Frames and dilemmas in multifunctional projects

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IN MULTIFUNCTIONAL PROJECTS

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Summary

Increasing population, sea level rise and changes in public spending encourage the development of multifunctional projects. Multifunctional projects integrate various functions in the same area to satisfy multiple objectives simultaneously and to combine the resources and expertise of various stakeholders. Although the involvement of multiple interdependent actors offers opportunities for the inclusion of various interests in the decision-making process, the complex organizational context of multifunctional projects makes the identification and selection of functional combination difficult. When defining and selecting functional combinations, actors often need to prioritize various functions based on the demands that they need to fulfill and the available resources for the project. Since actors belong to different sectors and administrative levels, they often have different interpretations about what is going on and what the preferred course of action is. In these settings dilemmas naturally occur.

Dilemmas are situations in which actors are confronted with various options to make a choice, all being equally desirable or undesirable. Dilemmas are often associated to situations of paralysis or impasse. Not knowing what to do leads to a deadlock. However, encountering dilemmas also offers the possibility of looking at issues from different lenses, stimulating deliberation about the issue at stake from different angles. Consequently, dilemmas have the potential to foster creativity and to think about solutions that bridge seemingly competing demands. Realizing their potential requires creating awareness about dilemmas and understanding their origin. The incorporation of various interdependent actors having their own interpretations about issues at stake makes multifunctional projects an ideal case to understand the influence of frames and dilemmas in decision making.

The main goal of this thesis is to unravel the role of frames in the occurrence of dilemmas in multifunctional projects. To achieve this goal, this research answers four questions that make up the chapters of this thesis. These chapters focus on understanding (1) the impact of various frames in the context of multi-functionality, (2) the dilemmas that actors encounter in this process, (3) the role of frames in the occurrence of dilemmas in decision making and (4) the use of a collaborative tool to make dilemmas explicit in a multi-actor context.

Chapter 2 explores how the presence of various interpretations influences the definition and selection of functions in multifunctional projects. To this end, this chapter examines the influence of frames of reference on the decision-making process of a multifunctional project. The retrospective case study analyzing a multifunctional project in the harbor area of Rotterdam reveals how the interdependencies among functions and resources in the project trigger the emergence of a predominant frame, showing the influence of power frames in decision making. Given the interdependence of actors, frames that become predominant change depending on the authority and resources required for a specific decision context. These results highlight that comprehending the influence of a variety of frames on multifunctional projects is the first step towards identifying approaches that help to involve multiple interpretations in multifunctional projects.

With insights into the influence of frames on the definition and selection of functional combinations, chapter 3 identifies prominent dilemmas that actors encounter in this process. By empirically analyzing dilemmas, this chapter explores how actors made sense of them and influenced the formulation of final solutions in the project. To this end, this chapter draws on a previous categorization of dilemmas provided by Savini *et al.*'s (2013; 2014) that provides three main types of dilemmas in planning namely: intervention, regulation and investment dilemmas. Analyzing the occurrence of these three dilemmas in an in-depth case study in a multifunctional project located in the South West Delta in the Netherlands shows the preponderance of the investment dilemma in multifunctional projects. Safeguarding the financial viability of the project requires a focus on the earning potential of functional combinations. However, encouraging the commitment of regional stakeholders needed satisfying stakeholder demands that were not always aligned with those that provided the highest earning potential. Furthermore, chapter 3 shows that integrating functions leads to tensions between transforming the area and preserving existing values. As a consequence of the dilemmas, actors emphasize the financial profitability of the functional combinations to guarantee stakeholder commitment, so the occurrence of dilemmas steers the process towards placing more attention to functions that had a higher earning potential. Chapter 3 creates awareness of the dilemmas during decision making for multifunctional projects as a vehicle to identify practices that bridge seemingly competing demands.

After understanding the role of frames and dilemmas in multifunctional projects separately, chapter 4 explores the influence of frames on the occurrence of dilemmas in a multifunctional project. Contrary to much of the current literature that focuses on either frames in multi-actor contexts or dilemmas, chapter 4 explores the relationship in practice between frames and dilemmas. Following a case study approach this chapter analyzes the influence of frames on the occurrence of dilemmas in a regional multifunctional project in the South West Delta in the Netherlands. This in-depth case study elucidates the role of frames in the occurrence of dilemmas since diverse actors prioritize and favor different courses of action. Furthermore, decision contexts have intrinsic dilemmas that remain hidden until the interaction of actors' frames makes them explicit. Based on the results of chapter 4, it is possible to conclude that the co-existence of frames leads to dilemmas and are the vehicle through which dilemmas manifest. These two views do not exclude one another. Whether considered as intrinsic to the situation requiring a decision or caused by the interaction of actors having different interpretations, these results reveal the relevance of surfacing frames to understand the occurrence of dilemmas, shedding light on the importance of treating dilemmas as part of a social context in which situated actors operate. Understanding the occurrence of dilemmas in decision-making processes is the stepping stone to exploit the potential of bridging seemingly competing or excluding demands. Rather than choosing between opposites, it is important to understand dilemmas as synergistic, embracing opposing forces as an invitation for creativity and opportunity.

Chapter 5 presents the development and test of a three-dimensional collaborative cognitive mapping tool designed to make dilemmas explicit. This chapter reveals that the use of a

collaborative tool like the ‘dilemma cube’ helps to surface dilemmas in a multi-actor context. The ‘dilemma cube’ guides the contribution of participants, acting as a canvas in which they can create the content contained in the cube while debating their interpretations about the project. The ‘dilemma cube’ witnesses what has been discussed, and participants can build on previous contributions allowing to show alternative and complementary views about the same issue. Given the three-dimensional nature of the cube, this collaborative tool informs participants about the existing dilemmas in the project, since it allows visualizing co-existing the interrelatedness of conflicting interpretations about issues at stake. This chapter reveals the socially constructed nature of dilemmas, being the stepping stone to explore strategies that stimulate deliberation, and provide opportunities of exploiting opposite orientations in light of dilemmas.

Chapter 6 provides reflections on the results of this thesis. Dilemmas as a sense making trigger stimulate looking for solutions that integrate seemingly conflicting demands and reconsidering the situation by looking at it from different angles. As a result, dilemmas offer the potential of including multiple views about issues at stake, avoiding a one-sided decision-making process. However, not having a clear and straightforward preferred choice tends to paralyze actors that perceive dilemmas as a source of delay and conflict in decision making. The standpoint of this thesis is that, instead of suggesting approaches to deal with dilemmas in a prescriptive manner, it is important to understand their origin in the first place to stimulate finding strategies that bridge seemingly competing demands.

Understanding the origin of dilemmas requires gaining insights into why different choices seem desirable and undesirable. This thesis concludes that dilemmas can both be intrinsic to a decision context and surface through the interaction of actors having dissimilar frames. Organizing open processes that allow for the inclusion of a range of divergent frames helps to surface stakeholders’ interpretations about how dissimilar actions are preferable under different frames and how these dependencies relate to stakeholder interests. Treating key framing assumptions as explicit inputs in decision making offers a means to make dilemmas explicit in multi-actor contexts. By making dilemmas explicit, actors make sense of the project as a whole triggering discussions about strategies to deal with them. As a result, the use of collaborative tools like the ‘dilemma cube’ helps to gain insights into the social context through the interaction of actors.

Chapter 1

Chapter 1. Introduction

1.1. Introduction

Accelerated sea level rise, population growth, and changes in public spending are some of the driving forces shaping our regions and cities. These and other socio-economic challenges are increasingly interconnected. As a result, decision makers are exploring approaches that address multiple issues simultaneously through the integration of various demands and resources. There is increasing attention to multifunctional projects that combine multiple socio-economic functions in the same area (Priemus *et al.*, 2000; Vreeker *et al.*, 2004) to fulfill various demands, and ensure the feasibility of the project. Although promising, the integration of functions in the same location poses challenges. Integrating multiple functions requires bringing together actors that belong to different disciplines, sectors, and administrative levels. These actors have their own interpretations about the project, and very often, there is a lack of agreement about the desirable functional combinations to be developed. Consequently, decision making in multifunctional projects is often a path full of divergent interpretations about issues at stake and courses of action. This thesis explores (1) the role of multiple interpretations in the decision making of multifunctional projects, (2) the dilemmas that actors encounter in this process, and (3) how the co-existence of multiple interpretations influences the occurrence of dilemmas in the decision-making process of multifunctional projects.

1.1. Multifunctional projects

Multifunctional projects combine various functions and activities in the same area to fulfill multiple demands simultaneously (Priemus *et al.*, 2000; Helming and Wiggering, 2003; Vreeker *et al.*, 2004). Traditionally, spatial planning has been sectorial, with individual sectors defining their policies, procedures, instruments and resources. However, some factors have triggered the development of multifunctional projects (Heeres *et al.*, 2012) such as the changing distribution of roles between public and private actors, land scarcity, increasing population, sea level rise, the inclusion of environmental and social considerations in decision making, or fluctuating financial circumstances.

The concept of multi-functionality is closely related to integration. Integration concerns the interaction from bringing together various economic, environmental, and social objectives, so the resulting combination of functions has a value that did not exist before (Holden, 2012; Heeres *et al.*, 2012; Roe and Mell, 2013). In other words, the *whole is greater than the sum of its parts*. Decision making in multifunctional solutions aims at looking for possible synergies between sectors (Salet *et al.*, 2013; Swart *et al.*, 2014). Subsequently, identifying and selecting functional combinations that allow achieving synergy requires the incorporation of multiple actors that belong to different disciplines and sectors.

Previous studies have extensively studied multifunctional projects with a focus on urban development (Vreeker *et al.*, 2004; Hoppenbrouwer and Louw, 2005; Bruinsma, 2009; Van

Leeuwen *et al.*, 2010), governance (van Broekhoven *et al.*, 2014), flood protection (Vis *et al.*, 2003; Vellinga *et al.*, 2009; Van Loon-Steensma and Vellinga, 2014; van Loon-Steensma *et al.*, 2014; Van Veelen *et al.*, 2015), adaptation to climate change (Swart *et al.*, 2014); agriculture (Vejre *et al.*, 2007; Bjørkhaug and Richards, 2008), landscape management (Mander *et al.*, 2007; Wiggering *et al.*, 2006), or forest management (Wolf and Primmer, 2006; Carvalho-Ribeiro *et al.*, 2010). This literature points out that a main challenge in organizing multi-functionality originates from the complex organizational structure of these projects. Realizing multifunctional projects often needs more intense involvement of actors compared to single sector projects (Swart *et al.*, 2014). Integrating functions requires combining resources and expertise, thus actors become more interdependent and their interactions more frequent. The strong interdependencies in multifunctional projects make it essential to encourage the support and commitment of multiple actors. Actors have diverse interpretations that influence their perceptions about what is at stake, and what should be done in the project. Consequently, actors' interpretations shape their preferences regarding the functional combinations to be developed. Since various functional combinations might seem equally desirable or undesirable under different interpretations, actors are constantly facing dilemmas in the decision making of multifunctional projects. Indeed, selecting functional combinations requires dealing with tradeoffs among various alternatives (Groot *et al.*, 2007) and actors often need to select functions that do not satisfy demands as it was originally planned.

Consequently, integrating various functions in multifunctional projects involves ongoing tensions between actors with different interpretations about what is going on and should be done in the project. Some actors might perceive that what is good for one function is not always good for another (van Broekhoven *et al.*, 2014). Despite the importance of different interpretations for the definition and selection of functional combinations, prior literature has not addressed this issue.

Although previous literature has acknowledged the influence of the involvement of multiple actors on the decision-making process, little is still known about (1) the impact of various interpretations in the context of multi-functionality, (2) the dilemmas that actors encounter in this process and (3) the role of interpretations in the occurrence of dilemmas in the decision-making process. Under this premise, the next section describes the problem that this thesis addresses.

1.2. Problem statement

Despite the synergistic potential of integrating various functions and activities in the same area, realizing multifunctional projects is a challenging task. The need to coordinate the activities, resources and interests of multiple actors makes it difficult to identify functional combinations that satisfy a broad array of demands. Although the involvement of multiple interdependent actors offers opportunities for the inclusion of various interests in the decision-making process, actors bring their own interpretations to the process, leading to situations in which it is not clear what the most desirable course of action is. Furthermore, the incorporation of

various sectors and disciplines results in actors constantly facing dilemmas related to the fulfillment of seemingly conflicting objectives. As a result, the decision making process of multifunctional projects is perceived as longer and more complex than for single sector projects (Aarts *et al.*, 2008; Salet *et al.*, 2013). Realizing the synergistic potential of multifunctional projects requires gaining insights into the role of the co-existence of multiple interpretations in their decision making and the dilemmas that actors encounter in this process. This way this thesis sheds light on the roles of interpretations in the occurrence of dilemmas in multi-actor decision contexts.

1.3. Dilemmas

In multifunctional projects, actors are constantly confronted with competing values and knowledge claims without any given order of preference. Consequently, actors need to take standpoints, and make choices throughout the decision-making processes. While making choices, actors often face *dilemmas*. Dilemmas refer to situations in which actors are confronted with making a decision based on various options that offer equally valuable opportunities, or have equally unpleasant results. In dilemmatic situations, regardless the decision people make the outcome is unfavorable: ‘in front of the precipice, behind the wolf’ (Billig, 1988, p. 9).

Dilemmas are a prominent topic in literature for climate change adaptation (Ko and Chang, 2012; van Buuren *et al.*, 2013; Root *et al.*, 2015; Hartmann and Spit, 2014), and organization science (Schreyögg, and Sydow, 2010; D’Adderio, 2014). Although there are numerous studies dealing with dilemmas in literature about regional and urban planning (Bański, 2010; De Bruijne *et al.*, 2010; Gawel and Ludwig, 2011; DiLucia *et al.*, 2012; Banai, 2013; Savini, 2013; Davies and Msengana-Ndlela, 2014; Holman, 2014; Savini *et al.*, 2014; Hartmann and Spit, 2015), studies on dilemmas in multifunctional projects are rare. This is surprising because the interdependencies among actors and the diversity of sectors and disciplines involved in multifunctional projects make them a breeding ground to understand dilemmatic situations. Actors need each other to get the project implemented, and facing dilemmas might lead to hesitancy for some actors, with a subsequent lack of support that might jeopardize the feasibility of the project.

In the context of multifunctional projects, combining various functions requires making choices about the functions to be implemented. Integrating functions involves finding compromises among various issues like environmental, social, and economic (Groot *et al.*, 2010). Many times, some goals conflict, and one of them has to be given preference. Different functions often have different lifespans requiring the integration and consideration of multiple demands in different time frames. Resources are often scarce, and there needs to be a choice about the functions that are going to be developed. Consequently, the exploration of functional combinations requires determining the tradeoffs among various alternatives (Groot *et al.*, 2007). Actors need to accept tradeoffs and sometimes make decisions and implement functions that do not satisfy demands as it was originally planned. Consequently, dilemmas

require constant attention and conscious decision-making processes to identify strategies to find solutions and tradeoffs satisfactory for a large number of actors.

Exploring the dilemmas that actors encounter in the decision making of multifunctional projects is relevant since the notion of dilemmas is crucial to explore how to reconcile various goals, and how to deal with the limitations of foreseeing future events. Recent studies (Savini, 2013; Savini *et al.*, 2014) have provided insights into the dilemmas in the context of spatial planning: (1) intervention, (2) regulation and (3) investment. First, the intervention dilemma emerges from the need to set up clear targets and objectives in the decision-making process, while also enabling bottom-up local initiatives and spontaneous processes. Second, the regulation dilemma stems from the need to both transform an area through the development of the project while preserving existing values. Third, the investment dilemma stems from the need to prioritize financial profit while prioritizing regional demands. In the decision making of planning processes, actors are constantly navigating between these opposing demands, having to arrange the process accordingly. Understanding the dilemmas that exist in the decision making of multi-functionality using this lens provides insights into the challenges of the integration of multiple demands.

In light of a dilemma, actors might become hesitant since there is an associated tradeoff, forcing them to accept unpleasant consequences related to the decision. Indeed, having to select from a broad range of solutions that sometimes seem contradictory, actors may feel paralyzed when encountering multiple choices, none of which seems clearly desirable. However, dilemmas might also have the power to encourage deliberation and to consider competing or apparently opposing forces or requirements in the project (Höijer *et al.*, 2006). It is often the case that dilemmas provide opportunities to reinterpret the situation, help to reshape practices, and create spaces for new approaches to emerge (Holman, 2014). To exploit dilemmas, it is important to embrace the dilemmatic nature of decision making and recognize its potential (Storey and Salaman, 2010).

Understanding the nature of dilemmas requires comprehending how actors have various interpretations about what a desirable or an undesirable choice is. In the next section I introduce the theoretical lens of frames that helps to unravel actors' interpretations and their influence on the decision-making of multifunctional projects.

1.4. Frames in multi-actor contexts

As I previously mentioned, multifunctional projects aim at satisfying the demands of a wide array of actors. Fulfilling multiple demands requires the coordination of knowledge, expertise and resources of various actors that often belong to different sectors, disciplines, and administrative levels. The cooperation among disciplines and sectors is challenging because of the existence of different value systems at various levels (Meuleman, 2015). To define and select project choices, stakeholders are involved in decision-making processes. In decision-making, actors interact to provide justifications for decisions, fostering the engagement of public and private stakeholders and helping to understand the project effects (Stirling, 2006).

Decision making in spatial planning attempts to reconcile differences between actors' positions and organize their cooperative relationships (Ernste, 2012). Different stakeholders focus on different aspects of reality as problems or opportunities, and thus requiring action (Dewulf *et al.*, 2004). Indeed, those trained in different disciplines carry their own interpretations into decision contexts, where they can have influence on decision-making (Schön and Rein, 1995; Benford and Snow, 2000).

