 2004; Hernes, 2004; Jones, 2009; Sturdy et al, 2009). They are enacted in interactions where they are made explicit, are shaped, enforced, or form a matter of contention. They do not exist independent of such enactment, and thus need to be studied through the interactions of the people that enact them.

Therefore, rather than researching how interaction across predefined boundaries takes place, this thesis proposes to study boundaries by analysing how boundaries are (re)constructed and evolve by identifying and observing or reconstructing the boundary actions of the involved actors in specific empirical contexts. I define a boundary action as: *a recurring set of articulations, actions, and interactions that shape a demarcation, taking place over a longer period of time*. To identify actors’ boundary actions, this research develops a typology which can be used to systematically map and interpret the dynamics of boundary (re)construction in action during integrative processes. This typology distinguishes three dimensions on which boundaries can be expressed and three main types of boundary actions, building upon earlier typologies. I distinguish social (social relations between people), cognitive (ideas and meanings), and physical (material or territorial) dimensions of boundaries. These dimensions are interrelated. I furthermore distinguish three main types of boundary actions: Challenging boundaries, referring to problematizing existing ideas or divisions; stabilising or maintaining boundaries, referring to strategies to defend or draw demarcations; and spanning a boundary whilst respecting the distinction it entails, referring to, for example, scouting or bridging.

Summary

The case analysis corroborates the theoretical idea that what relevant boundaries are in complex initiatives to integrate functions is not readily visible, not clear on forehand and changes during the process. Moreover, the analysis shows that in multifunctional initiatives actors need to juggle multiple discussions on boundaries simultaneously.

Conclusions on realising effective integration

The case analysis shows that realising effective integration requires both spanning, challenging and drawing boundaries. Each can be beneficial for realising integration, but can also constrain it.

Maintaining boundaries

Whilst drawing boundaries is often seen as problematic for collaboration, a main conclusion and intriguing of this research is that drawing boundaries can also be beneficial to realise effective integration. The research shows that drawing boundaries can provide actors involved in integrative processes safety and comfort by clarifying and guarding their interests and ensuring their wishes are met. Moreover, it can enable creating an understanding and respect for what important boundaries are in the integrative process, and what different viewpoints and interests are that need to be taken in account. In addition, constructing boundaries in terms tasks, risks and responsibilities – as seen in the interaction between public and private actors in the Dakpark - can make complex integrative processes more manageable, by creating a certain sense of order or clarity. The enabling effects of drawing boundaries have been shown by others before (e.g. Hernes, 2003). However in recent studies the focus has been on spanning boundaries. This research brings back attention to how drawing boundaries can also have enabling effects for integrative processes.

However, drawing boundaries can also constrain integrating functions. By drawing boundaries actors demarcate and limit who is included in the decision making process, what activities are legitimate, and what ideas or solutions can be developed, as also identified in previous studies. Moreover, actors may also make assumptions in boundaries from earlier experiences, thereby limiting integration possibilities beforehand.

Spanning boundaries

Whilst studies often focus on the benefits of spanning boundaries, the analysis reveals that spanning boundaries can also have constraining effects. One of the difficulties that actors need to deal with in integrative processes is that by crossing boundaries the roles of actors previously acting separately become overlapping in the multifunctional development. This makes it unclear who should bear what responsibilities, risks, and

costs. Moreover, actors struggle with a dilemma of inclusiveness who should be part of the joint process versus efficiency of meetings.

This research at the same time supports earlier findings that boundary spanning activities facilitate a positive interaction between groups and enable actors to come to a joint idea of problems and solutions (e.g. Tushman & Scanlan, 1981; Williams, 2002). Moreover, when conflicts rise, boundary spanning activities can help actors to find solutions. Here, political change agents can play an important role by intermediating and by enabling or enforcing changes in established practices that help the integrative initiative, confirming earlier studies (e.g. Klerkx et al. 2010; Degeling 1999).

Challenging boundaries

To achieve integration, actors will need to negotiate and change boundaries that hamper multifunctionality, for example in existing practices and legislation. By challenging boundaries actors can form new coalitions, change existing ideas or possibilities, include new resources, and change which activities are legitimate.

However, changing boundaries has consequences, amongst others for whether and how functional tasks and demands of the own organisation or group can be fulfilled. Others within the organisation may resist and protect existing practices and policies. As a consequence, conflicts and (internal) discussions can rise on whether change should be allowed.

Patterns in sequences of boundary actions during process

The analyses above gives rise to the question where spanning will help or in contrast take you in, and where will drawing help or take you in? Where can we find the dynamic balance that is needed to realise integration? This research analyses temporal sequences of boundary actions and their effects on the integrative process. I identify four patterns in the sequences of boundary actions found in the 13 sets of boundary actions within the three cases. As with any case study, these findings are contextually bound. They will need to be tested in further empirical studies.

1. To work across boundaries, boundaries first need to be created, strengthened and explicated, whilst also connecting where possible

Paradoxically, I find that drawing boundaries at the start of an interaction, in complement to spanning boundaries, can have beneficial effects for integrating functions, as it gives actors safety and comfort by clarifying and guarding their interests, and creates an understanding and respect for what different viewpoints and interests are that need to be taken in account. This pattern is in line with earlier finding by Ernst & Chrobot-Mason

(2010) and Lee et al. (2014), indicating it is not only limited to the cases studied here. We elaborate upon this by emphasising that the beneficial effects discussed here were a result of both boundary drawing and spanning actions together – complementing each other. This however does not mean that actors should or can make all boundaries clear at the start of the process. This research has shown that what important boundaries are is not readily visible and can change over time.

2. After a period of spanning and challenging boundaries, reconstructing boundaries can help to keep the process manageable, provide safety and maintain autonomy.

This research underlines earlier findings that boundary spanning actions are important to realise integrative initiatives. However, this is not sufficient. The analysis reveals reconstructing boundaries after a period of boundary spanning and negotiating boundaries can help actors to divide task and responsibilities that become blurred, overlapping and shared in the integrative initiative, making the project more manageable. Furthermore, the research indicates that after a period of (internal) cross-boundary negotiation and making changes, redefining the conditions, responsibilities and new ways of working for the new situation enables actors to ensure the degree of change keeps within certain limits that they feel are important, in line with some earlier findings (Kerosuo, 2006; Mørk et al., 2012). This way, constructing boundaries after a period of working across boundaries provides a certain degree of order, safety and autonomy that is important for organisations in order to be comfortable with integrative measures.

3. Challenging boundaries is often necessary to realise integration, but actors can and should expect this will lead to conflicts and internal discussions during the integrative process

Actors often need to challenge boundaries to enable an integrated initiative (e.g. in legislation, existing ways of working, or roles and tasks) and realise organisational change. Actors can and should expect this will lead to conflicts. The expectation that integrating functions creates only win-win situations and can be realised by ‘merely’ optimising boundary spanning strategies is not realistic. Integrating functions requires practitioners to address inevitable tensions between interests and make clear what hard boundaries are at an early stage, rather than keeping these quiet or trying to avoid them.

Moreover, this research finds in reaction to the changes required to enable the integrative initiatives, others within the organisation resist and protect existing practices and policies, leading to discussions on whether to accommodate such changes. Discussions on boundaries consequently move towards the internal organisation, confirming earlier studies (e.g. Van Meerkerk, 2014). To resolve internal discussions boundary spanning activities were important. In contrary to our expectations however, we find that after a

period of internal cross-boundary negotiation and making changes actors also redefined boundaries, as discussed in pattern two presented above.

4. The different dimensions of boundaries need to be addressed together and in a coherent manner to successfully manage boundaries in integrative processes

This research also shows a pattern that concerns the different dimensions that boundary actions can address: the social, cognitive and physical dimension. The cases show several instances where actors try to maintain or keep in line with boundaries at one or more dimension(s) whilst challenging it or trying to span it at others. This does not result in effective integration. This indicates that in order to successfully manage boundaries in integrative processes the different dimensions of boundaries need to be addressed together and in a coherent manner.

Boundary management in project and programmatic approaches

Another interesting question is whether integrative initiatives that take a programmatic approach require a different type of boundary management than project approaches. The research indicates in the context of the programme the benefits of boundary spanning are especially helpful to realise integration, underlining some findings. However, this does not mean actors should put all effort on boundary spanning and should not draw boundaries at all in programmatic approaches. The analysis at the same time shows that similar to the findings in the context of integrative projects, also in a complex programme context drawing boundaries can be beneficial when actors want to work across boundaries, by creating an understanding and respect for what important boundaries are and for the other's position.

3. Recommendations

Firstly, whereas practitioners in integrative initiatives may tend to focus on how they can span boundaries they encounter, this study provides the intriguing and paradoxical insight that integrating functions does not mean all efforts of practitioners need to be on bridging boundaries. Although boundary spanning is important to facilitate interaction and connect different interests, this is not enough and needs to be accompanied by making clear what hard boundaries are and (re)constructing boundaries. Drawing boundaries can enable integration in several ways: At start of the interaction to guard interests, ensure wishes are met, and create an understanding and respect for boundaries; and after a period of boundary spanning and negotiating boundaries, to divide tasks and responsibilities or ensure the degree of change keeps within certain limits that the involved actors feel are important. This way, (re)constructing boundaries provides a certain degree of order, safety and autonomy that is important for actors and organisations in order to be comfortable with integrative measures. Secondly, this research makes clear that