To evaluate the interpretations of multiple actors involved in the decision making of a multifunctional project, I use the theoretical concept of *frames*. Frames often refer to *schemata of interpretation* (Goffman, 1974) and influence how actors make sense of specific issues by selecting what is relevant to them, providing a holistic picture of reality, and delineating its boundaries (Putnam and Holmer, 1992). Frames are not deployed at will. On the contrary, frames act as filters through which actors experience the world and allow them to make sense of what is happening. In multi-actor contexts, the presence of various actors framing the project differently, and giving different meaning to the events is inescapable. Pursuing interests can only be understood alongside the frames that actors use to interpret what they want to achieve (Kaplan, 2008). As Dewulf *et al.* (2004, p.178) states: 'different stakeholders will understand the situation differently, prioritize different problems, include or exclude different aspects, and favor different kinds of solutions'. This way, frames influence how meaning is inferred and how actors understand a situation, serving to define a problem relative to core values, and to determine how to respond to it (Dewulf *et al.*, 2007; Brugnach *et al.*, 2008; Nisbet and Mooney, 2009).

There is a great body of knowledge about the influence of frames on strategic choices (Kaplan, 2008), environmental conflicts (Lewicki *et al.*, 2002; van den Hoek *et al.*, 2012), or framing and reframing in multi-stakeholder environments (Dewulf *et al.*, 2004; Dewulf *et al.*, 2007). The co-existence of multiple interpretations about the same issue is called *ambiguity* (Brugnach *et al.*, 2008; 2011). Ambiguity refers to the co-existence of multiple interpretations what is worth aiming for, and the desirable courses of action. To take action in an ambiguous environment, one frame becomes predominant, influencing the choices that actors make (Kaplan, 2008). Often, this predominant frame is not evident and actors need to muddle through the existence of multiple desirable or undesirable options.

In this thesis I use the lens of frames to understand how actors interpret situations requiring a decision and the choices they make. Throughout decision making actors constantly encounter situations in which it is not clear which course of action is desirable and need to navigate between equally desirable options. Consequently, actors encounter dilemmas. In the next section I discuss the role of frames in the occurrence of dilemmas in multifunctional projects.

1.5. Understanding frames to unravel dilemmas

Creating awareness about dilemmas requires exploring the underlying issues which gave rise to the dilemma in the first place, to stimulate cooperation and find mutual benefits (Northcraft and Tenbrunsel, 2011). Understanding the nature of dilemmas requires considering whether

dilemmas are intrinsic to decision contexts, *or* constructed by the co-existence of multiple interpretations of actors (Smith and Lewis, 2011).

First, considering dilemmas as intrinsic to decision contexts acknowledges that every decision context presents intrinsic contradictions or inconsistencies. When actors need to make a choice, there are myriad potential scenarios that could possibly occur, all having positive and negative consequences. In this view, it is through the interaction of actors framing the decision context that dilemmas surface. Smith and Lewis (2011) acknowledge that the presence of a plurality of views renders intrinsic tensions like dilemmas salient. Second, seeing dilemmas as socially constructed assumes that dilemmas result from the presence of multiple frames. As I previously acknowledged, actors involved in the decision-making process have different interpretations about what is going on in the project, and what should be done (Dewulf *et al.*, 2004; Brugnach *et al.*, 2008; Kaplan, 2008). Consequently choosing courses of actions will be subject to *ambiguity* (Brugnach *et al.*, 2011). Ambiguity refers to the possibility of interpreting an issue in two or more different ways and leads to a dilemmatic situation. Since multiple frames are valid, and there will be multiple potential courses of action to get the project implemented, actors will encounter a dilemmatic situation. A dilemma signifies that there are at least two actors with divergent views, both of which are valued either highly or lowly (Höijer *et al.*, 2006).

Studies exploring the role of frames in the occurrence of dilemmas in multi-actor contexts are rare. However, surfacing frames might help to create awareness about dilemmas, which can help to identify solutions that bridge competing demands. In this thesis I focus on understanding the roles of frames in the occurrence of dilemmas. This way I gain insights into the nature of dilemmas in multi-actor contexts, and I aim at informing practices that help to deal with contradictory potential courses of action in multifunctional projects. Based on these insights, I designed a collaboration tool and tested it to analyze how it helped to surface dilemmas in a workshop setting.

1.6. Objective and research questions

The main goal of this research is to explore the roles of frames in the occurrence of dilemmas in the decision-making process of multifunctional projects. To achieve this research goal, I divided the overall research process into four research sub questions:

- RQ1: How do predominant interpretations mobilize actors and influence their choices in the decision making process of a multifunctional project?
- RQ2: What are the intervention, regulation and investment dilemmas that actors encounter in the decision making of multifunctional projects?
- RQ3: What are the roles of frames in the occurrence of dilemmas in a multifunctional project?
- RQ4: How does a collaborative tool help to make dilemmas explicit in a multi-actor setting?

1.7. Research perspective and method

Since this thesis explores frames and dilemmas during decision making in multifunctional projects, I adopted an interpretative stance. I attempted to understand phenomena by assessing the meanings that actors allocated to them (Orlikowski and Baroudi, 1991). In interpretative research, data are our own constructions of other actors' compositions of what they and their colleagues are up to (Greetz, 1973). I selected a research method that allow intensive and long term observations to gain in-depth understanding in a real life setting, followed by reflection of what was observed. Consequently, I followed a case study approach (Yin, 2013). I selected three case studies to answer the research questions introduced in section 1.6. A case study was an appropriate approach to achieve my research goal since it allows exploring and analyzing a specific phenomenon in depth (Flyvbjerg, 2006).

I selected cases based on three main criteria. First, the projects needed to combine various functions in the same area, aiming at fulfilling several demands simultaneously. Second, the cases had to involve various actors from different sectors, and disciplines to select functional combinations. Third, data should be easily accessible. Table 1 describes the time of data collection, and the sources of data are shown in the table below.

Table 1 Analyzed cases to answer research questions, time of data collection and sources of data

	Case	Time period of data collection	Sources of data
RQ 1	Roof park with shopping mall	December 2011- July 2012	17 semi-structured interviews 70 project documents.
RQ2 RQ3	ABC Lakes: integrated area development with focus on water quality	February 2013- July 2014	2 rounds of interviews with 10 members of project team in two rounds (20 cognitive maps). 1 round of interviews with 10 regional stakeholders (10 cognitive maps). 400 project documents. 21 observation meetings of project team.
RQ4	BlueValley project: multifunctional flood defense	July 2014- March 2015	7 interviews. 3 meetings project team. Workshop session

To answer RQ 1, I chose a pilot case to explore the main challenges during the decision-making process of multifunctional projects. The selected case was retrospective so it allowed me to reconstruct events whose outcomes were already known by using semi-structured interviews. To analyze the data I followed a grounded theory approach (Strauss and Corbin,

1990). I analyzed the data inductively: I first openly coded the data, observed the events that happened in the project, identified the patterns that emerged from the data and went constantly back and forth to literature. In this way, I identified the relevance of multiple frames for the identification and selection of functional combinations in this one project. Once I chose a theoretical lens to study the project – frames by Goffman (1974) -, the retrospective nature of the case allowed me to evaluate the influence of the variables under study (frames) on these outcomes (functional combinations) (Street and Ward, 2010).

To answer RQs 2 and 3, I chose an ongoing case that allowed collecting data as the decision-making process evolved. I used three sources of data: observations during meetings, interviews and documents. During my individual interviews, I used cognitive mapping techniques. Cognitive maps help to understand people's perspectives on complex domains, exploring values, issues, concerns, perspectives, and goals of individuals (Eden, 1988). When actors make decisions, they form a mental picture of the situation that configures the elements of what is going on there (Miller and Sardais, 2013). For this reason, I used cognitive maps to analyze the interpretations of participants involved in the decision-making process. Cognitive mapping supported by face to face interviews helps interviewees to reflect about their own mental models, articulating interpretations that they may not have been fully aware of (Jetter and Kok, 2014). The longitudinal observations in this case (during 1.5 years) and the data that I obtained from this case allowed answering the RQs 2 and 3. To answer these questions I followed two different approaches. For RQ 2 I followed a grounded theory approach, similar to the one described for RQ 1. I inductively identified patterns in the data and went back and forth to literature. I selected an inductive approach for analysis to explore what was relevant while the decision-making process was evolving. This way, by inductively analyzing the three sources of data that I collected in the second case study I identified the relevance of dilemmas in the decision-making process of the multifunctional case. After answering RQ1 and RQ2 and understanding the relevance of both frames and dilemmas in the decision-making processes of multifunctional projects, RQ 3 focused on evaluating the role of frames in the occurrence of dilemmas. To answer RQ 3, I previously selected a theoretical framework and analyzed the data qualitatively. This was deductive reasoning since once I identified patterns in the data that corresponded to an existing theoretical framework, I focused on coding my data based on the framework. This way I aimed at understanding how the co-existence of multiple frames influenced the occurrence of dilemmas in the decision making of a multifunctional project. To answer RQs 1, 2 and 3 I used a software for qualitative data analysis (Atlas.ti) to chronologically order the documents and interviews, and facilitate the coding process.

Based on the insights gained by answering RQs 1, 2 and 3, to answer RQ 4 I selected a case that allowed me to adopt a hands-on strategy and develop an intervention to test in a real case. For the third case study, I designed a collaborative tool and tested it in a workshop setting. The tool, called the 'dilemma cube', is a three-dimensional cognitive mapping tool to make dilemmas explicit in a multi-actor setting. I tested the tool in a workshop setting to evaluate how sharing interpretations about issues at stake and surfacing interrelatedness of issues and actors help to make dilemmas explicit.

1.8. Outline of the thesis

To achieve my research goal I provide answers to the previously introduced research questions in the next four chapters. Each chapter addresses one of the specific research sub-questions as outlined in Figure 1.

Figure 1. Outline of the thesis

Throughout the course of my research, I answered the research sub-questions in four separate journal publications. The following papers correspond to each research question previously introduced:

- Chapter 2. ‘What is going on’ and what should we do?’ Predominant frames in multifunctional projects.

Chapter 2 explores how predominant interpretations mobilize actors in the decision-making process of a multifunctional project, and influence their choices. These findings show that frames are filters of how actors perceive a problem, shaping their interests and the required actions to solve the problems. Frame differences are often resolved by the emergence of a predominant frame to make an actor gain influence in different decision arenas and contexts. When actors use their power to establish their own frame as predominant, other actors might mobilize because the predominant frame helps them to achieve their own interests, or because they are forced to follow a particular course of action. Mobilizing around a particular predominant frame involves decision tradeoffs. Although tradeoffs are unavoidable, it is important to surface frames to create awareness about the consequences of actors’ choices. In light of these results, I consider that understanding how predominant frames emerge and how

other actors mobilize around them, helps to anticipate strategies to support the predominance of frames that will support the achievement of mutual gains or joint benefits instead of individual interests.

- Chapter 3. Understanding the dilemmas of multifunctional regional planning. A case study in the South West Delta in the Netherlands.

Chapter 3 identifies the dilemmas that manifested during the decision-making process of a regional multifunctional project. Drawing on an earlier categorization of dilemmas (Savini *et al.*, 2013; 2014), I identify the intervention, regulation and investment dilemmas in multifunctional projects. I identified the dilemmas by following a case study approach. These findings make the prevalence of the investment dilemma in multifunctional projects clear, showing the difficulties of balancing the need for financial profit to guarantee the feasibility of the project, while satisfying multiple interests. Although integrating functions is the strategy to satisfy multiple objectives, and ensure the financial viability of the project, the difficulty lies in bridging these two rationales. Furthermore, this chapter provides insights into the interrelation of the need to transform and preserve the area while prioritizing regional demands or earning potential.

- Chapter 4. Exploring the roles of frames in the occurrence of dilemmas: A case study of a regional multifunctional project.

Chapter 4 explores the role of frames to unravel dilemmas in a multi-actor decision-making process. My research results show that the co-existence of various frames leads to dilemmas because diverse actors prioritize different aspects and prefer different courses of attention. In this view, multiple frames *create* dilemmas. Furthermore, decision contexts often have intrinsic dilemmas that remain concealed until the interaction of frames surfaces them. In this view, dilemmas *manifest* through multiple frames. Showing the role of frames in the occurrence of dilemmas reveals the importance of surfacing frames to create awareness about dilemmas in a multi-actor context.

- Chapter 5. Making dilemmas explicit through the use of a three-dimensional cognitive mapping collaborative tool.

Chapter 5 explores the role of a material artifact as a collaborative tool to surface dilemmas in a workshop setting. To this end, I designed a three-dimensional tool and tested it in a workshop setting. This collaborative tool, called the ‘dilemma cube’, is based on cognitive mapping principles and allows a diversity of actors to share their interpreted actions, effects, and connections among different issues at stake. The outcomes of the workshop show that the ‘dilemma cube’ guided participants to share their interpretations about the project, surfacing the interrelatedness of issues and actors. The three-dimensional nature of the dilemma cube informed actors about existing dilemmas in the project since it allowed visualizing existing conflicting interpretations about issues at stake.

The following chapters answer the research questions introduced above and conclude with a discussion of the research findings.

Chapter 2

Chapter 2. ‘What is going on and what should we do?’ Divergent frames in multifunctional projects¹

Abstract

Multifunctional projects offer advantages because they enable synergetic effects among functions. However, realizing these plans is more challenging than mono-functional projects because of the difficult adjustment of several functions in an area and the involvement of a larger diversity of actors with often conflicting interpretations about decision contexts. The present paper is an in-depth study about how predominant interpretations mobilize actors and influence their choices in the decision-making process of a multifunctional land use project. To this end, we reconstruct the decision-process of an urban brownfield multifunctional project located in the western part of the Netherlands. To indicate what actors interpret as problems and solutions in decision contexts, we use the concept of ‘frames’ as a lens. We reconstructed the decision-making process of the project by interviewing 17 actors, and reviewing more than 70 documents. Following a grounded theory approach, we evaluated decisions that actors indicated as having an influence in the design and the conditions of the project. The analytical results show that frames act as filters of how actors perceive a problem, shaping their interests and the required actions to solve the perceived problems. In particular, our results show that frame divergences are often resolved by the emergence of a predominant frame to make an actor gain influence in different decision arenas and contexts. When actors use their power to establish their own frame as predominant, other actors might mobilize because the prevalent frame helps them to achieve their own interests, or because they are forced to follow a particular course of action. Mobilizing around a predominant frame involves decision tradeoffs. Although tradeoffs are unavoidable in decision contexts, it is important to bring frames to the surface to create awareness about the consequences of actors’ choices. In light of our results, we consider that understanding how predominant frames emerge and how other actors mobilize around them help to anticipate strategies to support the predominance of frames that will support the achievement of mutual gains or joint benefits instead of individual interests.

2.1. Introduction

The existence of multiple interpretations in multi-actor contexts and its influence on collective and individual actions has been extensively researched by organization science scholars (Weick,

¹ This chapter has been published as: Matos Castaño, J., Hartmann, T., Dewulf, G. P., & van Huffelen-de Kort, I. A. (2015). ‘What is going on and what should we do?’ Divergent frames in multifunctional projects. *Engineering Project Organization Journal*, 5(1), 36-48.

1995; Goffman, 1974). Literature in multiple fields has paid attention to the analysis of multiple interpretations in various contexts like technological change (Orlikowski and Gash, 1994), strategy making (Kaplan, 2008), climate change (de Boer *et al.*, 2010), environmental conflicts (Lewicki *et al.*, 2003) or natural resource management (Brugnach *et al.*, 2011). The premise is that the meaning that actors assign to certain situations has an influence on their choices. Not surprisingly, in multi-actor contexts, there are different and often conflicting meanings to situations and issues. Making a choice requires the emergence of a predominant interpretation that guides action and mobilizes actors in a particular direction. Previous research (Kaplan, 2008) has analyzed how some interpretations prevail over others and what are the reasons for this predominance.

In this paper, we draw on Kaplan's research to explore how predominant interpretations mobilize actors and influence their choices in the decision-making process of a multifunctional land use project. In multifunctional projects, actors attempt to achieve the synergy from integrating various land purposes and resources in the project. This integration requires the identification and selection of purposes that satisfy multiple demands in the project. Consequently, the decision-making process requires the intensive coordination of interdependent actors that belong to various disciplines, administrative levels, and backgrounds. Coordinating multiple actors is challenging because of the existence of conflicting meanings and interpretations in the project.

To analyze how actors interpret the social and physical context of a multifunctional project, we use the theoretical concept of *frames* as a lens. Frames are the *schemata of interpretation* that allow actors to 'locate, perceive, identify, and label' events around them and support the guidance and filtering of actors' interpretations about a situation, and what is the best course to act within the situation (Goffman, 1974). In particular, frames guide actors to define if a problem exists and what the problem is, and to define preferred solutions to tackle the problem (Lewicki *et al.*, 2003). Although frames are essential to influence how actors act, they are usually taken for granted and actors rarely bring them to the surface (Dewulf *et al.*, 2009). Awareness about frames is particularly important in multi-actor processes where there are often different and equally valid interpretations of problem situations (Brugnach *et al.*, 2011). If unresolved, frame divergences might lead to delayed decisions because of the lack of clarity about the desirable course of action.

Similar to Kaplan (2008) our research results show that a prevailing frame resonates and mobilizes other actors to act collectively. The emergence of a predominant frame is related to the functional and organizational interdependencies in the project, and the power or authority that an actor has when dealing with a specific issue. When an actor gains influence in the process by making his or her own frame predominant, other actors might mobilize around it because it helps them to achieve their own interests or because they are forced to do so to avoid a decision impasse. In light of our results, we consider that making frames more explicit helps to add interpretations to decision making-processes helping to open up the option space so new and overlooked options might emerge (de Boer *et al.*, 2010). Furthermore,

understanding how predominant frames rise and how other actors mobilize around them helps to anticipate strategies to support the prevalence of frames that will support the achievement of mutual gains or joint benefits.

This paper is organized as follows. First, we elaborate on the concept of frames to analyze actors' interpretations in a decision-making process. Second, we present our research method, describing how we selected the case, the performed in-depth interviews, and followed a grounded theory approach. Third, we present our research results, describing the framing dynamics during the decision making process of a multifunctional project in the Netherlands. Fourth, the discussion section reflects on our research results in the context of literature about frames, reflecting on the implications for multifunctional land use and suggesting further research.