Summary

integrating functions is not an easy process. I take a critical standpoint on when it should be pursued. Although its' potential benefits make integration attractive, the governance challenges of integrative processes are often underestimated. Integration does not only lead to benefits but also to compromises and conflict. Integrating functions requires practitioners to address inevitable tensions between interests and make clear what hard boundaries are at an early stage, rather than trying to avoid them. The complex governance process implies that practitioners would do well to only pursue integrative initiatives if the integrative benefits well outweigh the integration challenges. Thirdly, whilst in integrating functions it is easily assumed the important boundaries are those between sectors and organizations, I find boundary discussion also move within organisations. In order to deal with internal discussions it is important to involve from early on not just those representatives who are good in working across boundaries (e.g. policy officers or strategists), but also those who are responsible for guarding boundaries to ensure the organizations' own tasks are fulfilled (e.g. enforcing body) to ensure sufficient support. A last recommendation for practitioners is to strategically divide attention between multiple issues with which integration is sought in future integrative initiatives. Whilst I have argued that all relevant boundary discussions should be given sufficient attention, this is complicated as boundaries are not readily visible, actors need to juggle multiple discussions on boundaries simultaneously, and what the important boundaries are changes during the process. However, including all actors in the whole process is impractical and leads to a dilemma on efficiency versus inclusivity. As a consequence, practitioners need to be aware of a crowding out effect. Much attention for one discussion on boundaries inevitably leaves less time for other discussions, which can lead to blind spots. One solution may be to create multiple moments during the process where actors take stock, review what are relevant discussions on boundaries at hand, and who should be more or less closely involved.

As with any case study, the findings in this research are contextually bound. More research on sequences of boundary actions and their effects in integrative processes is needed to create a broader basis that confirms, corrects or elaborates the findings of this research. Furthermore, future research can delve into the conditions under which certain sequences of boundary actions develop or have a specific outcome. Moreover, future research can focus on a further understanding of how actors can address the different dimensions of boundaries together. A better understanding of the construction, contestation and spanning of boundaries at different dimensions, how these work together, and how actors can address them in a coherent manner can help practitioners to more consciously and strategically address each dimension during the integrative process.

Samenvatting

1. Introductie, onderzoeksvragen, en onderzoeksaanpak

Maatregelen die verschillende sociale, economische en ecologische landgebruiksfuncties combineren staan veel in de belangstelling van wetenschappers en beleidsmakers die zich bezig houden met duurzaamheid. Maatregelen die functies integreren kunnen synergiën tussen functies creëren en tegelijk ecologische, economische als sociale diensten leveren, en een duurzamere ontwikkeling mogelijk maken (Lovell en Taylor, 2013; Selman, 2009). Hoewel deze potentiële baten integratie aantrekkelijk maken en initiatieven voor multifunctioneel landgebruik (MLU) vaak veel steun krijgen, toont onderzoek aan dat integrale initiatieven echter niet eenvoudig te realiseren zijn (O'Farrell en Anderson, 2010; van Broekhoven en Vernay, 2018). Een belangrijke uitdaging is dat voor hun realisatie meerdere sectoren en overheden, private en maatschappelijke actoren betrokken die gezamenlijk moeten handelen, maar elk handelen naar hun eigen verschillende en mogelijk conflicterende belangen, perspectieven en institutionele regels en praktijken (van Broekhoven en Vernay, 2018; Priemus et al., 2000; Van Ark, 2006; Wiering en Immink, 2006). Het is daarom belangrijk om een goed begrip te verkrijgen van de onderliggende perspectieven, belangen, institutionele structuren en werkpraktijken die tot uitdagingen voor integratie leiden, en nieuwe oplossingen te verkennen. Een mogelijk perspectief om dit te onderzoeken is om te focussen op hoe actoren met grenzen omgaan gedurende het proces van integratie. Dit is wat ik in deze thesis doe. Wanneer actoren zich integratie ten doel stellen, dan worden ze geconfronteerd met grenzen. Ze zullen over grenzen moeten werken, zullen anderen ontmoeten die grenzen trekken en verdedigen, zullen zelf grenzen definiëren en verdedigen die behulpzaam zijn voor hun eigen handelen, en moeten omgaan met grenzen die onduidelijk worden in hun samenwerking.

De vraag hoe actoren om kunnen gaan met grenzen in integrale initiatieven voor duurzame ontwikkeling heeft recentelijk steeds meer aandacht gekregen (Bressers en Lulofs, 2010, Warner et al., 2010; Van Meerkerk, 2014; van Broekhoven et al., 2015; Opdam et al., 2015; Westerink, 2016). Veel studies richten zich op boundary spanning strategieën, en geven waardevol inzicht daarin (e.g. Bressers en Lulofs, 2010, Warner et al., 2010, Edelenbos en Van Meerkerk, 2015; Van Meerkerk, 2014). De grenzen zelf hebben echter minder aandacht gekregen. Studies definiëren vaak vooraf bepaalde grenzen waarvan wordt aangenomen dat ze vrij stabiel van aard zijn (bijvoorbeeld organisationele of sectorale grenzen). De literatuur over grenzen wijst er echter op dat grenzen in de interactie tussen actoren geconstrueerd worden, bediscussieerd worden, en veranderen of behouden worden (e.g. Heracleous, 2004; Kerosuo, 2006; Mørk et al, 2012; Paulsen en Hernes, 2003; Santos en Eisenhardt, 2009). Bovendien laat de literatuur

zien dat grenzen niet enkel beperkende maar ook faciliterende eigenschappen hebben (Hernes 2003). Hierop voortbouwend is het doel van dit onderzoek om bij te dragen aan inzichten over effectieve integratie door te analyseren waar grenzen opkomen en overbrugd worden, maar ook getrokken worden, betwist worden, verdedigd worden en onderhandeld worden in integrale processen, en welke type organisatie van grenzen helpt om integratie van functies te realiseren.

In dit onderzoek beantwoord ik de volgende onderzoeksvraag en deelvragen: *Hoe organiseren actoren grenzen in initiatieven voor multifunctioneel landgebruik, en wat voor soort activiteiten en sequenties van activiteiten om grenzen te organiseren zijn behulpzaam om effectieve integratie van landgebruiksfuncties te realiseren?*

1. *Wat zijn uitdagingen en strategieën voor het realiseren van initiatieven voor MLU in de bredere literatuur over integratie van grenzen?*
2. *Hoe kunnen grenzen en de organisatie van grenzen in initiatieven voor MLU geconceptualiseerd en bestudeerd worden?*
3. *Wat voor soort activiteiten en sequenties van activiteiten gebruiken actoren om grenzen te organiseren gedurende het proces van initiatieven voor MLU?*
4. *Wat voor soort activiteiten en sequenties van activiteiten om grenzen te organiseren zijn behulpzaam om effectieve integratie van landgebruiksfuncties te realiseren?*

Om de onderzoeksvragen te beantwoorden worden de volgende studies uitgevoerd: een literatuur review van uitdagingen en strategieën voor integratie van functies, ontwikkeling van een conceptueel raamwerk om systematisch de dynamiek van grensconstructie in kaart te brengen en analyseren, en drie longitudinale casusonderzoeken waar dit raamwerk toegepast wordt. Een kwalitatieve onderzoeksaanpak die gebruik maakt van case studies past bij het type vragen die ik wil beantwoorden, omdat dergelijke aanpak het mogelijke maakt om diepgaand de micro-interacties te bestuderen van actoren in initiatieven voor MLU. De cases zijn geselecteerd volgens het principe van maximalisatie (Boeije, 2009; Pettigrew, 1990). In de bestudeerde cases integreren actoren meerdere functies, waaronder watermanagement. Gegeven de belangrijke historische rol en positie van watermanagement in Nederland, biedt dit een sociaal relevante setting waar verwacht kan worden dat grenzen sterk aanwezig zijn. Data wordt verzameld door een combinatie van semigestructureerde interviews, document analyse, niet-participatieve observaties van de interactie van actoren, en workshops met betrokken actoren.

2. Onderzoekresultaten en conclusies

Uitdagingen voor integrale initiatieven

De literatuur review laat zien dat integrale initiatieven veel uitdagingen kennen. De samenwerking die nodig is tussen actoren die aan verschillende functies gerelateerd zijn (b.v. waterveiligheid, recreatie, natuur, afvalwaterzuivering) is de grootste uitdaging. Daarnaast laat de review zien dat de noodzaak tot grote investeringen en onzekerheden over de kosten en baten voor verschillende actoren integratie in de weg kan staan. Daarnaast kan bestaande wetgeving integrale initiatieven belemmeren. De integratie van functies vraagt echter meer dan het faciliteren van samenwerking, het veranderen van wetgeving, het vinden van voldoende financiën, het ontwikkelen van kennis over technische haalbaarheid en ontwerp of het verkrijgen van publiek draagvlak. Op basis van de review benadruk ik dat integrale processen actoren vragen om samen te werken over voorheen gescheiden werelden, en dat de verschillende institutionele achtergronden en logica's van actoren behorende bij bepaalde functies aandacht vragen in toekomstige studies. Het integreren van functies vereist het overbruggen van grenzen van min of meer autonome actoren die volgens de principes van bureaucratie georganiseerd zijn: verdeeld in taakgerichte eenheden gespecialiseerd en verantwoordelijk voor een functie. Een mogelijk perspectief om de uitdagingen voor integratie beter te begrijpen en nieuwe oplossingen te vinden is om te focussen op hoe actoren met grenzen omgaan in het integrale proces.

Conclusies over het organiseren van grenzen

Dit proefschrift toont dat het organiseren van grenzen een centraal onderwerp is voor de actoren in initiatieven voor MLU. Grenzen zijn in essentie plekken van verschil; manieren om iets te onderscheiden van wat het niet is (Abbott, 1995; Hernes, 2004). Voortbouwend op de literatuur over de formatie van grenzen conceptualiseer ik grenzen als sociaal geconstrueerde, complexe en dynamische constructen (Abbott 1995; Heracleous, 2004; Hernes, 2004; Jones, 2009; Sturdy et al, 2009). Ze worden bekrachtigd in interacties waar ze expliciet worden gemaakt, gevormd worden, gehandhaafd worden, of betwist worden. Ze bestaan niet onafhankelijk van deze bekrachtiging, en moeten daarom bestudeerd worden via de interacties van de mensen die ze bekrachtigen.