2.2. Decision-making processes, frames and multifunctional land use

Decision-making is a social process which involves at least one participant attempting to choose the most desirable outcome for a project (Kamruzzaman & Baker, 2013). In a decision-making process, actors need to (1) constantly interpret the context that determines events around them, and (2) interact with other actors using different political, financial, economic, legal, and technical rationalities and resources (De Bruijn *et al.*, 2010; Lyhne, 2011). When deciding on issues like the allocation of resources, or the most convenient distribution of land use purposes in an area, actors are constantly asking *what is going on* and *what should we do*. Previous literature has acknowledged that decision making is context dependent and conditioned by past decisions that influence how decision makers see, interpret and respond to events (Vickers, 1965). Weick's sense making theory (Weick, 1995) suggests that actors first make sense of what is going on to develop an interpretation of the existing circumstances to take action. More recently, some scholars (Stirling, 2006) have emphasized how interpretive elements in decision making and analysis are crucial in determining the outcomes of the process. To interpret the context around them and provide a meaning to a certain situation, actors use *frames*. As previously introduced, frames are the *schemata of interpretation* that allow people to 'locate, perceive, identify, and label' events around them (Goffman, 1974).

Frames have been subject to analysis and discussion in both planning and decision-making literature. Scholars define frames as 'how actors select issues, define problems, challenges and opportunities, practices; interact with the dynamics and tensions of a place and a situation, and shape actions in a project as a result' (Albrechts, 2012, p.7). Frames have an active role in planning and decision-making processes because they influence the decisions of actors, and the process of reaching a collective action (Salet, 2008). Contemporary literature about frame analysis has focused on how actors use their frames to interpret what a problem is about, why it occurs, the motivations of people involved and how the problem could be solved (Lewicki *et al.*, 2002). The combination of interests, and cultural and professional backgrounds shapes frames. While interacting with others, actors attempt to produce meaning for themselves and

for other actors; shaping and balancing their interests and actions (Kaplan, 2008). In this process, frames shape not only how people perceive the circumstances forming a certain context, but they also influence people's preferences about how to change that situation (Vaughan & Seifert, 1992).

Consequently, in multidisciplinary teams frames are often contested (Kaplan, 2008) and guide actors towards diverse interpretations about an event (Chong & Druckman, 2007). Although the involvement of various actors with different backgrounds can lead to a better accepted project solution (van den Hoek *et al.*, 2014), each actor might frame the project differently. A divergence of frames often leads to situations where it is no longer clear what the issues of concern and the potential courses of action are (Brugnach *et al.*, 2011). This situation might delay reaching an agreement about the design or conditions of a project. To deal with the existence of divergent frames, we consider it important to understand the dynamics of frames in multi-actor contexts and how this influences organizational practices.

Previous studies on organizational strategies (Kaplan, 2008), or the resolution of environmental disputes (Lewicki *et al.*, 2002) have operationalized the concept of frames. Kaplan (2008) describes how actors have different diagnostic and prognostic frames about decision contexts, and constantly negotiate about the assessment of problems and potential solutions. When frames are not aligned, actors attempt to make their own frame resonate at the collective level to mobilize others in favor of their desired outcome. According to Kaplan (2008) frames that resonate are called 'predominant frames'. Predominant frames emerge from interactions among actors and shape how the problem and the solutions are defined, and which decision should be made. The emergence of a predominant frame depends on actors' interests. Actors' interpretations shape their interests, and their interests reinforce their interpretations. Frequently, actors do not have similar interests, and therefore they attempt to establish the legitimacy of their own frames, questioning the legitimacy of other actors' differing frames, or realigning their frames to others. In the event that there is a predominant frame, actors engage in collective action. Otherwise, the frames remain divergent, and decisions may be delayed.

To investigate the influence of frames in decision-making processes, we studied the decision-making process of a multifunctional land use project. Multifunctional land use is a planning concept aimed at the 'sustainable use of land, focused on the creation of synergy between land use functions' (Vreeker *et al.*, 2004, p. 292) that aims at mobilizing actors and resources to deliver innovative spatial projects that satisfy multiple societal demands (Lagendijk, 2003). Multi-functionality is the simultaneous and interrelated provision of various functions in the same area (Carvalho-Ribeiro *et al.*, 2010; Mander *et al.*, 2007). The concept of multi-functionality has attracted attention with a range of topics exploring the multi-functionality of landscapes (Dewi *et al.*, 2013), multifunctional forest management (Carvalho-Ribeiro *et al.*, 2010), multifunctional agriculture (Zasada, 2011), and multi-functionality in urban areas (Bomans *et al.*, 2010; de Groot, 2006; Rodenburg, 2006).

Multifunctional projects involve numerous actors that belong to different disciplines and administrative levels. The complicated organizational context of multifunctional projects makes their realization more challenging than for mono-functional projects. When deciding upon function combinations that will satisfy multiple functional claims, actors manage a great deal of legal, economic, and technical requirements and objectives (De Bruijn *et al.*, 2010; Lyhne, 2011). Defining and selecting function combinations requires the coordination of numerous actors that often have diverging interpretations about the context of the project, and the desirable courses of action. Consequently, integrating various spatial functions requires understanding framing practices (Salet, 2008). Drawing on previous research about frames, this paper evaluates diagnostic and prognostic frames to analyze how actors frame certain situations in a project, how the differences among frames manifest, and which frame becomes predominant to mobilize other actors in the context of a multifunctional project. In the following section we elaborate on our selected case and the method for our analysis.

2.3. Method

To evaluate how various actors frame a specific decision context in a multifunctional project and the influence of frames on the outcomes of the decision-making process, we conducted a retrospective case study about a multifunctional urban brownfield project located in the Netherlands. Understanding what led to multiple changes in the project design and conditions throughout the decision-making process was the main trigger for case selection.

Given the goal of our research on evaluating the influence of frames in the decision-making process, it was important to understand the history of the project. For this reason, we chose a retrospective case study because it allowed us to reconstruct events whose outcomes were already known, making it possible to evaluate the influence of the variables under study in these outcomes (Street & Ward, 2010). A case study approach allowed us to provide an extensive and in-depth description within its real life context (Yin, 2011). The origin of the chosen project dates back to the late 1990s, when the municipality and the port authority launched the plan to renovate an area located in the harbor of an important port city in the Netherlands. In earlier days, the area hosted the biggest fruit port of Europe, and food companies had access to a rail network consisting of twelve rail tracks. However, the port authority moved the companies to a different location, and the use of the rail tracks decreased. Moreover, the residents in the neighborhood contended with long standing complaints about a lack of green areas in the neighborhood, asking the district authority and the municipality to provide parks.

Given the pressure of the port authority and the neighbors, two major interests became the driving forces to improve the area: developing new businesses in combination with more green space for the neighbors. Consequently, the municipality proposed the innovative design of developing office space with a park on its roof. As a result of this design, the national government awarded the municipality with a subsidy, granted under two conditions: the design had to be multifunctional, and the residents had to be involved in the design process.

Based on these conditions, the municipality involved the residents in the design of the park and appointed a private developer to acquire the financial resources, and technical support to develop the multifunctional project. The private developer was responsible for the real estate aspects of the project, while the municipality was responsible for the park. Although the design started as an integrated plan to provide office space with a park on the roof, the design soon after changed and actors delivered a shopping mall with a park on its roof. This was not the only change in the design and the project conditions during the planning of the project that took more than fifteen years. The long design effort of the project, the variety of actors' backgrounds in the decision-making process; and the intertwinement of physical, financial, legal and technical aspects of the project made this an excellent case to analyze the influence of frames in the decision-making process of a multifunctional project.

To understand how actors framed decision contexts on the project, we performed open ended interviews which allowed our interviewees to be the story tellers of the issues that they considered important. To identify our interviewees, we used a snowballing strategy. The first interviewee was involved in a recent evaluation of the project, written in the year we started our research (2011). Being involved in the project evaluation, the first interviewee could provide the key actors involved in the project. He suggested the first two informants in his organization who then pointed us to others. In the end, we interviewed 17 actors involved in this project. Our interviewees belonged to different organizations, and had different roles in the project. This way, we got a heterogeneous picture of the decisions around the project from the narratives of various organizations and disciplines, and how different actors perceived them.

We triangulated the data collected through interviews by confronting it with over seventy project documents namely master plans, land use plans, meeting minutes and official internal communications. Once the data collection stopped providing additional insights, we did not collect more interviews.

After data collection, we used the project documents to create a timeline of events, identifying milestones in the project such as the approval of land use plan, or master plan. In Figure 2, we provide a timeline with the project events discussed in this study.

Figure 2 Timeline of project events described in this paper

This helped us to understand the impacts of certain events on the decision and project conditions. Furthermore, we transcribed the recordings from the interviews and coded the transcripts using a software for qualitative data analysis. By coding, we identified the decisions mentioned by a larger number of respondents. This way, it was possible to compare the frames among various actors involved. These decisions are (1) the adaptation of the design to flood protection requirements, (2) the selection of the function under the park, and (3) the removal of the existing rail tracks in the project area. For each of these decisions, we analyzed (1) the backgrounds of actors involved in the decision, (2) the context of the decisions, (3) the process of how the decision evolved, (4) the encountered challenges to find a resolution in the decision and (5) the resolution of the decision. We triangulated the data we collected from the interviews with the project documents (Yin, 2011). Using multiple data sources, we validated the events mentioned by our interviewees.

Subsequently, we confronted our findings with literature. This was an iterative process, constantly going from data analysis to literature review, following the principles of grounded theory (Strauss & Corbin, 1990). After a number of iterations, we acknowledged the influence on the decision making process of the divergent (1) problem interpretations, and (2) preferences to change the situation. Identifying the actors' interpretations allowed us to infer their frames. Consequently, we coded the data using the categories of "diagnostic frame", "prognostic frame", "emergence of a predominant frame", "mobilization of other actors", and "resolution towards a collective action" to depict how frames influenced the course of the decision-making process in our case. This allowed us to arrive at the final findings that we put forward in the next section.

2.4. Results

As mentioned in the previous section, we identified the decisions mentioned by a larger number of interviewees. These decisions are related to (1) adapting the design of the project to flood protection requirements, (2) selecting the function under the park, and (3) making a decision about whether or not to remove the existing rail tracks in the area. At the end of this section, Table 2 provides an overview of the decision events here described, the actors involved, their frames, the emergence of a predominant frame, the mobilization of other actors, and the collective action.

2.4.1. Adapting the design to flood protection requirements

The first decision we identified during the data analysis is the adaptation of the design to flood protection requirements because of the existence of a dike in the project area. Due to the existence of the dike, it was required to involve the water board in the decision-making process. Since the water board is legally and financially responsible for water safety, they provide permits to guarantee that a project complies with the current legislation for flood protection. The water board had to decide about the type of solution that would comply with the flood protection requirements.

At the outset, the municipality and the private developer had similar diagnostic frames. Their priority was the development of a financially feasible project. Consequently, the municipality and the private developer framed the existence of the dike and the involvement of the water board as problematic. In their interpretation, the water board's requirements would make the project more expensive and the decision-making process longer. Based on this assessment of the problem, their preferred course of action was to integrate the multifunctional structure and the dike so the water board could be fully involved in the design, encouraging communication, and sharing technical solutions. This is what we call 'design integration' prognostic frame.

For its part, the water board had different diagnostic and prognostic frames. Being legally and financially responsible for flood protection in the area, the water board's assessment of the problem was such of providing flood protection. This frame guided the water board's interpretations about the project. For the water board, the main problem was the existence of flood risk in the project area. With this diagnostic frame, the water board interpreted that the project should not interfere with the current dike because this flood protection structure should protect citizens from potential flood events. The water board's prognostic frame was to minimize the interference between the multifunctional project and the dike. In their view, the dike should not be moved nor integrated in the project.

The municipality and the private developer drafted a solution that integrated the dike and the multifunctional project. However, the water board was reluctant to allow for an integrative solution because, in their view, the best course of action was to interfere as little as possible with the dike. Consequently, the water board required a structural design that did not integrate

the dike and the multifunctional project. This solution made the project more expensive and taking more time. This situation is illustrated by the following quote of a municipal engineer:

“The finest solution should have been the integration of the flood defense and the building ... But the water board wanted a defensive structure that was too expensive to realize, it was a building with steel foundations, going down for meters, all along the building, it was millions.”

Since the suggested design was too expensive in the view of the private developer and municipality, and the water board would not approve a different solution, the final design respected the original boundaries of the dike. However, this solution did not satisfy the water board. In one of the last meetings to get the water board's permits, the water board used its legal authority. As the water board had a diagnostic frame focusing on flood protection, they interpreted that the contract should consider a potential dike reinforcement in the future. A dike reinforcement would entail the partial or total demolishment of the proposed multifunctional design. The water board brought up the matter for discussion: who should take the responsibility of demolishing the multifunctional project in case the dike has to be reinforced? Under these new circumstances, a new framing process started.

The diagnostic frame of the private developer led them to interpret the conditions of the water board as a risk in the future. To create a financially profitable project, the private developer had to find a tenant to sell the project, and make profit out of it. Given the water board's requests, the private developer considered that finding a tenant could be difficult. Based on this diagnostic frame, the private developer had a prognostic frame focusing on business. To them, the assessment of the solution was to only accept conditions that facilitated finding a tenant after the construction phase. Not surprisingly, the private developer did not accept the conditions of the water board and communicated this to the municipality. On its part, the municipality also had a financial diagnostic frame. However, their interpretation was different than the private developer's. To them, the building under the park was key to deliver a financially feasible project. In their view, losing the financial support of the private developer was undesirable. Based on this diagnostic frame, the municipality had a prognostic frame of feasibility. For the municipality, the best course of action was to support the private developer to keep their financial resources on board. Consequently, the municipality accepted the requests of the water board, and fully accepted the conditions of the water board, so the private developer would contribute financially to the development of the project. This situation is illustrated by the following quote of the project secretary:

“It took long time before (the water board) gave consent... (The water board) said: ‘when we want to (reinforce) the dike, then you have to take apart the building’. That was impossible, we could not (ask) that to the developer ... We asked the alderman to speak with the water board, and we thought that they would agree. But they didn't. So our alderman said: ‘we take the risk’. I don't think it will happen. If they have to (reinforce) all the dikes all over the city.... Moreover, the dike is better because of the building. We think this is not going to happen.”

None of the three actors had similar or comparable frames. Despite their different frames, the municipality accepted the risk of demolishing the building for a dike reinforcement to keep the support of the private developer. The water board had the authority to stop the decision-making process by denying the permit for flood protection. The water board used its authority to mobilize the other actors. Although the municipality and the private developer did not have similar diagnostic frames to the water board's frames, their only choice was to accept the conditions of the water board. Otherwise, the water board would not file the permit to build the project. This situation created tensions among the three actors.

In essence, we observed a divergence of frames among the municipality, the private developer and the water board, leading to different interpretations of the project context. These differences caused changes in both the design and contract. Our data shows that the water board used their authority to make their own frame predominant and mobilized other actors to fulfill their interests of keeping flood protection. The final decision was to keep the multifunctional project independent from the dike and adapt the contract to the water board's conditions.

2.4.2. Office space or commercial area under the park

The second decision we identified is the selection of the function under the park. Initially the design of the multifunctional project included office space with a park on its roof. This solution allowed for the exploitation of the function under the park, and avoided competition with existing shops in the area. Furthermore, the province provided a subsidy for the project because it did not compete with existing businesses in the neighborhood. However, the private developer had a financial frame, and interpreted that the project would not be profitable enough with office space. Based on this diagnostic frame, the private developer considered that the best course of action was to develop retail instead of offices. The following quote by a project manager of the private developer shows this situation:

“Our practice is to start building when we have found about 70% of tenants for the building... At the beginning, we had to make some low profile company area, and also offices... And the market for offices was not good. So we thought that we could change it to a shopping center. This would mean that the rent would be higher so we could develop this project.”

The municipality agreed with this change because they had a feasibility frame. Consequently, the municipality interpreted that the best course of action was to support the proposal of the private developer to build retail instead of office space, as shown by the following quote from a project manager in the municipality:

“Real estate is not about building beautiful things. Real estate is a *cash flow machine*... The real project is the building, the cash flow machine we had to agree with the private developer. That part was being born or killed ... Because if we didn't agree with the private developer on the building, and they didn't control themselves in the

cost of the building, nor succeeded in getting rental functions which cut the cost of the building, we had a problem.”

Given the shift from offices to retail, the province revoked the business restructuring subsidy that they offered for the construction of office space. The province had a regional diagnostic frame which led them to interpret that there were existing businesses in the region that should not be influenced negatively by the new project. As a result, their prognostic frame was business oriented. The province interpreted that the best course of action was to stop projects that would compete with existing shops, and businesses. Consequently, the province attempted to stop the development of the shopping mall in the multifunctional structure and, as stated previously, they decided to revoke the provincial subsidy.

The district authority, representing the interests of the residents in the neighborhood, was also involved in this process. The district authority had a social diagnostic frame. Based on this frame, the district authority interpreted that the main problem was to safeguard the interests of the neighbors. The district authority perceived two main problems: on the one hand, the project should not interfere with existing shops. On the other hand, the most urgent problem for the district authority was the lack of green areas in the neighborhood. As a result, they had a pro-green prognostic frame. When the private developer proposed to develop a commercial area instead of office space, the district authority interpreted that the best course of action was to support the project since it was a means to provide parks for the neighbors, as shown by the following quote by a member of the district authority:

“There was kind of a discussion here in this room about: ‘well, should we be against it or with it?’ At that point we didn’t know if it was a good option, but we needed the park. ... Well, we were not going to do very much against the municipality at this time to stop that, or to put a ban on the supermarket or other shops. Because we might end up with nothing, because at the time the municipality wanted to have businesses and we wanted to have the park. It was not sure if there were not going to be any businesses we would get a park. Getting just a park is very expensive. Now the park is partly paid by the businesses so I think it was kind of like, as a colleague said: “we did sell our soul to the devil for the park.”

This statement ‘we did sell our soul to the devil’ is related to the potential consequences of building retail for local shop-owners in the neighborhood. The consequences of building retail for small shop owners were not certain, but both the municipality and the district authority accepted the trade-off as shown by the following quote by a member of the district authority:

“We are not completely sure about the impact in the long term. It is kind of scary seeing other countries, for example France. When I am in France I love big supermarkets. But you also see villages and cities where there aren’t a lot of small shops anymore, partly because everything is sold in those big supermarkets. You can see the benefits of bigger shops, but you also wonder what will happen to the city in the long term. It is very complicated.”