In dit proefschrift stel ik daarom dat het nuttig is om grenzen te bestuderen door te analyseren hoe ze ge(re)construeerd en ontwikkeld worden door de grensacties van de betrokken actoren in de specifieke empirische context te observeren of reconstrueren, in plaats van te onderzoeken hoe interactie over vooraf gedefinieerde grenzen verloopt. Ik definieer een grensactie als: *een terugkerende set van articulaties, acties, en interacties die een demarcatie vormen, gedurende een langere periode*. Om de grensacties van

actoren te identificeren, ontwikkeld dit onderzoek een typologie welke gebruikt kan worden om systematisch de dynamiek van grens(re)constructie in actie in kaart te brengen en te interpreteren in integrale processen. Deze typologie onderscheid – voortbouwend op eerdere typologieën - drie dimensies waarop grenzen uitgedrukt kunnen worden en drie belangrijkste typen grensacties. Ik onderscheid sociale (sociale relaties tussen mensen), cognitieve (ideeën en betekenissen) en fysieke (materieel of territoriaal) dimensies van grenzen. Deze dimensies zijn onderling gerelateerd. Ik onderscheid daarnaast drie belangrijke typen grensacties: Betwisten van grenzen, refererend aan het problematiseren van ideeën of visies; stabiliseren of behouden van grenzen, refererend aan strategieën om demarcaties te verdedigen of trekken; en overbruggen van grenzen terwijl het onderscheid waar het over gaat gerespecteerd blijft, refererend aan bijvoorbeeld scouting of spanning.

Het casusonderzoek bevestigt het theoretische idee dat wat relevante grenzen zijn in integrale initiatieven niet makkelijk te zien is, niet op voorhand duidelijk is, en veranderd gedurende het proces. Daarnaast toont de analyse dat actoren in multifunctionele initiatieven met meerdere discussies over grenzen tegelijk om moeten gaan.

Conclusies over het realiseren van effectieve integratie

De analyse van de casussen laat zien dat zowel overbruggen, betwisten, als construeren en behouden van grenzen nodig is om effectieve integratie te realiseren. Elk van deze typen acties kan behulpzaam zijn om integratie te realiseren, maar kan het ook beperken.

Grenzen behouden

Hoewel het behouden en construeren van grenzen vaak gezien wordt als problematisch voor samenwerking, is een belangrijke en intrigerende conclusie van dit onderzoek dat het trekken van grenzen ook behulpzaam kan zijn om effectieve integratie te realiseren. Dit onderzoek toont dat het trekken van grenzen de actoren in integrale processen een gevoel van comfort en veiligheid kan geven, door hun belangen duidelijk te maken en te bewaken, en te zorgen dat aan hun wensen tegemoetgekomen wordt. Ook kan het zorgen voor begrip en respect voor wat belangrijke grenzen zijn integrale proces, en wat belangen en perspectieven zijn waar rekening mee gehouden moet worden. Bovendien kan het construeren van grenzen in termen van taken, risico's en verantwoordelijkheden – zoals gezien in de interactie tussen publieke en private actoren in de casus Dakpark – het complexe proces beter beheersbaar maken door een gevoel van orde en duidelijkheid te geven. De faciliterende eigenschappen van het trekken van grenzen zijn ook in eerdere onderzoeken aangetoond (b.v. Hernes, 2003). In recente studies heeft de focus echter op het overbruggen van grenzen gelegen. Dit onderzoek trekt opnieuw aandacht voor hoe het trekken van grenzen ook faciliterende effecten kan hebben op het integrale proces.

Het trekken van grenzen kan het integreren van functies ook belemmeren. Door grenzen te trekken wordt beperkt wie er in het besluitvormingsproces deelneemt, welke activiteiten legitiem zijn, en welke ideeën en oplossingen ontwikkeld kunnen worden, zoals in eerder onderzoek aangetoond. Ook kunnen vanuit hun eerdere ervaringen actoren aannames maken over grenzen, en daarmee de mogelijkheden voor integratie van tevoren beperken.

Grenzen overbruggen

Terwijl studies veelal focussen op de baten van boundary spanning strategieën, laat dit onderzoek zien dat dit ook beperkende effecten kan hebben een van de moeilijkheden waar actoren mee om moeten gaan in integrale processen is dat door het overbruggen van grenzen de rollen van voorheen separaat handelende actoren overlappend worden in het multifunctionele initiatief. Dit maakt het onduidelijk wie welke verantwoordelijkheden, risico's, en kosten moet dragen. Ook worstelen actoren met een dilemma rond inclusiviteit wie er deel met nemen aan het gezamenlijke proces versus effectiviteit van besluitvorming.