As described above, none of the actors had similar diagnostic and prognostic frames. However, the interests of the private developer, the municipality and the district authority overlapped: developing a commercial area was convenient since it would provide a profitable project; hence a park would be possible. The municipality and the district authority supported the private developer because they required the private developer's financial capability to pursue their own interests. As a result, actors reached the final decision of developing commercial space under the park, contrary to the originally planned office space. In this process, the province used their authority by lengthening the process of providing the permits, and revoking the subsidy for the project because there was no overlap in their frames or interests. However, the financial resources of the private developer allowed them to make their financial frame predominant, hence the final design included retail instead of offices.

2.4.3. Whether or not to remove the rail tracks

The third decision we identified in our data analysis was whether or not to remove the existing rail tracks in the project area. The actors involved in this decision were the municipality, the port authority, the rail company, and the private developer.

There were twelve rail tracks in the fruit port area which influenced the design of the project. The fruit port used to be one of the largest ports in Europe. However, companies had gradually moved to different areas. This situation led to increasingly unused rail tracks, only used by few companies.

Planning to integrate the harbor and the city, the municipality and the port authority interpreted having obsolete rail tracks and a vacant area as a problem. Particularly, the existence of unused rail tracks in the fruit port represented a physical and functional obstacle for the integration of the harbor and the city. Based on this diagnostic frame, the municipality and the port authority had a prognostic frame of removal. According to their interpretation, the best course of action was to expropriate the company using the rail tracks, and remove these.

The rail company framed the situation from a different perspective. In fact, they had three different diagnostic frames: a political diagnostic frame, a transport service diagnostic frame, and an obsolescence one. Firstly, the rail company heavily depends on the subsidies of the Ministry of Infrastructure and the Environment. The Ministry put an increasing political pressure on the rail company to keep the rail tracks available as long as possible. Based on the political diagnostic frame, the rail company interpreted that the problem was the need to promote rail transport. Secondly, there still was a company using the rail tracks, having the right to use the service provided by the rail company. Based on the transport service diagnostic frame, the rail company interpreted that they should provide service to the user. Thirdly, the municipality put increasing pressure on the rail company to remove the rail tracks. Like the municipality, the rail company interpreted that the rail tracks were obsolete and their maintenance was costly. Consequently, the rail company considered that the pressure from the

municipality to remove the rail tracks and start the project was justified. This situation is illustrated by the following quote by a project manager of the rail company:

“The municipality wanted to have the rail tracks out. Well, that was difficult for us ... They were in a hurry, and we had this user ... Besides, sometimes, when the functions in the harbor change, then the rail tracks become obsolete and then that is the big political issue in the country. We build big rail lines, but at the same time, we are removing rail tracks elsewhere. That is always a big political thing ... One of the problems is, of course, that the interest of the minister and of the rail company is to keep as long as possible the rail tracks there.”

Consequently, the rail company did not have a clear single prognostic frame. In fact, the rail company interpreted that there were two potential conflicting courses of action: removing the rail tracks or keeping them in the project area. To define the project design, the rail company, the municipality, and the port authority had to reach an agreement about the removal of the rail tracks, but the rail company did not have a preferred course of action.

To speed up the process, the municipality proposed a design which included a tunnel with four rail tracks running through the building. This solution could satisfy various interests simultaneously: the municipality could develop the project, the rail company could keep some cargo transport in the area while facilitating the project for the municipality, and the rail users could use the rail tracks for transport.

However, the incorporation of the private developer entailed changes in the design. As mentioned earlier, the private developer had a financial diagnostic frame. With the change of function from office space to commercial area described in the previous decision context, the private developer considered that keeping rail tracks in the design was not desirable because of the potential annoyances caused by rail traffic to the customers of the shops, as shown by the following quote:

“When we started there were only four rail tracks left ... And you don’t want to mix a shopping street with rail tracks... Removing all the rail tracks makes it much easier logistically speaking, but also from the whole surrounding, because the rail tracks were going over the street and that is a very difficult traffic square, and because there is a tram, a train, quite few cars... It makes the total area easier, and also it helped the project ... So that helped everyone.”

As a result, the private developer assessed that the best course of action was to support the removal of the rail tracks. In this case, other decision contexts like the selection of the building under the park, had an influence on the removal of the rail tracks, making the frame of the private developer predominant. To support the private developer, the municipality resorted to legal procedures to expropriate the users, and to reach an agreement with the rail company so the rail tracks could be removed. It took five years to make a decision about the removal of the rail tracks.

Table 2 Decision-making process and actors' frames for each decision situation

Decision event 1. Flood protection requirements				Decision event 1. Flood protection requirements			
Decision situation	Main involved actors	Diagnostic frame	Prognostic frame	Emergence predominant frame of:	Mobilization of actors	Decision	
Existence of a dike in the project area	Municipality	Financial	Design integration	Water board using authority	Water board uses its authority to satisfy their interests	Multifunctional design respecting the boundaries of the dike.	
	Private developer	Financial	Design integration				
	Water board	Flood risk	No interference				
Decision event 2. Flood protection requirements/ requests water board				Decision event 2. Flood protection requirements/ requests water board			
Responsibilities associated to a future dike reinforcement	Municipality	Financial	Feasibility	Water board using authority	Water board uses their authority to satisfy their interests	Municipality takes the risk of demolishing the building in case the dike has to be reinforced.	
	Private developer	Financial	Business focus				
	Water board	Flood protection	Legal				

Decision event 3. Selection of the function under the park				Decision event 3. Selection of the function under the park		
Selection of the function under the park	Municipality	Financial	Feasibility	Private developer	Actors mobilize around the need of the private developer's capacities	Development of a commercial area under the park despite the revocation of provincial subsidy
	Private developer	Financial	Retail			
	Province	Regional interest	Business			
	District authority	Social	Pro-green			
Decision event 4. Removal of rail tracks				Decision event 4. Removal of rail tracks		
Existence of rail tracks in the project area	Municipality	Obsolescence	Removal	Private developer	Need for in-between solution including four rail tracks Incorporation of the private developer supporting the removal of the rail tracks	Users expropriated by the municipality Removal of the rail tracks by rail company
	Port authority	Obsolescence	Removal			
	Rail company	Political	----			
		Transport service	Obsolescence			
		Private developer	Financial			

Given these findings, we observed that there were divergent frames not only among different organizations, but even within the same organization. The rail company was caught between three frames. This indecisiveness slowed down the process until they made a decision about what to do with the rail tracks. In this case, actors required a temporary solution and the influence of a new participant (the private developer) so the municipality could get financial support from another spatial function to develop the park. In Table 2, we provide a summary of our research results.

2.5. Discussion

In our analysis of the three main decisions in an urban brownfield multifunctional project, we observed how frames influenced the interpretations of actors about a decision context and the decisions actors made. In particular, we observed the influence of frames on how these decisions evolved, and how actors reached a resolution. We evaluated frames as schemata that actors use to simplify the world and search for solutions in situations that require several actors to make a decision. Similar to Kaplan (2008) we have focused on the link between what actors perceive, and construct together in the decision-making process. Our data shows that actors do not follow a linear path in which they identify a problem and match a solution (Kaplan, 2008). On the contrary, actors perceive different problems; thereby solutions are not always evident. Although a ‘polysemy of frame repertoires’ (Kaplan, 2008, p. 746) can help to make the logics evolve towards an agreed project outcome, this situation might result in longer decision-making processes than desired by the actors.

According to Kaplan (2008) successful framing practices produce a predominant diagnostic and prognostic frame, which shapes the definitions of problems, solutions, and decisions. Consequently, predominant frames are decisive to reach collective action. Otherwise, ‘frames remain divergent, activities unresolved, and decisions deferred’ (Kaplan, 2008, p. 736). Our data indicates the role of having a predominant frame to motivate collective action, and more specifically the influence of power on making a frame predominant to mobilize other actors. Our findings show that actors can use their power and authority to reinforce their positions.

Kaplan (2008) says that there is a reciprocal link between power and the emergence of predominant frames. On the one hand power is not something that actors have but something that happens during the engagement of framing practices. By making their own frame predominant, actors can have an effect on the course of the decision-making process to gain influence. On the other hand, powerful actors can make their frame resonate and force their preferred course of action in the decision-making process. Gray (2003) acknowledges the existence of ‘power frames’: actors can advance their own position by using resources, unique knowledge, or authority that others do not have. According to Kaufman *et al.* (2003) power frames help to define which forms of power are legitimate but also the forms that are likely to advance one’s own position. For instance, financial resources or legal authority might be key on influencing people’s views. More recently, Brugnach *et al.* (2011) have also identified the use

of power to impose a particular frame as strategy to deal with diversity of frames and avoid an impasse in a decision-making process.

In our study, the episodes of the integration of the dike in the project, and the selection of the function under the park showed how actors used their power or authority to make their own frame predominant. We did not find instances of actors purposefully making their own frame predominant and, as a result, gaining influence in the process. Nevertheless, we do not reject this situation in multi-actor contexts.

Interestingly, our results also showed how actors are likely to mobilize around a predominant frame that satisfies their interests although that mobilization might entail a tradeoff. In the case of the selection of shops instead of office space, we acknowledged that the predominant frame of the private developer allowed to mobilize actors around a strategy that could satisfy the interests of the district authority and the municipality. Although the province had the authority to approve the land use plan and provide a subsidy, the municipality and the district authority considered that this frame did not guarantee the achievement of their interest of developing a park. Consequently, the private developer's frame became predominant instead of the province's frame. However, the province used their authority and delayed the approval of the land use plan and refused to give the provincial subsidy for business restructuring. It could also be argued that actors had a preference for the short-term locally oriented decision to develop retail instead of office space, above the longer-term regionally oriented decision to develop office space and fulfill the provincial conditions. The future consequences of mobilizing around the private developer's frame instead of the province's one are still disputed, as we showed in the previous section.

Moreover, the case of the integration of the dike and the multifunctional project showed how the water board used their legal authority to make their own frame predominant. Although this predominant frame did not contribute to satisfy the interests of the private developer and the municipality, actors mobilized around it and accepted the conditions that the water board proposed. This way there was a trade-off: without the permit of the water board it was not possible to develop the project hence actors decided to mobilize around this frame and look for strategies that avoided an impasse in the decision-making process.

Our research results show that the emergence of a predominant frame proved to be important not only for collective actions but also for individual ones. Indeed, in our case we observed how actors held multiple, and sometimes contradicting frames, not only among different organizations, but even within the same organization. The most prevailing example of multiple simultaneous frames is the decision of whether or not to remove the rail tracks influenced by the rail company's multiple frames. The rail company struggled between two potential strategies: (1) to satisfy political interests or (2) to facilitate the process of implementing the new project by removing the rail tracks. The high maintenance costs and the decreasing activities in the harbor were two of the influences on the rail company to have a preference for removing the rail tracks. However, the emergence of the predominant frame of the private developer to develop shops instead of office space was a determining factor to remove the rail

tracks. The pressure and mobilization of the municipality encouraged the rail company to resolve the ambiguity they were struggling with. This case shows the influence of a predominant frame across different decision arenas, helping to resolve the indecisiveness resulting from the existence of multiple divergent frames within the same organization.

In summary, our results show that frame divergences are often resolved by the emergence of a predominant frame to make an actor gain influence in different decision arenas and contexts. When actors use their power to establish their own frame as predominant, other actors might mobilize because the prevalent frame helps them to achieve their own interests, or because they are forced to follow a particular course of action. Mobilizing around a predominant frame involves decision tradeoffs. Although tradeoffs are unavoidable in decision contexts, we consider it important to bring frames to the surface to create awareness about the consequences of stakeholders' choices. In light of our results, we consider that understanding how predominant frames emerge and how other actors mobilize around them helps to anticipate strategies to support the predominance of frames that will support the achievement of mutual gains instead of individual interests. Making frames more explicit helps to add interpretations to decision making-processes helping to open up the option space so new and overlooked options might emerge (de Boer *et al*, 2010).

2.5.1. Implications for multifunctional projects

In multifunctional projects, integrating purposes in the same area and sharing costs and benefits increase the level of interdependencies of these projects compared to mono-functional ones. Our research results show how the interdependencies among functions have an influence on the frames that become predominant as we observed in the episode of the selection for the function under the park. Predominant frames influenced the design and conditions for the project, leading to changes throughout the process.

Furthermore, the interdependencies among resources and organizations in multifunctional projects require the consideration of the project as a whole, as a common pool of resources that actors combine to achieve synergy. Actors might use their power or authority to make their frame resonate or vice versa to achieve their own self-interest without taking the consequences for the project as a whole into consideration. Under these circumstances, there could be a similar problem to the one presented in the tragedy of the commons (Hardin, 1968) where actors attempt to maximize their own self-interest without considering the public good and leading to a situation undesirable for all involved actors. It is therefore important to stimulate strategies that help to identify combinations of functions that minimize the occurrence of this problem.

We have seen that actors use power and authority to make their own predominant to mobilize others in the direction of achieving their own interests. In light of our results, we consider highly relevant to search for strategies to stimulate the emergence of predominant frames that help to achieve mutual benefits. Finding these strategies seems highly relevant for

multifunctional projects, where different interdependent actors have unique expertise, or resources necessary to implement the project. Organizing open processes that allow for the inclusion of a range of divergent frames might help to create awareness and deal with frame differences (Dewulf *et al.*, 2007). Differences in how actors frame the scope of the context, the selection and definition of options are crucial elements that could be considered as explicit inputs in decision-making processes. Stirling (2006) acknowledges that treating key framing assumptions as explicit inputs offers a means to bring to the surface stakeholders' interpretations and how different courses of action would be preferable under different frames, and show how these dependencies relate to stakeholder interests (Stirling, 2006). Furthermore, we encourage the use of deliberative practices to explore the potential of showing existing frame divergences in decision-making processes, helping to make actors aware of the options and potential actions under different interpretations (Renn, 2006) and facilitating the emergence of potential predominant frames that allow for the achievement of synergy and mutual benefits.

2.5.2. Implications for further research

This research has provided insights into the dynamics of the emergence of a predominant frame to mobilize other actors in the context of a multifunctional project. As the decision making in this project took more than fifteen years, the frames and interpretations of actors might have changed over time due to external conditions (e.g. real-estate market, local economic and/or legislative changes) which alter the diagnostic or prognostic frames. This aspect has not been taken into consideration in the paper. We encourage rich longitudinal studies addressing this point. Furthermore, we consider it important to make explicit three other points of discussion deriving from using frames as a lens.

First, frames are inherent to individuals, and actors construct different frames in different contexts. Certain backgrounds or experiences could be shared within an organization, but different people could enact them differently. A different participant, in the same situation, and belonging to the same organization, could have formed different frames. Despite the fact that we attempted to provide a heterogeneous sample of actors within the same organization, we consider it important to increase our understanding of the influence of differences in frames within the same organization in a decision-making process.

Second, we are aware that decision-making processes are not only influenced by actors' frames. Decisions that are taken in different arenas, changes in the external environment, or the incorporation of new actors can also have a major impact. We encourage further research providing a comparative study that offers an analysis of a decision-making process using frames as a lens and other approaches focusing on the connection between streams of actors, problems and solution matching. Especially since the analysis of decision-making processes in multifunctional projects is complex and relatively unexplored in literature, we consider that this could provide valuable insights for both theory and practice.

Third, the scope of this study is to analyze frames as guides to interpretation that allow actors to make sense of the world. We have not evaluated the influence of these interpretations on the communication and information sharing among actors, following a research tradition of communication theory. Since how actors characterize an issue has an influence on how it is understood by others (Scheufele and Tewksbury, 2007), we consider it important to provide studies that evaluate the influence of a predominant frame on how an issue is shaped and understood in a decision-making process.

2.6. Conclusions

This research evaluates the influence of framing practices in the decision-making process of a multifunctional project. We performed in-depth interviews with actors involved in a multi-purpose project in the Netherlands. By involving stakeholders in a qualitative approach, we were able to analyze the influence of frames on this decision-making process. Notwithstanding the specificity of the project, our results contribute to the body of knowledge about framing practices in a multi-actor context. Our findings show how the interdependencies among functions and resources influence the emergence of a predominant frame, and the influence of power frames in this process. Furthermore we provide insights into how frame differences have an effect on the definition and selection of functions in multifunctional projects. We believe that understanding the diversity of frames and its influence is a first step towards an approach to incorporate the diversity of interpretations and interests involved in the decision-making process of a multifunctional project. This way, it should be possible to achieve the desired complementarity of multi-functionality.

2.7. Acknowledgements

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Chapter 3.

Chapter 3. Understanding the dilemmas of multifunctional regional planning²

Abstract

Multifunctional projects are used to cope with demands such as changes in public spending and land scarcity. Although combining functions helps to achieve synergy, decision making in multifunctional projects can be more difficult than for mono-functional projects because of their interdependences of effects and the complex multi-actor context. This paper presents a case study of a multifunctional project in the South West Delta in the Netherlands. Drawing on an earlier categorization of dilemmas (Savini *et al.*, 2013; 2014), we identify the intervention, regulation and investment dilemmas in a multifunctional project. Savini's conceptualization allows grasping how dilemmas play an important role in the conception, deliberation, and formulation of final resolutions. The investment dilemma is the most predominant dilemma in multifunctional projects since decision makers had to balance the need to identify and select functions based on earning potential while satisfying stakeholder demands. Often, functions that satisfied regional demands did not maximize financial profit and vice-versa. Furthermore, we shed light on the interrelation between the regulation and investment dilemmas, given the tension of having to transform and preserve values in an area, while prioritizing regional demands and earning potential. Our results reveal that decision making of spatial planning in general, and of multifunctional projects in particular, is characterized by tensions, and subject to unanticipated consequences different to actors' desired outcomes. Understanding dilemmas and their interrelation helps to inform practices that integrate multiple objectives.

3.1. Introduction

Changes in public spending, land scarcity and increasing population encourage the development of multifunctional projects. Multi-functionality brings together functions to satisfy economic, environmental and social objectives (Holden, 2012; Roe and Mell, 2013). Multifunctional projects incorporate multiple actors to stimulate stakeholder commitment, provide flexibility, and explore market strategies to realize the potential of satisfying multiple demands (Gualini and Majoor, 2007). Although the main rationale to develop multifunctional projects is to achieve synergy by connecting various land use purposes and resources (Rodenburg *et al.*, 2010), practical experiences reveal that realizing this synergy is difficult. The

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challenges of multi-functionality relate to their complex multi-actor context, and the difficulty to calculate the project's integrated effects.

First, developing a multifunctional project requires bringing together public and private actors from diverse backgrounds that have different interpretations about the project (Peek and Louw, 2008), making it difficult to balance their objectives and coordinate their activities (van Broekhoven *et al.*, 2014). Second, different functional lifespans complicate the quantification of the project's integrated effects. Issues like cultural heritage, sustainability, quality of life have become important subjects in planning processes and these are often difficult to calculate. Furthermore, the perspective of effects is different across various sectors, and the balance of a social cost benefit analysis (SCBA) might be positive from the perspective of the national government, but negative from the perspective of a local stakeholder (Bakker, 2012). Defining and selecting functional combinations requires taking the diversity and interdependence of interpretations into consideration.

Complexity in multifunctional projects is larger than for single-sector projects (Aarts *et al.*, 2008; Salet *et al.*, 2013). More functions entail more components and interconnections. The increased complexity rises the variety of available options. Multiple combinations are possible to satisfy divergent demands while attempting to maximize synergy. Identifying and selecting functions is subject to trade-offs depending on whether or not the existence of one function excludes another (Turner *et al.*, 2014). Decision making in multifunctional projects requires navigating trade-offs between social, economic, and environmental outcomes resulting from potential futures (Groot *et al.*, 2007; Adams *et al.*, 2014). This situation entails dilemmas. Innovative planning practices - like multi-functionality- can be enhanced by identifying the dilemmas that actors encounter during decision making (Savini *et al.*, 2013; 2014). These authors emphasize that planning is a process of compromise along three dilemmas: (1) intervention, (2) regulation and (3) investment. These dilemmas relate to the specific situations where actors need to make choices, and how the decision contexts influence the exploration and selection of projects. Despite the relevance of dilemmas in planning and decision-making, there is a lack of research identifying concrete dilemmas that actors encounter during decision making in multifunctional projects. This paper draws on the work of Savini *et al.* (2013; 2014) to identify the intervention, regulation and investment dilemmas in a multifunctional project. Savini's conceptualization of dilemmas helps to grasp how actors make sense of dilemmas, playing an important role in the formulation of final resolutions.

We follow an in-depth case study analyzing a multifunctional project in the Dutch South West Delta. The most prevalent dilemma in multifunctional projects is the investment dilemma. Developing a multifunctional project was a form of 'financially led' spatial planning based on the distribution of gains among multiple functions as described by Savini *et al.* (2014). Financially riskier functions were connected to more lucrative ones, thus revenues were reinvested to compensate for less profitable functions. However, uncertainty and the difficulty of aligning timeframes and distributional effects made it difficult to link multiple effects and investment agendas. We show instances of the interrelation between the regulation and

investment dilemmas. Knowing *what to transform* and *what to preserve* required involving regional demands and getting financial resources to ensure the project's viability. The investment dilemma arose because of the mismatch between functions that satisfied regional demands and financially profitable functions. There was a tension between transforming and preserving, and how to understand regional demands to focus on *what mattered* to regional stakeholders, while ensuring that the project was viable.

How actors made sense of the dilemmas shaped the formulation of final solutions. Dilemmas caused hesitancy among regional stakeholders, which jeopardized the project's financial viability. Actors took standpoints about priorities, and emphasized the need to focus on financially profitable functions to ensure financial feasibility. Although integrating functions is the strategy to satisfy multiple objectives, and ensure the financial viability of the project, the difficulty lies in bridging these two rationales. We did not observe the intervention dilemma since the priorities of the project were delineated when we became involved in the process: water quality and economic development. The government steered the process to ensure that its outcome complied with pre-set up goals. Decision-making processes of multifunctional projects present tensions, choices around goals and means, and are prone to unexpected effects different to what actors planned. Comprehending dilemmas and their interrelation is valuable to inform practices that integrate multiple objectives.

3.2. Dilemmas in urban and regional planning

The word “dilemma” has a Greek origin. It means “two premises” and refers to situations where one is confronted with making decisions based on two or more options, and either choice has undesirable consequences. No matter the decision, the outcome is unfavorable in some sense: “damned if you do it, and damned if you don’t”. Dilemmas are the interaction of two opposing forces creating a ‘force field’: they cannot exist without each other and they are complementary (Sachs *et al.*, 2006). These forces co-exist and represent the opposite sides of a coin: they are appreciated individually, but they cannot be separated from each other.

Previous literature has studied dilemmas in different contexts such as climate change adaptation (Ko and Chang, 2012; van Buuren *et al.*, 2013; Root *et al.*, 2015), organization science (Schreyögg, and Sydow, 2010; D’Adderio, 2014), management studies (Storey and Salaman, 2010), land management (Hartmann and Spit, 2015), policy making (DiLucia *et al.*, 2012), regional and urban studies (Bański, 2010; Banai, 2013; Davies and Msengana-Ndlela, 2014). Some authors have focused on understanding the need to provide flexibility and robustness to integrate water and spatial planning (Tempels and Hartmann, 2014), or the need to deal with competing demands from external environmental demands like flooding and droughts (Van den Berghe & De Sutter, 2014).

This study elaborates on previous work by Savini *et al.* (2013; 2014) who acknowledge that making decisions entails a series of compromises based on constructed visions of problems at stake (Savini, 2013). Savini *et al.* (2014) recognize that the contradictory nature of planning emerges from three aspects that define planning process: (1) the spatial component that targets

explicit areas in specific times to define intervention (interventions), (2) the framework that conditions the project implementation (regulations), and (3) mobilization of resources to make interventions financially viable and economically sustainable (investments).

The intervention dilemma emerges from the need to prioritize issues while ensuring that plans meet the needs of inhabitants (Savini *et al.*, 2014). These demands can be contradictory. Often, bottom up proposals remain controlled by governments, not being adaptive to initiatives that emerge from citizens (Meerkerk *et al.*, 2012). Dilemmas arise from the need to involve governmental, NGO's, and market interests to become effective, efficient and legitimate (Janssen and Jansen, 2013). Targeting and control from the government entail that stakeholders are involved from the outset, but hardly proposing initiatives beyond the boundaries of government procedures (Boonstra and Boelens, 2011).

The regulation dilemma originates from the need to provide room for preservation and transformation. "The regulation dilemma entails conflict between the practices managing existent land usages and the need for flexible adaptation to emerging land uses" (Savini, 2013; p.337). Spatial planning affects the future of a place, and requires exploration and justification of choices. On the one hand, planning needs to provide regulatory certainty to avoid undesirable outputs and protect existing values. On the other hand, there is a need to provide grounds for innovation that facilitate transformation. The establishment of formally or informally regulated processes involves a restriction for innovation required for the exploration of new land uses. Regulations prevent the natural change of land use with respect to stakeholders' preferences (McLaughlin, 2012). The issue is how to protect specific values while enabling flexibility to explore land use combinations. Some authors have discussed that current planning approaches are organized in a way that directs actors' behavior toward the goals of a top-down plan instead of providing rules through which actors can create their own plan (Moroni, 2010; Holcombe, 2013). The challenge is to balance regulative certainty and flexibility to transform (Steele and Rummung, 2012).

Last, the investment dilemma arises from the need to organize planning processes that balance supply and demand. The need for supply focuses on the exploration of increasing land use values based on calculations of economic growth and financial profit. Demand planning mobilizes locally generated ambitions before establishing financial arrangements. Due to the economic recession, planning is structured around earning potential and risk reduction for investors (Savini *et al.*, 2014). Often, decision making is organized not only based on what is best for the area, but on considerations of raising money for realizing the plan (Needham, 2014). To give confidence for the project, the use of economic instruments is crucial. In most western countries SCBA is a used ex-ante evaluation tool to support decision making (Mouter *et al.*, 2013). In the Netherlands, value capturing is at the core of planning. Governments try to make profit out of land development to support less profitable projects elsewhere or use the income for other financial duties (van der Krabben and Jacobs, 2013). Besides, there is growing attention to the creation of value considering local demands that are hardly quantifiable such as spatial quality, social cohesion or place attachment (Savini *et al.*, 2014).

This poses difficulties for a planning system that focuses on the distribution of costs and redistribution of benefits at different scales (Beukers *et al.*, 2012; Sager 2013).

Dealing with dilemmas requires acknowledging their existence to make informed choices (Mantere and Ketokivi, 2013). The challenge is to accept the contradictory nature of decision making and planning, and navigate between the extremes of dilemmas to find a balance that fits each particular case (Savini *et al.*, 2014). Savini *et al.* (2014) emphasize the importance of better profiling the elements that constitute dilemmas, and how they are interrelated. That is the goal of this paper. Using Savini *et al.*'s (2013; 2014) categorization, we identify the dilemmas that actors encounter in the decision making of a multifunctional project, how actors make sense of these dilemmas, and how the occurrence of dilemmas influences the formulation of final solutions.

3.3. Method

To achieve our research goal, we analyzed the planning process of the ABC project³. Key to successful single case study is the strategic choice of the case (Flyvbjerg, 2006). We selected ours for three main reasons. First, the ABC is a multifunctional project that combines various functions to satisfy environmental, economic, social, and flood protection demands. The integration of multiple purposes required involving organizations from various disciplines and administrative levels. Second, the planning process started at the beginning of our research, allowing for a longitudinal study to get an insider's perspective. Third, financial constraints and the involvement of multiple stakeholder interests were at the core of the planning process, encouraging to balance conflicting demands that lead to dilemmas. Following a case study approach (Yin, 2013) fitted our research goal, since we wanted to investigate a contemporary phenomenon (planning dilemmas) within its real life context (the planning process of a multifunctional project).

The A, B and C are three lakes located in the Dutch South West Delta. For decades the ABC area was a popular touristic destination and an engine for regional employment. However, water quality of the three basins worsened, having a negative impact on the economic activities. Since 2000s, national and regional authorities performed studies to comprehend the problems about water quality and fresh water supply.

In the Lake A, the concern was the lack of oxygen in water threatening the habitat of flora and fauna. Previous studies showed that changing the tide in the Lake A by 50 cm stimulated a better oxygenation of the water. In the BC Lakes the problem was related to blue algae. Blue algae had a negative impact on recreation because of the odors they caused, and the unattractive color of the water. Although the situation improved over the years because of the introduction of a specific mussel (*quagga mussel*) that filtered and cleaned the water, the problem

³ The name of this project has been anonymized.

persisted. The insufficient environmental quality had a negative impact on economic activities, and previous studies showed that a solution for water quality was salinizing the BC Lakes.

Both problems in the ABC Lakes caused that the basins did not comply with the policies and guidelines influencing developments in the South West Delta like the Delta Program and Natura 2000. The measures to improve the water quality had to comply with these policies. The Delta program was a national policy that aimed at providing protection against flooding, ensuring fresh water supply, and linking the developments to the environment and economy. The Natura 2000 policy framework aimed at ensuring the protection of nature areas in Europe.

A process started in January 2013 to evaluate the opportunities of an improvement of water quality. We had three main sources of data: observations during project meetings, access to documents that participants exchanged during the process, and interviews with project participants. We attended 21 meetings of the team that focused on the financial-economic and political-administrative aspects of the project. This team consisted of 11 members of the provincial and national governments. Given our involvement in the meetings, we gained access to the documents that actors exchanged. In total, we collected more than 400 documents. These were internal and external communications, policy documents, and evaluation reports of the project.

We collected cognitive maps in two points of time. Cognitive maps help to understand people's perspectives on complex domains (Eden, 1988). Cognitive mapping supported by face to face interviews helps interviewees to articulate interpretations that they are not aware of (Jetter and Kok, 2014). We applied the 3CM method –open ended conceptual cognitive map– presented by Kearny and Kaplan (1997). We involved our interviewees in an individual exercise to develop a cognitive map, following the next four steps:

1. Enumerate what was important in the decision making.
2. Group aspects into themes, giving names to the categories.
3. Provide a verbal link between themes.
4. Explain the map, allowing for a structured narrative.

Figure 3 Picture taken during a cognitive map session and cognitive map developed by a participant

10 members of the project team agreed to be part of the research in 2 points of time, separated by 7 months (March 2013- October 2013). The first round was at the beginning of the decision-making process. The second round happened after the publication of a progress report, showing the first results of the process and communicating the ambitions of regional stakeholders. Based on our observations during round 1, we recognized the relevance of regional stakeholders - external to the project team-. Consequently, in round 2, we collected the cognitive maps of the team members and regional stakeholders namely: administrative groups (municipalities, water boards), business community (fisheries, recreation, agriculture, transport), and social and nature organizations (fresh water supply, NGOs, nature organizations). In total, we collected 30 cognitive maps. The cognitive mapping activity took from 25 minutes to 1.5 hours. Table 3 provides an overview of the number of cognitive map-meetings.

We represented the maps digitally using the 'Cmap Tools', transcribed the participants' narratives describing their cognitive maps and compared the participants' maps to their explanations. With the support of a software for qualitative data analysis (AtlasTi), we chronologically organized the documents, cognitive maps and transcripts of the narratives. We created a timeline to identify activities related to (1) the study of the problems in the ABC and the outputs of these studies and (2) the activities in 2013 and 2014 focusing on defining projects to address the water related problems and provide regional opportunities.

For analysis, we followed a grounded theory approach (Glaser and Strauss 1967, Locke 2001) going back and forth between data and theory. Initially we did not code the elements. We started with multiple readings of the cognitive maps, interview transcripts and the archival materials to get acquainted with the data. The case's process focused on making a decision about the future of the ABC. Since the cognitive maps provided what was important for participants to make a decision, we created a database with the elements that the maps

included. The cognitive maps and the participants' narratives helped us to understand the required decisions, the project context and what was important to make the decision. We focused on two main decisions that had an important impact on the outcome of the decision-making process: (1) salinizing the BC Lakes and (2) changing the tide in the Lake A.

Table 3 Organizations involved in data collection

Organization	Number of cognitive maps	Round 1	Round 2
Provinces	4	X	X
National government	5	X	X
Independent process manager	1	X	X
Municipality	1	-	X
Water board	1	-	X
Recreation	1	-	X
Fisheries	1	-	X
Agriculture	1	-	X
Nature organizations	3	-	X
Energy	1	-	X
Fresh water supply company	1	-	X
Total	20	10	20
Total cognitive maps	30		

Then, we developed codes for recurrent patterns, and analyzed the codes for themes. We first coded the contextual elements identifying: (1) policy frameworks, (2) relevant stakeholders, (3) history of the project, (4) regional identity and (5) financial circumstances. Second, we coded the elements that were important to make a decision: (1) organization of the process, (2) involvement of goals, (3) encouraging commitment, (4) identifying earning potential and (5) understanding project effects. We identified both favorable and unfavorable conditions related to the effects of decisions, resulting in dilemmas. Since we were in a constant process of going back and forth to literature, when we recognized the dilemmas for the decisions in the ABC decision-making process, we sought the theoretical categorization provided by Savini *et al.* (2013; 2014) and searched for emerging theoretical insights. We examined (1) to what degree those decisions included considerations to balance spontaneous development or targeting specific areas and priorities (intervention dilemma), (2) whether there was a need to consider transformation and preservation simultaneously (regulation dilemma), or (3) whether or not it was necessary to prioritize regional demands or the earning potential of projects (investment dilemmas). Figure 4 summarizes our data analysis.

The dilemmas we identified emerged during rounds 1 and 2 of our data collection phase. To understand how actors made sense of the dilemmas as they emerged, we analyzed the cognitive maps of participants in round 2. We traced back the perceptions of participants about the dilemmas, identifying the consequences of the dilemmas pinpointed in the previous stage of our analysis. Then we analyzed how actors' perceptions about the dilemmas shaped their priorities to select functional combinations. This way, we gained insights into how the dilemmas, and how actors made sense of the dilemmas influenced the formulation of final solutions.

We validated the data by triangulation. When we identified a dilemma in the cognitive maps and narratives, we confirmed that the same dilemma was described in the project documents. The next section presents our results. To illustrate the consequences for practice of the existing dilemmas, we added quotations from the interviews (in italics). Since the identity of the respondents can be inferred from their role, and we guaranteed their anonymity, the role of the participants is not indicated in the quotes.

Figure 4 Data analysis process

3.4. Results

Table 4 Dilemmas identified in the ABC project

Decision	Dilemma			Type of dilemma
Salinizing the BC Lakes	1	Stimulation of economic development	Reduction of fresh water supply for agriculture	Investment Regulation
	2	Opportunities for development of recreational facilities	Not immediate tangible effects in landscape to realize opportunities for recreational sector.	Investment
	3	Opportunities for development of 400-600 ha of mussel farms.	Scarcity of “mussel ground” to realize the opportunities for mussel farms.	Investment
	4	Improved living conditions in municipalities	Uncertainty about influence of better water quality on real estate prices.	Investment
	5	Placing wind turbines could offer revenues to finance salinization of the VZM	Nature under pressure because of intense terrain use	Investment
Tidal changes in Lake A	6	Opportunities to develop recreational facilities in the A Lake.	Loss of 50% or 75% for the population of <i>groenknolorchis (liparis loeselii)</i> (local preserved flower)	Investment Regulation
	7	Developing a tidal power plant could be regional showroom	Lack of clarity about its ‘fish-friendliness’	Investment Regulation
	8	A connection between VZM and Lake A offered opportunities for recreation, and fisheries	Dioxin in water.	Investment Regulation
	9	Increased number of more experienced divers	Unclear whether or not this would bring more money	Investment
	10	Charging an entrance fee for the natural areas could help to pay for improvement in nature	Limited accessibility to the area.	Investment

1. Salinizing the BC Lakes stimulated economic development but reduced fresh water supply for agriculture.

Bad water quality in the BC Lakes not only caused odors, but also threatened the health of humans and fauna. The situation was harmful in warm periods when the odors worsened.

Recreationists avoided the lake and the economic activities declined. There was a wish to transform the area by improving water quality.