Dit onderzoek bevestigt tegelijk eerdere bevindingen dat boundary spanning activiteiten een positieve interactie tussen groepen faciliteren en het mogelijk maken voor actoren om tot een gezamenlijk idee over problemen en oplossingen te komen (e.g. Tushman & Scanlan, 1981; Williams, 2002). Ook kunnen boundary spanning activiteiten actoren helpen om tot oplossingen te komen wanneer er conflicten ontstaan. Dit onderzoek toont dat politieke change agents hierbij een belangrijke rol kunnen spelen door te intermedieren en door veranderingen in bestaande praktijken te faciliteren of op te leggen die het integrale initiatief vooruit helpen, zoals ook in eerdere studies is gevonden (e.g. Klerkx et al. 2010; Degeling 1999). Dit is van belang om de interactie tussen organisaties te faciliteren, maar ook om tot oplossingen voor interne discussies te komen.

Grenzen betwisten

Om integratie te bereiken, zullen actoren grenzen die multifunctionaliteit belemmeren moeten veranderen (bijvoorbeeld in bestaande praktijken en wetgeving). Door grenzen te betwisten kunnen ze nieuwe coalities vormen, bestaande ideeën of mogelijkheden veranderen, nieuwe middelen betrekken en veranderen welke activiteiten legitiem zijn.

Het veranderen van grenzen heeft echter consequenties, onder andere voor hoe aan functionele taken en eisen van de eigen organisatie voldaan kan worden. Anderen binnen de organisatie kunnen weerstand bieden tegen veranderingen en bestaande praktijken en

beleid beschermen. Als gevolg daarvan kunnen (interne) conflicten ontstaan over of veranderingen toegestaan moeten worden.

Patronen in sequenties van grensacties gedurende het proces

Bovenstaande analyse doet de vraag rijzen waar het overbruggen van grenzen helpt of juist belemmerd, en waar het trekken van grenzen of betwisten van grenzen helpt of belemmerd. Waar ligt de dynamische balans die nodig is om effectieve integratie te realiseren? Dit onderzoek analyseert sequenties van grensacties gedurende het proces en hun effecten op het integrale proces. Ik identificeert vier patronen in de sequenties van grensacties in de 13 sets van grensacties binnen de drie cases. Zoals bij iedere casusstudie zijn deze bevindingen context gebonden. Ze moeten getest worden in verdere empirische studies.

1. Om over grenzen te werken, moeten grenzen eerst geconstrueerd, versterkt en geduid worden, terwijl tegelijk waar mogelijk verbinding gezocht moet worden

Paradoxaal genoeg vind we dat het trekken van grenzen aan het begin van een interactie, tezamen met en in aanvulling op boundary spanning, een bevorderend effect kan hebben op het integreren van functies. Dit omdat het actoren veiligheid en comfort biedt door hun belangen te duiden en bewaken. Ook kunnen actoren door grenzen te trekken duidelijk maken wat belangrijke grenzen zijn in het integrale proces, en begrip en respect te creëren voor verschillende belangen en perspectieven die in ogenschouw moeten worden genomen. Dit patroon is in lijn met eerdere bevindingen van Ernst & Chrobot-Mason (2010) en Lee et al. (2014), wat aangeeft dat het niet alleen beperkt is tot de hier bestudeerde cases. We vullen hierop aan door te benadrukken dat de gunstige effecten die hier worden besproken het resultaat waren van zowel het trekken als het spannen van grenzen, beiden vullen elkaar aan. Dit betekend echter niet dat actoren alle grenzen aan het begin van het proces moeten of kunnen duiden. Dit onderzoek heeft aangetoond dat wat belangrijke grenzen zijn niet direct zichtbaar is en in de loop van de tijd kan veranderen.

2. Na een periode van overbruggen en betwisten van grenzen kan het reconstrueren van grenzen helpen om het proces beheersbaar te houden, en door veiligheid te bieden en autonomie te behouden

Dit onderzoek bevestigt eerdere bevindingen dat boundary spanning activiteiten belangrijk zijn om integrale initiatieven te realiseren. Dit is echter niet genoeg. De analyse laat zien dat het reconstrueren van grenzen na een periode van overbruggen en onderhandelen van grenzen actoren kan helpen om taken en verantwoordelijkheden te verdelen die in het integrale initiatief overlappend zijn geworden. Dit maakt het proces beter beheersbaar. Daarnaast vindt dit onderzoek dat na een periode van (interne)

grensoverschrijdende onderhandelen en veranderingen, herdefiniëren van de condities, verantwoordelijkheden en nieuwe manieren van werken voor de nieuwe situatie actoren kan helpen om zeker te stellen dat de verandering binnen bepaalde limieten blijft die zij van belang achten. Dit is in lijn met enkele eerdere bevindingen (Kerosuo, 2006; Mørk et al., 2012). Op deze manier kan het (re)construeren van grenzen na een periode van grensoverschrijdend werken een bepaalde mate van orde, veiligheid en autonomie bieden welke van belang is voor organisaties om zich comfortabel te voelen met integrale maatregelen.