Since 2006, the ‘quagga mussel’ improved the water conditions. This kind of mussel filters the water and removes algae ameliorating water quality. However, it was unclear to what extent the improvement in water quality because of the quagga mussel was permanent. As stated in the environmental impact assessment (EIA): *Whether the improvement of water quality because of the quagga mussel is structural or just temporary is highly uncertain* (p.15). The reduction of fresh water supply, and the unknown effects of the quagga mussel called into question the desirability of salinizing the BC Lakes as the following quote illustrates (interview 14):

“Given that the problem related to blue algae has been stabilized over the years because of the introduction of the quagga mussel, we should consider whether or not salinizing the lake is still necessary to improve water quality.”

Under these conditions there were two options. The first option was to salinize the BC Lakes, reduce the fresh water for agriculture and find compensatory measures for farmers. The second option was to wait and observe if the quagga mussel reduced the disturbance of blue algae.

2. Salinization offered opportunities for the development of recreational facilities but the tangible effects in landscape to realize these opportunities were not immediate.

Actors sought synergies by aligning an improvement of water quality, landscape and investment agendas. However, it was difficult to show when the benefits of an improved landscape would come to fruition. Entrepreneurs in the recreational sector wanted short term financial benefits whereas the achievement of these benefits required an improvement that would only occurred in a longer term. The following quote from a regional stakeholder shows this situation (interview 15):

“It will take 30 or 40 years to restore the landscape... However, somebody who has a small harbor and wants to have more boats thinks in a different timescale. They think in a scale of 5 years. What is the problem we are going to solve? In which time scale? Who is paying for the solution?”

For example, the business cases of salinizing the BC Lakes included the development of 10ha camping areas, 120 water houses and 190 sites for recreational accommodation. These functions offered a financial benefit for both the national government (land owner) and regional entrepreneurs. The development of these recreational facilities was planned for 2020, requiring an investment between 2015 and 2019. However, the effects of salinization on the landscape would become tangible in 2030. This meant that the value was not created after salinizing the BC Lakes, but that it would gradually increase 15 years after the salinization.

Although the business case recognized that the faster the realization of developments the greater the expected benefits, it acknowledged the need to consider the rate at which recreation would develop from the moment the BC Lakes was salinized, and how to link it with the

investment agendas of entrepreneurs. Previous surveys among entrepreneurs showed that there was willingness to invest only if the landscape improvement was tangible. The region indicated that the development was likely to be more organic and evolve over time instead of requiring big investments. To get the political support of the project, and to start implementation, it was necessary to provide a financial package showing the commitment of regional stakeholders which proved to be challenging given the difficulty of aligning timeframes.

There were two options. Recreational entrepreneurs could either invest in the project despite the existing uncertainties about the benefits or they could wait for an improvement in the landscape. While investing required taking a financial risk, waiting jeopardized the political support of the project.

3. Salinization offered opportunities for the development of 400-600 ha of mussel farms, but realizing the opportunities required scarce 'mussel seeds'.

Improving water quality in the ABC Lakes offered opportunities to develop 400-600 ha of mussel farms giving financial profit for both the fisheries sector and land owners. However, there were two main insecurities to achieve these benefits.

First, producing shellfish required raw material called 'mussel seeds'. Both, the business case of the BC Lakes salinization, and the SCBA discussed that 'mussel seeds' became scarcer, limiting the availability for a production of the planned size in the ABC Lakes. While assessing the benefits for fisheries, it was unknown whether or not there were enough resources to support the production of the planned hectares of mussel farms.

Second, the achievement of conditions of optimal oxygen concentration, food and flow rates could only be realized after salinization. These insecurities called into question the desirability for regional stakeholders to invest in the fisheries sector. Based on expert judgement, the business case acknowledged that the chances of realization of income could be 60% but it was still uncertain whether or not this situation would happen.

4. Salinization led to improved living conditions in municipalities around the area, but the influence of improved water quality on the real estate prices was uncertain.

Salinizing the BC Lakes would reduce annoyances that were decreasing the attractiveness to live and recreate. Neighboring municipalities could profit from the positive effects in the housing market, due to an increase in the real estate value, and the chances to develop new housing areas. For example, a neighboring municipality considered developing 3800 new houses by 2030.

However, there was no consensus among experts about the positive impact of attractiveness on the housing market. In the SCBA, the benefits for the real estate market were uncertain, estimating a likely increase of 25% in the housing prices. Regarding the development of new houses by the municipalities, leading to more revenues for housing permits and taxes, these

developments were dependent on the success of recreational activities that were not certain in the economic instruments. The following quote shows this situation (interview 12):

“We have a housing project here... In the SCBA, the question is: ‘this residential area is not going to happen if the water quality is not good’... The housing value is completely dependent of the water quality... and I don’t know how many millions of euro it will bring, but it makes sense that this will have a financial effect... But economists, decision makers need numbers to argue and justify their decisions. And many benefits are indirect and very difficult to calculate.”

5. Placing wind turbines around the BC Lakes offered revenues to pay for salinizing the BC Lakes, but they put nature under pressure.

Given the focus on earning potential, the government explored functions that provided profits to provide security for regional investors. Functions like fisheries and windmills showed high earning potential in the business cases for salinizing the BC Lakes. First, fisheries contributed to 93% of the total earning potential of the salinization, compared to a 5% for recreation and 2% for urban development. Second, the development of a wind park next to the BC Lakes could make a benefit of 16 million euro available for the national government for the next 15 years. This intervention contributed to the provincial ambitions of supplying 6000 MW of sustainable energy.

However, functions like windmills and fisheries put nature under pressure. Windmills disturbed the landscape, and caused unwanted noise. Besides, large production of fish disturbed the living conditions for flora and fauna. Some stakeholders questioned the desirability of developing functions based on financial profitability as the following quote shows (interview 16):

“There are things that you want but not any price. Two years ago, it was very clear what we wanted: reduction of tide in the Lake A, salinization of the Lake B.... But now we see how they plan to finance it, everywhere windmills, everywhere housing, also in nature areas, hundreds of acres of new production area for the fisheries... and the attention to (other values) has decreased.”

6. Tidal changes provided opportunities for recreation but it entailed a loss of 50% or 75% for the population of *groenknolorchis*.

The environmental impact study (EIA) discussed the positive effects of salinization and tidal changes on water quality and nature around the wetlands. The regional economy and the environment could profit from these interventions. However, the EIA included negative effects of the salinization and tidal changes.

Tidal changes in the Lake A had positive effects for marine life and could create new breeding sites for birds. However, tidal changes had negative effects on wet dunes and the protected ‘fen orchid’ (*groenknolorchis*) which were important for important for the Natura 2000 policy.

The area around the lake was one of the main habitats of this orchid. The expected negative effects needed to be minimized by planting fen orchids in different areas. Experts stated that there were options to prevent negative effects for the fen orchid, but the recoverable area would not outweigh the loss. This situation is shown by the following quote of a regional stakeholder (interview 26):

“Tidal changes will have a negative impact on some flowers like a special kind of orchid. But we understand that we cannot achieve everything, and that there are trade-offs. Tidal changes benefit other areas and improve water quality so we need to accept that.”

7. Developing a tidal power station was a showroom for the region, but there was a lack of clarity about its ‘fish-friendliness’.

Implementing a tidal power plant in the Lake A could improve water conditions and supply energy for 30 000 households. The tidal power plant provided an opportunity for innovation and an export product of delta technology in the water sector. The following quote from a project document shows the opportunities perceived by the government (Project team, 2013):

“The development of a tidal power station is a good example of (multi-functionality): we combine safety, water quality and ecology. Nowadays, we invest together with the region in sustainable energy. The government, research institutes and market parties work together to co-create new solutions for a sustainable society like the tidal power plant. So there is also an option to provide an export product from the Dutch water sector.”

Despite the opportunities of the tidal power plant, the SCBA included the risk of the development of using an unproven technology. The lack of experience implementing a tidal power plant led to uncertainty regarding the effects of the use of bubble screens for the separation of fresh and salt water, and the ‘fish friendliness’ of the solution. It was necessary to make sure that the bubble screen allowed migration of fish from the lakes to the North Sea, to minimize the chance of mortality for fish. The SCBA argued that there was a need for more research to explore the effects of the tidal power plant, but more research required more time, being too late for application within the timeframes of the decision-making process of the ABC Lakes.

8. A connection between the BC Lakes and A Lake offered opportunities for recreation, and fisheries, but it was not clear whether a current problem of dioxin in water could be solved.

Salinizing the BC Lakes, and an open connection between the A Lake and the BC Lakes provided various opportunities. First, an open connection allowed for new sailing routes, positively contributing to recreation. Second, salinizing the BC Lakes could diversify fishing activities because of the increased exchange with salt water from the delta. This increased exchange benefited fish migration between the Lake A and the North Sea, both for

commercial and sport fishing. Last, the improved water quality led to more suitable fishing locations, and a higher level of nutrients for fish.

However, fishermen feared that the connection between the Lake A and the BC Lakes could pollute the water in the Lake A. Due to industrial processes, large quantities of dioxin concentration were released in the environment, negatively affecting the BC Lakes. Since the introduction of a European regulation in 2006, it was banned to commercialize fish produced in waters that presented concentration of dioxins above the norm. The chemical properties of these substances were persistent, and reducing the concentration through natural processes was slow. Since dioxin accumulated in fat, its concentration in 'oily fish' such as eel was very high in polluted areas like the BC Lakes. This situation led to uncertainty about the suitability of the areas for cultivation of mussels and oysters. Shellfish required specific conditions of oxygen concentration, food and flow rates. If this problem was not solved, the production of shellfish farms would not meet European standards, banning the commercialization of catches from those basins. Only after salinization, it could be certain that the water conditions were suitable for the production of mussels and oysters without resulting in a ban for commercialization from the European Union.

9. Tidal changes attracted more experienced divers, but whether or not this would bring more money was questionable.

Modifying the tidal dynamics of the Lake A would change the soil conditions in the lake. These new conditions would make diving sports harder, turning the Lake A into a more attractive destination for experienced divers but less attractive for beginners. Since experienced divers spend more money than beginners, the SCBA considered the potential benefits that a change in visitors' preferences could entail for the recreational sector in the ABC Lakes. Around 0.5 million divers came from abroad.

However, fluctuations in visitors' preferences made it challenging to calculate the benefits for the recreational sector. In the SCBA the effect of an increase in visits of experienced divers on the benefits was negligible and given the uncertainty, it was obviated. The following quote describes the difficulties quantifying benefits for the recreational sector associated to an improvement of water conditions (interview 15):

"It is difficult to calculate financial benefits... If you think about fisheries... you can calculate (the effects) and say: 'I can earn this much by having this production per square meter'... But what would that square meter bring for recreation, or nature? You cannot calculate everything... You can say: 'there will be X number of boats here... and if we improve the water conditions, perhaps so many more people are going to come'. But you don't know how many people."

10. Charging an entrance fee for the natural areas helped to pay for an improvement in nature but it limited accessibility to the area.

Although developing recreational areas could allow paying for the preservation of nature, most of the recreational benefits were for local businesses such as restaurants, hoteliers, or shops. The size and openness of the nature reserve was an opportunity and an impediment to get profit. Charging an entrance fee would allow limiting the number of visits to recreational sites. Furthermore, revenues from visits could help to maintain the environment. In other nature parks, there was a trend to pay an entrance fee to access nature reserves, because tourists who like going to distinct natural areas benefit from preserving them. However, some organizations put up resistance to initiatives like collecting money for parking or admission to the area, based on the principle that nature should be open to the general public and not only to those willing to pay. Fencing the reserve to limit accessibility was not desirable for some regional stakeholders. The intention was to keep nature as accessible as possible, and use natural walls to close off parts of the reserve. This would keep the area open and accessible.

3.4.1. Influence of dilemmas

Throughout the process, actors made sense of the various dilemmas, influencing the attention given to functional combinations. The emergence of dilemmas influenced the formulation of final resolutions. First, investment dilemmas 2, 3, 4, 8, 9 and 10 originated from a lack of clarity about the project effects. The presence of dilemmas led to actors' hesitancy to invest in the project. This hesitancy could result in a lack of commitment from regional stakeholders, jeopardizing financial feasibility. Two years after the start of the process, there was a need to bring 20% of the necessary resources to pay for salinizing the BC Lakes and tidal changes in the A Lake (Cobouw, 2015). The challenge lay on how to overcome the investment dilemmas and encourage the contribution of regional stakeholders despite the uncertainty about the project effects. When the dilemmas emerged, regional stakeholders requested more certainty to become investors. The project team considered that uncertainties about the project effects put at risk the project's financial viability as the following quote shows (interview 20):

“The government waits for the region, the region waits for the government, this is a gridlock and you need to work it out, but there is a lack of trust in some regional parties. For instance fisheries or recreational entrepreneurs.... They say: sure, we think about it, we participate, but we cannot believe in it yet.”

To deal with the hesitancy caused by dilemmas, actors took standpoints about priorities, emphasizing the need to focus on the financial profit of functions (1) to encourage the commitment of regional stakeholders, (2) to ensure the project's feasibility, and (3) to realize an improvement of water quality. The following quote illustrates the emphasis on showing the earning potential of functional combinations (interview 5):

“Everyone sees indispensable to realize the project but there is not enough money. Therefore, this process is necessary to make some feeling of money... When the feeling of money is good, the public goals will be realized and also the project can be organized.”

Dilemmas led to actors placing more attention to functions with a higher financial profit. Having several demands to balance, functions whose financial profit was easily quantified were more attractive because they provided more certainty about the earning potential for regional stakeholders.

Regulation dilemmas 1, 6, 7, and 8 emerged since functions that provided financial profit were detrimental for existing values. Dilemmas 5, and 7 emerged from the dichotomy between transforming the area to realize financial opportunities or preserve existing values like environmental protection. Actors made sense of the regulation dilemmas differently. In dilemma 6, actors accepted the need to make tradeoffs and transform the area in detriment of existing values. For the rest of dilemmas, actors emphasized the benefits of transformation to justify the loss of existing values. At first, actors acknowledged that the project was about improving water quality and identified functions that helped to pay for this improvement. After publishing the first results, dilemmas emerged and the focus shifted to the functions that provided economic opportunities and required an improvement of water quality. This is illustrated by the following quote (interview 13):

“We started with the lack of water quality that required a solution.... Then, we thought that when the situation improves, then there are more opportunities for economic development. (Now) The wish for economic opportunities and development has gained a more important position.... Right now we say: ‘ok, we want to do something related to economic development and that requires improvement in the situation’.”

3.5. Discussion

In this section we first we elaborate on the identified dilemmas reflecting on what constituted them. Second, we describe the interrelationship between the regulation and investment dilemmas. Third, we discuss how actors made sense of the dilemmas and the consequences in the project. Four, we reflect about the limitations of Savini’s framework, and describe our limitations.

Using Savini’s framework allowed understanding what caused the dilemmas. The investment dilemma originated from the need between prioritizing regional demands or the project’s earning potential. In the ABC Lakes, financially risky functions were connected to lucrative ones, thus financial returns could be reinvested to compensate for functions that did not provide a direct financial profit - like improvement of water quality-. Lack of time and limitations associated to the use of economic instruments made it difficult to calculate the integrated project effects. The lack of clarity and certainty about the project effects led to an investment dilemma (dilemmas 2, 3, 4, 7, 8, and 9). Dilemmas 1, 5, 6, and 10 stemmed from the need to integrate functions with different focus and priorities. Some regional demands had a focus on the long term (environmental value or improved landscape) whereas other regional needs required short term considerations (return of investment) causing tensions among competing interests as Janssen-Jansen *et al.* (2013) point out.

Savini *et al.* (2013; 2014) acknowledge the importance of comprehending the interrelation of dilemmas to inform practices that exploit them. We observed an interrelation between the regulation and investment dilemmas. Preserving and transforming the area required both (1) an understanding regional demands and (2) financial resources to ensure its viability. Knowing *what to transform* and *what to preserve* required gaining insights into the regional demands. The investment dilemma arose as a mismatch between functions that provided financial profit and functions that satisfied regional demands. There was a tension between transforming and preserving, and how to understand regional demands to focus on “what mattered” to regional stakeholders, while ensuring that the project was financially feasible (dilemmas 1, 6, and 7). This was a clear example of the “two-hats dilemma” (Needham, 2014) where decision makers had to safeguard spatial quality, while maximizing financial profit.

Actors made sense of the various dilemmas which influenced their attention to functional combinations. First, dilemmas caused actors’ hesitancy to invest; leading to a lack of commitment and jeopardizing the project’s financial feasibility. The challenge lay in how to encourage the contribution of regional stakeholders despite the uncertainty about the project effects. Functions whose financial profit was easily quantified got more attention, disregarding other functions that satisfied regional demands but did not have quantitative effects. When encountering dilemmas actors tend to polarize issues (Storey and Salaman, 2010), emphasizing the positive effects of preferred options and accentuating the negative aspects of less preferred choices. How actors perceived the different dilemmas caused discrepancies between means and ends. Although at the beginning of the process achieving financial profit was a means to improve water quality, over time, financial profit turned into an end. The difficult financial circumstances in the public sector led actors to rationalize the use of multifunctional projects as a practice to compensate a lack of financial resources. Under difficult circumstances, actors tend to justify the use of approaches as a defensive strategy (Savini, 2013). When uncertainties and a lack of clarity became apparent, actors favored quantifiable effects over potential (but uncertain) qualitative impacts (Beukers *et al.*, 2012). Monetizing certain effects would create deceptive confidence, whereas not monetizing them and describing them as uncertain would leave them out of the process (Sager, 2013).

Using Savini *et al.*’s (2013; 2014) framework revealed that opposing forces were necessary to realize the project’s potential. On the one hand, a lack of attention to financial profit jeopardized the financial feasibility of an improvement of water quality. On the other hand, regional support was impossible without attention to regional interests. Simultaneously, the development of new functions to transform the areas and realize economic opportunities was important but, to what extent does transformation affect preservation? Understanding dilemmas sheds light on how considering situations from a dilemmatic perspective leads to a binary treatment of issues, encouraging *black/white* thinking. This propensity stems from the need to encourage commitment to the project. Since decision making and planning require consistency and clarity, practices are inclined towards the polarization of issues (Storey and Salaman, 2010). Black/white thinking usually leads to hesitancy, hiding the opportunities that the conflicting demands could offer if exploited concurrently (Sachs *et al.*, 2006). Exploiting

the potential of dilemmas requires devoting attention to the qualities of both sides of the spectrum (Lewis, 2000; Storey and Salaman, 2010). Actors could benefit from the tensions between conflicting demands, and go beyond the uneasiness of existing dualities. This entails *working with rather than against the dilemmas* (Storey and Salman, 2010; p.13). Exploiting dilemmas requires finding advantages in contrasting choices, in search of strategies to connect their rationales into a new solution (Storey and Salaman, 2010). Surfacing dilemmas involves exploring the underlying issues which caused the dilemma in the first place, to stimulate collaboration (Northcraft and Tenbrunsel, 2011). Debating dilemmas among various actors allows forming an informed understanding of the context. Innovative planning practices like multi-functionality need to allow involving multiple voices and frames, otherwise they will fail to achieve their main rationale.

Our study has some limitations that future research could address. The first limitation is related to the framework that Savini *et al.* (2013; 2014) proposed. The framework does not account for the requirements of different project stages. We could not identify the intervention dilemma. Given the stage of the project at which we became involved, the targets and priorities were already established: water quality and economic development. Stakeholders were involved from the outset in a participatory process but initiatives were within the path-dependencies of governmental procedures (Boonstra and Boelens, 2011). We encourage further research identifying the dilemmas that emerge in different project stages and how they are interrelated. Furthermore, we encourage exploring how the categorization of dilemmas presented by Savini *et al.* (2013; 2014) manifest in planning contexts elsewhere, providing comparative studies.

Although we avoided research bias by collecting multiple data sources, identifying dilemmas depends on the beholder's interpretation. The identified dilemmas might not be a dilemma for other observers. This limitation relates to the reciprocal relationship between dilemmas and interpretations. It is important to provide in-depth studies on how different actors interpret dilemmas and what is the influence of these differences on the decision-making process in multi-actor contexts. Furthermore, our results reveal the importance of examining the role of perceptions of uncertainty for the manifestation of dilemmas. Given the limitations of estimating integrated project effects, how various actors perceive uncertainties influences how the decision making unfolds. Understanding dilemmas better requires comprehending perceptions of uncertainty. Last, we encourage further research that identifies innovative practices that result from the dilemmas. Studies analyzing this would provide insights into the potential of dilemmas to trigger deliberative spaces.

3.6. Conclusion

This research identifies the dilemmas during the decision-making process of a multifunctional project. We drew on Savini *et al.*'s (2013; 2014) categorization of dilemmas: intervention, regulation and investment. We explored the presence of these three dilemmas in a multifunctional project located in the Dutch South West Delta, following a single case study approach. The investment dilemma prevails in multifunctional projects, showing the

difficulties of balancing the need for earning potential to guarantee the financial viability and satisfying other regional demands. Although integrating functions is the strategy to satisfy multiple objectives and ensure the financial viability of the project, the difficulty lies in bridging these two rationales. Furthermore, we reflect on the interrelation of the regulation and investment dilemmas in multifunctional projects. There is a tension between transforming and preserving while having to prioritize regional demands or focusing on earning potential. How actors made sense of the dilemmas influenced the formulation of final resolutions. Actors emphasized financial profitability to ensure the project's feasibility and stakeholder commitment, so dilemmas shifted the attention towards functions that provided a higher financial profit. During our analysis, we did not observe the intervention dilemma. When we started our observations, the priorities and targets were already determined by the government. Our contribution to the current debate about dilemmas in regional planning lies in evaluating a complex case in which multiple actors had to deal with dilemmas to make decisions. The practical relevance lies in creating awareness of the dilemmas encountered during the decision making of multifunctional projects, as a steppingstone for practices that help to exploit the co-existence of conflicting demands.

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Chapter 4

Chapter 4. Exploring the roles of frames in the occurrence of dilemmas: a case study of a regional multifunctional project⁴

Abstract

Dilemmas are situations in which various options look equally desirable or undesirable, without a clear straightforward preferable choice. Although dilemmas have the potential of looking at issues at stake from various perspectives, their occurrence often leads to paralysis and impasse. To realize the potential of dilemmas, it is important to understand their nature and origin. Digging into the origin of dilemmas helps to understand what caused the dilemma in the first place, as a stepping stone to identify strategies that help to bridge seemingly competing choices. This study uses the theoretical lens of ‘frames’ to explore the role of multiple interpretations in the occurrence of dilemmas in a multifunctional project. Frames are the schemata of interpretation that actors use to interpret issues at stake. We follow a case study approach to evaluate a project in the South West Delta in the Netherlands. Our results show a dual role of frames. Decision-making processes often have intrinsic dilemmas that remain concealed until the interaction of actors’ frames surfaces them. At the same time, however, the co-existence of various frames leads to new dilemmas since diverse actors prioritize and prefer different courses of action. Comprehending frames helps to surface dilemmas, which encourages the vetting of ideas and the incorporation of multiple views.

4.1. Introduction

Decision making often entails the consideration of multiple choices that have equally desirable and undesirable effects; frequently leading to dilemmas. In the management literature, dilemmas are situations in which actors must choose between two seemingly incompatible courses of action (Sachs *et al.*, 2006), thus actors have to deal with contradictory choices, each with rewards and shortcomings. As a result, dilemmas often lead to paralysis and impasse in decision-making processes. However, the occurrence of dilemmas helps to reassess issues at stake and incorporate multiple perspectives. Organizational scholars have emphasized the importance of understanding dilemmas (Calton and Payne, 2003; Beech *et al.*, 2004; Höijer *et al.*, 2006; Lüscher and Lewis, 2008; Smith and Lewis, 2011; Northcraft and Tenbrunsel, 2011) to stimulate collaboration and deliberation. Digging into the origin of dilemmas helps to

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understand what caused the dilemma in the first place, as a stepping stone to identify strategies that help to bridge seemingly competing choices.

Dilemmas often originate from the coexistence of various conflicting interpretations about a decision that is being made. Frames are the structures of interpretation that influence how actors make sense of complex situations (Goffman, 1974) and that form what actors consider to be at stake and their desired courses of action. Particularly, making a collective decision requires involving various actors and their corresponding frames about what is going on and what should be done (Kaplan, 2008). This leads us to consider that frames have an influence on the occurrence of dilemmas.

Previous debates have already pointed at the relationship between frames and dilemmas (Clegg *et al.*, 2002; Smith and Lewis, 2011; Northcraft and Tenbrunsel, 2011). Although these studies provide insights into the occurrence of dilemmas in contexts where actors hold different interpretations, studies that empirically explore how frames influence the occurrence of dilemmas are rare. Our goal is to add to these studies and expand knowledge regarding the role of frames in the occurrence of dilemmas. In this study, we empirically explore the role of frames in the occurrence of dilemmas in a multi-actor context. In particular, we explore (1) how intrinsic dilemmas surface through the interaction of actors having different frames about issues at stake, and (2) how the co-existence of multiple frames leads to dilemmas in decision making. This way, we shed light into the origin of dilemmas, to help to identify strategies that bridge seemingly competing options.

To this end, we carried out an in-depth case study. Our case is a multifunctional regional project located in the South West Delta in the Netherlands. This project combines an improvement of water quality with various functions namely agriculture, transport, energy, real estate, recreation, ecology, and fisheries. The 18 actors involved in the decision-making process interpreted the project differently and encountered dilemmas when identifying and selecting functional combinations to implement in the project. Our findings extend previous literature and reveal that there are two ways in which frames influence the occurrence of dilemmas.

First, certain situations requiring a decision have intrinsic dilemmas that only surface through the interaction of actors that interpret the project under different frames. Choices have potential consequences which can be perceived as positive or negative by the actors involved in the decision making process. When actors that interpret the consequences of these choices through different frames interact, these intrinsic dilemmas surface. Second, differences in actors' frames about issues at stake can lead to dilemmas since actors have different priorities, and prefer dissimilar courses of action. Our study shows that surfacing frames enables making dilemmas explicit, since frames reveal the different orientations in the project. We conclude that differences in frames cause dilemmas, and at the same time are the vehicle through which dilemmas surface.

This paper is organized as follows. First, we provide an overview of literature about dilemmas, and frames. Second, we describe our research method. Third, we present our findings. Fourth, the discussion section reflects about our research results in the context of literature about organizational frames, dilemmas, and reflecting on the implications for multifunctional projects.

4.2. Dilemmas and frames

Dilemmas are situations in which there are competing choices, each with advantages and disadvantages (Smith and Lewis, 2011). A dilemma involves a difficult choice, either because all available alternatives have undesirable consequences, or because of the need to meet irreconcilable demands (Höijer *et al.*, 2006). For decades, dilemmas have played a prominent role in planning studies and decision making literature (Rittel and Webber, 1973; Höijer *et al.*, 2006; Savini, 2013; Savini *et al.*, 2014) and in organization science (Smith and Lewis, 2011; Northcraft and Tenbrunsel, 2011; Dye *et al.*, 2014). Some authors have acknowledged that dilemmas are the interaction of two opposing forces that constitute a ‘force field’: they are complementary and exert a reciprocal influence (Sachs *et al.*, 2006). Other authors have acknowledged that dilemmas emerge as a result of situations that require an immediate action in circumstances of limited information (Maitlis and Christianson, 2014). Gibbs and Krueger (2012) refer to Bevir and Rhodes (2006) and state that dilemmas are tensions between new ideas and existing beliefs or practices, forcing actors to reconsider their existing beliefs. Dilemmas often appear as an ‘either/or’ situation (Cameron and Quinn, 1989; Storey and Salaman, 2010), being resolved through the acceptance of a certain tradeoff. Treating dilemmas as either/or situations requires dealing with various solutions, posing benefits and limitations (Poole and Van de Ven, 1989). Confronted with dilemmas, actors encounter excluding options, difficult choices, and seemingly irreconcilable orientations (Küpers, 2014). Often, actors perceive that dilemmas lead to inefficiency and a sense of paralysis because they imply making a choice between polarities with high costs as well as valued benefits (Lüscher and Lewis, 2008). The presence of dilemmas frequently causes situations in which it is not clear which course of action to follow. Consequently, in light of a dilemma, there is no straightforward fix or solution. Creating awareness about dilemmas to realize their potential requires understanding their origin. Understanding who is involved in a dilemma and how the dilemma occurred is essential to seek a strategy to deal with the dilemma (Northcraft and Tenbrunsel, 2011).

To understand the origin and nature of dilemmas, the goal of this study is to explore the role of frames in the occurrence of dilemmas. Frames guide how actors interpret situations, and define what is relevant and what is not (Goffman, 1974; Lewicki *et al.*, 2002; Kaufman *et al.*, 2003). Consequently, frames are central to organize ideas, to make sense of relevant events, and to show what actors interpret as being at stake (Gamson, 1992). The interpretation of relevant aspects influences the choices that stakeholders prefer and make during decision-making processes. Last years, there has been a body of knowledge analyzing the influence of frames on multi-actor environments (Dewulf *et al.*, 2004; Dewulf *et al.*, 2009), on strategic

choices (Kaplan, 2008), environmental conflicts (Lewicki *et al.*, 2002, Brugnach *et al.*, 2011), and multifunctional projects (Matos Castaño *et al.*, 2015). Involving various stakeholders in decision-making processes requires considering multiple worldviews and differences in frames (Dewulf *et al.*, 2004, Brugnach *et al.*, 2008, Brugnach *et al.* 2011). As Dewulf *et al.* (2004, p.178) states: ‘different stakeholders will understand the situation differently, prioritize different problems, include or exclude different aspects, and favor different kinds of solutions’. Using frames as a theoretical lens helps to understand how actors make sense of specific issues, and select what is relevant to them (Putnam and Holmer, 1992). Drawing on research about social movement organizations (Benford and Snow, 2000), Kaplan (2008) evaluated the interactional nature of frames, particularly focusing on how different actors interpret what is going on in a certain situation (diagnostic frame), what should be done (prognostic frame), and why some frames prevail over others. The presence of different diagnostic frames entails prioritizing different aspects of the issues at stake. At the same time, the presence of various prognostic frames results in the existence of multiple desirable courses of action. Consequently we can infer that differences in actors’ diagnostic and prognostic frames have an influence in the occurrence of dilemmas, although this influence has been unexplored in previous literature.

Although a number of studies (Billig *et al.*, 1988; Höjjer *et al.*, 2006; Smith and Lewis, 2011) have highlighted the importance of understanding the nature and preconditions of dilemmas to realize their potential, empirical studies exploring how the co-existence of frames has an influence on the occurrence of dilemmas are rare. To date, most of the studies focus on understanding frames in multi-actor contexts (González and Healey, 2005), or dilemmas (Savini *et al.*, 2013; 2014) separately. Furthermore, studies that touch upon the relationship between frames and dilemmas present two views. One view looks at dilemmas as being intrinsic to a decision-making process, but surfacing through the interaction of actors’ frames. The second view looks at dilemmas as the result of the presence of multiple frames.

First, some authors acknowledge that dilemmas are intrinsic to a decision-making process, but it is through the interaction of frames that they surface. Decision-making processes are often characterized by the simultaneous presence of positive and negative effects (Højjer *et al.*, 2006). The extent to which the co-existence of these intrinsic dilemmas surface depends on the interaction of actors’ frames in decision-making processes. Smith and Lewis (2011) acknowledge that the presence of a multiplicity of views or interpretations about the situation requiring a decision surfaces dilemmas. In other words, it is through the interaction of actors in the decision-making process that dilemmas *surface*, otherwise they would remain concealed.

Second, other authors acknowledge that dilemmas originate from the co-existence of multiple interpretations in a decision-making process. Decisions require balancing the demands of stakeholders that have different frames, which raises the question of how conflicting preferences can be reconciled (Dye *et al.*, 2014). An important part of decisions relates to how actors interpret both, the issues at stake and the significance of their choices (March, 1994). Frames enable actors to filter what is important in a given situation, prioritizing different issues (Smith and Tushman, 2005). In multi-actor contexts there are multiple sensible interpretations of a problem situation, leading to more than one desirable course of action to choose that

eventually originates dilemmas. Consequently, dilemmas often originate from the co-existence of multiple frames (Storey and Salaman, 2010), because different actors interpret differently which things are worth aiming for and which should be avoided (Höijer *et al.*, 2006). For example, in the planning literature Salet *et al.* (2013) have acknowledged that bringing together various actors with different strategic perspectives on the project goals and means can lead to a number of dilemmas. In this view, the presence of different frames *causes* dilemmas, since frame differences *cause dilemmas to exist*.

Either way, dilemmas do not occur in the vacuum but as part of a larger social context in which actors interact. The presence of dilemmas often leads to not knowing which course of action to follow. In this study, we explore the role of frames in the occurrence of dilemmas by empirically analyzing (1) how intrinsic dilemmas surface through the interaction of actors having different frames about issues at stake, and (2) how the co-existence of multiple frames leads to dilemmas in decision making. A focus on the interactions of actors having dissimilar frames and exploring how this dissimilarity causes dilemmas is a fruitful avenue to explore and attain a greater understanding of the link between frames and choices that actors make.

4.3. Method

To achieve our research goal, we followed a case study approach (Yin, 2013). A case study allows exploring and analyzing a specific phenomenon in depth (Flyvbjerg, 2006). Our case is the ABC, a multifunctional project located in the South West delta in the Netherlands. Multifunctional projects combine various socio-economic activities and functions in the same area (Priemus *et al.*, 2000; Heeres *et al.*, 2012; Karaca *et al.*, 2013; Milestad *et al.*, 2014; Moriarty and Honnery, 2014). Multifunctional projects offer opportunities to satisfy public and private objectives by combining resources from the government and market parties. In multifunctional projects revenues flow across functions, and distribute financial gains among different actors. As a result, the decision-making process of multifunctional projects is characterized by great interdependence, with blurred boundaries between public, private, and semi-public actors. Identifying and selecting functional combinations require constant interaction between actors given the need to exchange resources and negotiate about a final solution in the project (Van Broekhoven *et al.*, 2014). Since multifunctional projects involve actors that belong to different sectors, disciplines, and administrative levels, actors have dissimilar interpretations of what is at stake and what should be done in the project. In other words, actors have different frames. Multifunctional projects seem an ideal case to understand the role of frames in the occurrence of dilemmas because of the strong interdependences of actors having different frames that need to combine their resources to implement the project.

We selected the ABC project based on three main criteria. First, the ABC combines multiple functions to satisfy environmental, economic, social, and flood protection demands. Second, the project involved more than 18 public, private and semi-public actors in the process of identifying and selecting functional combinations. Third, the decision-making process started

at the beginning of our research, allowing us to observe meetings and get access to the project documents that actors exchanged during the process.

The ABC was concerned with three lakes located in the South West Delta in the Netherlands. For decades, water quality in these basins had deteriorated. Previous studies showed that the BC Lakes were suffering from a blue algae problem. In the A Lake, the problem was related to oxygen deficiency. These problems threatened the life of flora and fauna in the area, worsened the landscape, and negatively affected the economic activities in the area around the ABC. Additionally, the current water conditions caused that the basins did not comply with the existing policies influencing developments in the South West Delta.

In 2012, there was a political decision to set up a decision-making process in cooperation with regional stakeholders to explore the opportunities for the region to improve water quality. A formal process started in 2013. Improving water quality in the ABC required changing the tides in the A Lake and salinizing the BC Lakes. However, these projects were costly, and the public sector did not have resources to finance them. Consequently, the decision-making process of the ABC focused on identifying and selecting functional combinations that could help to fulfil regional demands, and ensure the financial viability of the project. These functions were: recreation, fisheries, agriculture, housing, transport, energy.

4.3.1. Data collection

In 2013, we became involved as observers in the decision-making process to identify and select functional combinations for the ACB. We attended 21 meetings of the team responsible for the financial-economic and political administrative aspects of the project. From now on, we will call this team the ‘financial-administrative team’ (FA team). The team consisted of 11 members: 5 members from provincial organizations, 5 representatives of national organizations, and an independent process manager. Since we were involved in the project meetings, we got access to more than 400 documents. These were internal and external communications, policy documents, and evaluation project reports.