3. Grenzen moeten vaak betwist worden om integratie te realiseren, maar actoren kunnen en moeten verwachten dat dit tot conflicten en interne discussie zal leiden

Actoren moeten vaak grenzen betwisten om integrale initiatieven te realiseren (b.v. in regelgeving, bestaande manieren van werken, rollen en taken). De verwachting dat integratie van functies gerealiseerd kan worden door ‘enkel’ zo goed mogelijk grenzen te overbruggen is niet realistisch. Integratie van functies vereist dat beleidsmakers de onvermijdelijke spanningen tussen belangen adresseren en vroegtijdig harde grenzen duiden, in plaats van deze stil te houden of te omzeilen.

Daarnaast laat dit onderzoek zien dat in reactie op de veranderingen die nodig zijn om integrale initiatieven te realiseren, anderen binnen de organisatie weerstand kunnen bieden en bestaande praktijken en beleid verdedigen. Dit leidt tot discussies over of de gevraagde veranderingen mogelijk gemaakt moeten worden. Discussies over grenzen verplaatsen als gevolg daarvan naar de interne organisatie. Dit bevestigt eerdere bevindingen (e.g. Van Meerkerk, 2014). Om interne discussies op te lossen zijn boundary spanning activiteiten belangrijk. In tegenstelling tot mijn verwachtingen vind ik echter dat actoren na een periode van interne onderhandeling over grenzen en maken van veranderingen grenzen ook opnieuw definiëren, zoals besproken in patroon 2.

4. De verschillende dimensies van grenzen moeten tezamen en op een coherente wijze moeten worden geadresseerd om succesvol grenzen te organiseren in integrale processen

Dit onderzoek toont ook een patroon wat betrekking heeft tot de verschillende dimensies waarop grensacties plaats kunnen vinden: de sociale, cognitieve, en fysieke dimensie. In de cases vind ik verschillende momenten waarop actoren proberen een grens te behouden of in lijn ermee proberen te handelen op een of meerdere dimensies, terwijl ze deze op een andere dimensie betwisten of proberen te overbruggen. Dit leidt niet tot effectieve integratie. Dit suggereert dat de verschillende dimensies van grenzen tezamen en op een coherente wijze moeten worden geadresseerd om succesvol grenzen te managen in integrale processen.

Organiseren van grenzen in projectmatige en programmatische benaderingen

Een andere interessante vraag is of integrale initiatieven die een programmatische benadering hanteren een ander type van organisatie van grenzen vraagt dan in projectmatige benaderingen. Dit onderzoek toont dat in de context van een programma de baten van boundary spanning met name behulpvol zijn om integratie te realiseren. Dit komt overeen met eerdere studies. Echter betekent dit niet dat actoren zich enkel moeten richten op boundary spanning en geen grenzen moeten trekken in programatische aanpakken. De analyse laat tegelijk zien dat ook in de context van een complex programma het trekken van grenzen behulpzaam kan zijn wanneer actoren over grenzen willen werken, door een begrip van en respect voor belangrijke grenzen en elkaar positie te ontwikkelen.

3. Aanbevelingen

Hoewel beleidsmakers in integrale initiatieven wellicht zullen neigen om zich te richten op hoe ze de grenzen die ze tegenkomen kunnen overbruggen, leidt dit onderzoek ten eerste tot het intrigerende en paradoxale inzicht dat integreren van functies niet betekent dat alle inspanningen van beleidsmakers erop gericht moeten zijn om grenzen te overbruggen. Hoewel boundary spanning activiteiten belangrijk zijn om interactie te faciliteren, is dit niet genoeg en moet dit samengaan met het duiden wat harde grenzen zijn en (her)construeren van grenzen. Het trekken van grenzen kan op verschillende manieren behulpzaam zijn voor integratie: Aan het begin van de interactie kan dit helpen belangen te bewaken, zeker te stellen dat tegemoetgekomen wordt aan wensen, en leiden tot een begrip en respect voor grenzen; en na een periode van overbruggen en onderhandelen van grenzen kan het helpen om taken en verantwoordelijkheden te verdelen of zeker te stellen dat de mate van verandering binnen bepaalde limieten blijft die voor actoren van belang zijn. Op deze manier kan het construeren van grenzen een bepaalde mate van orde, veiligheid en autonomie bieden welke van belang is voor organisaties om zich comfortabel te voelen met integrale maatregelen. Ten tweede maakt dit onderzoek duidelijk dat het integreren van functies geen makkelijk proces is. Ik neem een kritisch standpunt in over de vraag wanneer beleidsmakers integratie moeten nastreven. Hoewel de potentiële baten integratie aantrekkelijk maken, worden de governance uitdagingen ervan onderschat. Integratie leidt niet alleen tot meekoppelkansen maar ook tot compromissen en conflict. Integreren van functies vereist dat actoren onvermijdelijke spanningen tussen belangen adresseren en duiden wat harde grenzen zijn, in plaats van eromheen te werken. Het complexe governance proces impliceert dat beleidsmakers er goed aan zouden doen om integrale maatregelen enkel na te streven als de baten van integratie zeer duidelijk opwegen tegen de uitdagingen. Ten derde, hoewel het bij integratie van functies voor de hand ligt dat belangrijke grenzen zich tussen sectoren en organisaties bevinden, laat dit onderzoek zien dat de discussies

zich ook naar de interne organisatie verplaatsen. Om voldoende steun voor integrale oplossingen te borgen is het van belang dat niet alleen die vertegenwoordigers die goed zijn in het werken over grenzen (bv, beleidsmakers of strategen), maar ook degenen die verantwoordelijk zijn voor het bewaken van organisatiegrenzen (bv. handhaving) betrokken zijn bij integrale initiatieven. Tot slot is de laatste aanbeveling voor beleidsmakers om strategisch de aandacht te verdelen over de verschillende zaken waarmee integratie wordt gezocht. Hoewel ik beargumenteerd heb dat alle relevante grenzen voldoende aandacht dienen te krijgen, is dit niet eenvoudig omdat grenzen niet eenduidig zichtbaar zijn, actoren in meerdere grensdiscussies tegelijk moeten handelen, en gedurende het proces veranderd wat de belangrijke grenzen zijn. Tegelijk is het betrekken van alle actoren in het hele proces niet praktisch en leidt dit tot een dilemma van efficiency versus inclusiviteit. Als gevolg hiervan moeten beleidsmakers zich bewust zijn van een crowding-out effect. Veel aandacht voor de ene discussie over grenzen leid onvermijdelijk tot minder tijd voor andere discussies waardoor blinde vlekken kunnen ontstaan. Een oplossing kan zijn om verschillende momenten in het proces te creëren waar actoren in kaart kunnen brengen wat relevante discussies rond grenzen zijn komende periode, en wie er meer of minder betrokken moet worden.

Zoals bij elke casusstudie zijn de bevindingen van dit onderzoek gebonden aan de context waarin ze gevonden zijn. Meer onderzoek naar sequenties van grensacties en hun effecten in integrale processen is nodig om een bredere basis te leggen die de bevindingen van deze thesis bevestigt, corrigeert of aanvult. Daarnaast kan toekomstig onderzoek ingaan op de condities waaronder bepaalde sequenties van grensacties ontwikkelen of een bepaalde uitkomst hebben zoals machtsverhoudingen of voorgaande ervaringen. Ook kan toekomstig onderzoek zich richten op de vraag hoe actoren de verschillende dimensies van grenzen tezamen kunnen adresseren. Een beter begrip van de constructie, confrontatie en het overbruggen van grenzen op verschillende dimensies, hoe deze samen werken, en hoe actoren ze op een coherente wijze kunnen adresseren, kan beleidsmakers helpen om zich meer bewust en strategisch op ieder van de dimensies te richten in het integrale proces.

About the author

Saskia van Broekhoven holds a Bachelor of Arts in Cultural Anthropology and Development Sociology at Leiden University. After her bachelor she decided to broaden her disciplinary knowledge and learn more on integrative and circular approaches towards sustainable development, and followed the multidisciplinary Master of Science on Industrial Ecology at the Technical University Delft, Leiden University and Erasmus University Rotterdam. After completing her master she worked for several years as a consultant on environmental policy, advising regional and local governments. In 2011 she started her Ph.D. at the department of Public Administration at the Erasmus University Rotterdam.

Her Ph.D. research concerns the multi-actor and multi-level governance of multifunctional land use initiatives. Specifically, she focusses on how actors manage boundaries, i.e. how they span, challenge, change, defend and construct boundaries during integrative planning processes, and what activities and sequences of activities are helpful to realise effective integration of land use functions. She performed a longitudinal analysis of three cases of multifunctional land use. During this period she also conducted research for two transdisciplinary ‘learning tables’, where scientists and policy makers reflected on integrative coastal development. She completed the Ph.D. training program of the Netherlands Institute of Government taking courses on, among others, case study methods, earth systems governance, and network governance. She also participated in the Ph.D. platform for peer reviewing and organised the yearly Ph.D. trip.

In 2015 she started a new challenge at the Netherlands Environmental Assessment Agency (PBL) and applied her knowledge as a researcher at the interface between science and policy. At PBL she worked on a reflexive evaluation of the Dutch nature policy, specifically on the implementation of policy strategies for nature management and societal involvement in nature management. She also coordinated and supervised research on legitimacy and societal involvement in nature management for a knowledge development programme performed by Wageningen University. Currently she is still working at PBL and has taken up the challenge to work in another sectoral domain, on a reflexive knowledge programme on regional broad welfare.