Besides observing the meetings we collected individual cognitive maps from participants (Eden, 1988) to understand the frames of actors involved in the decision-making process. Cognitive maps are sets of concepts forming a network of nodes, arrows, or links to represent their relationships. The formal basis of cognitive maps derives from personal construct theory (Kelly, 2003) which proposes an understanding of how people “make sense of” their world by seeking to manage and control it. There are several cognitive mapping methods that we could apply for our research. In our case, we use the Conceptual Content Cognitive map (3CM) exercise. This exercise has been widely used in the field of natural resource management (Kearney *et al.* 1999, Kearney and Gordon 1998, Tikkanen *et al.*, 2005, Biedenweg and Monroe, 2013) to explore the interpretations of individuals, and the differences of individuals in those interpretations. We chose this method because (1) it was useful in assessing people’s perspectives concerning complex domains, and (2) it focused on important factors for participants, providing links between factors through a process of exploration (Kearney and Kaplan, 1997). During our individual meetings, we brought a pin-board with pins, post-its and

a woolen yarn to create the connections. This way, participants could create their cognitive maps by themselves with the guidance of the interviewer (the first author of this paper). We started by asking participants to list items they believed to be important about a specific issue – in this case, the ABC project. The second step was to ask participants to sort the aspects in separate piles according to how they thought they should go together, giving a name to these groups. Third, we requested to provide a link between the groups that actors identified. Once the map was complete, we asked participants for an explanation about the map that they developed, allowing for a structured narrative about their perceptions. We ended the individual meeting asking participants for a description about their organizations, their role in their organization, and in the project in particular.

Figure 5 Cognitive map created by participant in the pin-board

We obtained cognitive maps from 10 of the 11 members of the FA team at different points of time. The first round took place at the beginning of the decision-making process, and the second round was 6 months later, after the publication of the first process results. The reason behind selecting these two points of time was to gain insights into the project over time, comprehending how the process unfolded. In round 1, it became clear that regional stakeholders, external to the FA team, were central to the decision-making process. Consequently, in round 2, we collected the cognitive maps of the FA team, and also the cognitive maps of members of regional stakeholders like: water boards, municipalities, representatives of different sectors (agriculture, recreation, fisheries, nature organizations, energy, and fresh water supply).

In total, we held 30 individual cognitive mapping meetings. These meetings took from 25 minutes to 1.5 hours. We recorded and transcribed the narratives of participants describing the cognitive map that they developed. Figure 6 summarizes our process of data collection and analysis.

Figure 6. Overview of data collection and analysis

4.3.2. Data analysis

Our data analysis was iterative and involved constant comparison between the data and our theoretical framework. We conducted the analysis of the data in several steps. With the help of a software for qualitative data analysis (Atlas.ti), we chronologically ordered the project documents. To get a general idea of the important activities during the decision-making process, we created a timeline of the project events since the early 2000s. In this timeline, we identified activities of actors related to (1) study of problems in the ABC and the outputs of these studies, and (2) activities in 2013 and 2014 focusing on defining functional combinations. Creating the timeline allowed us to identify two required decisions around which most of the project activities revolved: (1) salinization of the BC Lakes and (2) tidal changes in the A Lake.

Then, we analyzed the cognitive maps. We digitally represented the maps using the Cmap software, specifically developed for cognitive mapping. We used this software because it allowed us to get an overview of nodes and connections in maps. Then, we created a database with the elements that the cognitive maps included. The data analysis provided 160 concepts, 94 categories, and 77 relationships among categories.

We created a database with elements of the individual cognitive maps of the FA team, for rounds 1 and 2. Then, we focused on comparing across rounds and participants of the FA team. The maps contained elements of different semantic nature, since we used the open 3CM technique which does not provide any predetermined category. Despite their differences, the FA team's cognitive maps also had some similarities (i.e. focus on 'financial' and 'earning potential' aspects). We analyzed the maps and narratives seeking patterns in how participants framed the salinization of the BC Lakes and the tidal changes in the A Lake. Although we found some individual differences in the individual maps, we soon became aware that there was unanimity within the team about 'what was going on' (diagnostic frame) and 'what should we done' (prognostic frame) in the situation requiring a decision, and the required decisions (salinization and tidal changes). Consequently, we created a table with the shared frames in the FA team, providing codes to those frames as we show in the next section of this study. Since we observed similarities across all the participants in the FA team, we decided to treat them as a single actor for the purpose of this paper. This was possible since the main differences in the maps did not influence their similarities. Since the FA team had a shared objective in the process, it was appropriate to establish a comparison between those organizing the process,

and those being part of it (regional stakeholders). After identifying ‘what was going on’ (diagnostic frame) and ‘what should be done’ (prognostic frame) from the perspective of the FA team, we focused on understanding to what extent these frames were different for regional stakeholders. We identified and selected the stakeholders involved in making a decision for an improvement in water quality in the ABC, and focused on understanding the differences between the frames of the FA team and the regional stakeholders.

In the next stage, we went back and forth to the timeline of events, and the project documents stored in Atlas.ti. Our focus was on identifying dilemmas occurring in the setting requiring decisions in the ABC, particularly regarding the salinization of the BC Lakes and the tidal changes of the A Lake. Project reports included ex-ante evaluation assessments of salinization and tidal changes. Consequently, analyzing the project reports allowed identifying the positive and negative effects of salinization and tidal changes, revealing the intrinsic dilemmas. Since we collected the cognitive maps of regional stakeholders and FA team in round 2, we pinpointed how the FA team and regional stakeholders were framing these competing outcomes, and how the process unfolded because of different frames.

Then, we focused on extracting how various actors framed the salinization and tidal changes differently. We identified how the FA team and regional actors prioritized different issues in the settings requiring a decision (diagnostic frames), and preferred dissimilar courses of action (prognostic frames). Evaluating the project documents allowed us to see moments of impasse, or issues that were being debated because of the divergent frames of actors. Since the project attained great attention in the local and national media, we looked for online articles referring to moments of impasse that confirmed the existence of a dilemma and actors dealing with it. Consequently, we could trace back how frame differences were leading to dilemmas for salinization of BC Lakes and tidal changes in the A Lake.

During analysis, we were constantly going back and forth to the project documents, and writing memos about what happened in the process and our ideas about it. This helped us to gain a deeper and clearer understanding of the project and its decision-making process. Having different sources of data allowed us to validate the research results presented here. In the next section we present our findings. We illustrate actors’ frames by providing quotes and by showing cognitive maps of some of the participants to give evidence of our claims. For the FA team, we illustrate their frames by showing individual maps of its members as a representation of the frames of the overall FA team.

4.4. Results

This section describes our research results. We elaborate on the two main required decisions in the ABC project: salinization of the BC Lakes and tidal changes in the Lake A. For each situation requiring a decision we elaborate on the different diagnostic and prognostic frames of actors to explain how actors interpreted what was going on and what should be done in the project. Then, we elaborate on how the interaction of actors and their frames underscored different dilemmas. Table 5 summarizes our research results.

Table 5 . Summary of research results

Required decision	Situation requiring a decision	Actor	Diagnostic frame (what is going on?)	Prognostic frame (what should we do?)	Dilemma
Salinization BZ Lakes	1A: Salinizing is good for economic activities but it reduces fresh water supply.	FA Team	Financial Fresh water supply	Financial Compensation	<ul style="list-style-type: none"> Intrinsic dilemma surfacing because of the interaction of various frames <i>Dilemma 1</i>: Salinize the BC Lakes, look for alternatives or wait until the water conditions improve because of the presence of the quagga mussel.
		Representative agricultural sector	Fresh water supply	Compensation Alternatives	
Tidal changes A Lake	1B: Salinizing requires financial resources from regional stakeholders	FA Team	Financial	Financial	<ul style="list-style-type: none"> Dilemma caused by differences in actors' frames. <i>Dilemma 2</i>: Focus on functional combinations that provide maximum financial profit or prioritize avoiding overexploitation of nature.
		Coalition environmental organizations	Nature	Nature	
	2A: Tidal changes have financial and environmental benefits, but they have detrimental effects for some other environmental values. 2B: Calculating effects of tidal changes requires time but there is time pressure.	FA team	Financial	Financial	<ul style="list-style-type: none"> Intrinsic dilemma surfacing because of the interaction of various frames <i>Dilemma 3</i>: Change the tide in 50cm or change the tide in 30cm.
		Coalition environmental organizations	Nature	Trade-offs Alternatives	
		FA team	Financial	Financial	<ul style="list-style-type: none"> Dilemma caused by differences in actors' frames. <i>Dilemma 4</i>: Make a decision in the short term to get political support or wait until getting clarity about the effects of tidal changes in the water conditions and economic benefits.
		Recreational sector	Political urgency	Short term	
		Fisheries sector	Financial	Provide clarity fish-friendliness of tidal power-plant	

4.4.1. Salinizing the BC Lakes.

In this section, we elaborate on two dilemmas related to whether or not to salinize the BC Lakes. Dilemma 1 surfaced as a result of the interaction of actors having dissimilar frames. Dilemma 2 was caused by differences in actors' frames about the situation requiring a decision.

The main actors involved in these dilemmas were the FA team, the representatives of the agricultural sector, and environmental organizations. First, the FA team was responsible for the administrative financial aspects of the project to make a decision about the functional combinations to develop in the area. Second, the representatives of the agricultural sector safeguarded that the decisions made within the project were not detrimental for the farmers in the region. Having more than 3000 ha of farm land in the area, this was an important lobby group in the project. Third, environmental organizations created an alliance of 10 actors (the Coalition Delta Nature) that aimed at incorporating ecological interests to the decisions. The Coalition Delta Nature was responsible to safeguard the estuarine conditions of the lakes, and the habitat for flora and fauna in the area of the ABC. Apart from being an important influence group in the country, environmental actors owned part of the area surrounding the ABC Lakes. Consequently, getting their support for the project was important to realize an improvement of water quality.

Dilemma 1. Salinize the BC lakes or wait for an improvement of water quality

The first dilemma was whether to salinize the BC Lakes or wait for an improvement of water quality because of the introduction of a special mussel that improved water conditions. The interaction of two groups of actors with different frames caused this dilemma to surface. The groups of actors were: the FA team and the representatives of the agricultural sector. We first introduce the background of the situation requiring a decision and then the frames of these two groups of actors.

Salinizing the lakes would have positive and negative effects on different areas. Studies developed in the early 2000s showed that salinization of the BC Lakes would reduce blue algae; improving water quality and having positive and negative effects for different sectors. For example, reports like the social cost benefit analysis (SCBA) in 2012 discussed the benefits of salinization for the recreational and the transport sectors among others. Improving water quality could reduce odors and enhance the landscape. This improvement would make the area more attractive for visitors, leading to more use of the accommodation facilities. In the SCBA, the estimation of the benefits for the recreational sector was 4 million euro. For the transport sector, the salinization of the BC Lakes would allow for an open navigable connection. This connection would reduce the waiting times for ships in 11 minutes, leading to benefits of around 10 million euro.

Despite the benefits for different sectors, the salinization of the BC caused a reduction of fresh water supply. The BC supplied water for important agricultural areas in the Dutch South West Delta. Furthermore, the area was included in the Natura 2000 policy, and the Delta Program Policy guidelines. One of the targets of these guidelines was to ensure the availability

of fresh water. In case the BC Lakes were salinized, farmers in the region required a financial compensation for the loss of fresh water supply. Moreover, since 2006, the water quality in the BC Lakes had improved because of the introduction of the ‘quagga mussel’. This type of mussel filtered and cleaned the water, improving the conditions in the BC Lakes. Yet, it was unknown whether this improvement was permanent.

The interaction of two groups framing the positive and negative effects of salinization caused this dilemma to surface. These groups were the FA team and the representatives of the agricultural sector. While assessing the effects of salinization of the BC lakes, the FA team had a ‘financial’ diagnostic frame. This frame led them to interpret that the priority in the process was to revitalize the area and realize the economic opportunities of an improvement of water quality. Moreover, since the project was part of the Delta Program, and one of the main priorities of the policy framework was to safeguard available fresh water supply, the FA team had a ‘fresh water supply’ frame. This diagnostic frame led the FA team to interpret that fresh water supply should be central to the decision of whether or not salinizing the BC Lakes.

The ‘financial’ and ‘fresh water supply’ diagnostic frames shaped the prognostic frames of the FA team. First, the FA team had a ‘compensation’ prognostic frame. Based on this frame, the FA interpreted that, in case the BC Lakes were salinized, it was important to financially compensate the agricultural sector for the reduction of fresh water supply. Furthermore, since compensation required money, the FA team had a financial prognostic frame. Guided by this prognostic frame the FA team considered it as desirable to focus on the earning potential of functional combinations associated to an improvement of water quality to (1) get enough financial commitment from regional stakeholders to pay for salinization, and (2) justify the benefits of salinization against the loss of fresh water supply. This is illustrated by the following quote (interview 18):

“It is important to know the earning potential for the government, and the value for other parties in the region. What are we going to earn and what helps to increase the commitment of regional stakeholders? Then you need the numbers and the earning potential.”

For its part, being responsible to safeguard the interests of farmers in the region, the representatives of the agricultural sector had a ‘fresh water supply’ diagnostic frame. Similar to the FA team, the representatives of the agricultural sector had a ‘compensation’ prognostic frame with a focus on getting financial resources to compensate for a reduction in fresh water supply as the following quote illustrates (interview 14).

“Salinizing the BC Lakes will reduce the available fresh water supply. Many levels of government and nature organizations consider salinization beneficial. For us, it is ok, but we need to have enough fresh water supply. And that costs money. And there had to be money for this... and when we trust there will be money, we are ok with it.”

This passage is illustrated by Figure 7. Figure 7 is a cognitive map of a representative of the agricultural sector (interview 14). We have highlighted the nodes ‘trust’ and ‘financial’ that illustrate the ‘fresh water supply’ diagnostic frame, and the ‘compensation’ prognostic frame.

Figure 7 Cognitive map of a representative of the agricultural sector (interview 14)

However, there was a main difference between the prognostic frames of the FA team and the representatives of the agricultural sector that surfaced an intrinsic dilemma. While the FA interpreted as important to focus on the financial opportunities of salinization, the representatives of the agricultural sector interpreted as desirable exploring alternatives to salinization. To them, given the introduction of the quagga mussel, instead of focusing on showing the financial profitability of salinization, it was desirable to look for alternatives to salinization to avoid losing fresh water supply as the following quote illustrates (interview 14).

“Given that the problem related to blue algae has been stabilized over the years because of the introduction of the quagga mussel, we should consider whether or not salinizing the lake is still necessary to improve water quality.”

Salinizing the BC Lakes had positive and negative effects. On the one hand, salinization could provide economic opportunities for the region. On the other hand, it reduced available fresh water supply. This intrinsic dilemma surfaced as a result of the different diagnostic frames of actors. First, the co-existence of ‘financial’ and ‘fresh water supply’ diagnostic frames surfaced the relevance of both priorities in the process. Second, the coexistence of various prognostic frames underscored the desirability of two opposing courses of action. On the one hand, the FA team framed the desirability of focusing on showing the financial profitability of salinization to justify a potential loss of fresh water supply. On the other hand, the representatives of the agricultural sector framed that looking for alternatives and waiting could be a desirable course of action, given the existence of the quagga mussel. The main dilemma was whether it was worth salinizing the lakes despite the negative effects for the agricultural sector (but losing the potential economic opportunities that a salinization could offer for the

region), or it was preferable to wait for an improvement in water because of the quagga mussel.

Dilemma 2. Focus on financial profit or avoid overexploitation of nature.

The second dilemma was whether to focus on the development of financially profitable functions or to prioritize environmental values and avoid an overexploitation of nature. The interaction of the FA team and environmental organizations framing the salinization of the BC Lakes differently caused this dilemma.

The government did not have the financial resources to pay for salinization of the BC Lakes on their own. When confronted with the question of whether or not it was desirable to salinize the BC Lakes, the FA team had a ‘financial’ diagnostic frame. This diagnostic frame led the FA team to see the financial viability of the project as key to make any decision about the future in the ABC. Figure 8 shows the ‘financial’ diagnostic frame of the FA team. We highlighted the left node, called ‘financial strategies’, which is directly linked to the decision-making process and includes elements like ‘an offer you can’t refuse’ or ‘involvement of shareholders’ showing the emphasis that the FA team gave to financial issues requiring contribution of regional stakeholders.

Figure 8 Cognitive map of member of FA team (interview 21)

As a result of this diagnostic frame, the FA team had a ‘financial’ prognostic frame, as described in the previous section. The FA team framed that encouraging the contribution from regional stakeholders required showing the earning potential of functions so actors would be interested in investing in the project. To this end, they devoted their efforts on seeking functional combinations with a focus on financial profitability. Particularly, the FA team developed business cases, and SCBAs that calculated the profit for regional stakeholders. Throughout 2013, the FA team developed four business cases for the salinization of the BC Lakes including a financial analysis for recreation, fisheries, urban development, and energy. For the tidal changes of the Lake A, there were two business cases for fisheries and the recreational sector. The ‘financial’ prognostic frame is illustrated by the following quote (interview 24):

“You need economic instruments to get an idea of the social effects of the project. The business cases show the cash flows. And I think that in these days in which there is not much money, the business case is the most important. We want something in the region from a social point of view, but what does that mean regarding money? How can we pay for that? That is a very important challenge in the project.”

At the end of 2013, business cases showed the effects of salinization for different sectors. For example, fisheries provided the highest benefit earning 93% of the total profit. The development of wind turbines could provide a benefit of nearly 15 million euro. The FA team, based on the ‘financial’ diagnostic frame was enthusiastic about these results. However, the results of the economic instruments showed that the development of fisheries or wind turbines in the BC Lakes could put nature under pressure. Furthermore, large production of fish could disturb the living conditions of flora and fauna, and the development of wind turbines in the BC Lakes could be a disturbance for birds.

Developing functional combinations required the contribution and support of regional stakeholders including environmental organizations. Environmental organizations had a ‘nature’ diagnostic frame. To them, the priority of improving water quality, and salinizing the BC Lakes was to recover the estuarine conditions of the lakes, and safeguard existing environmental values. When the first results of the business cases and SCBAs were ready, environmental organizations interpreted that improving water quality was important, but not at any price. Consequently they called into question the development of functions that could be detrimental for nature. The following quote illustrates this ‘nature’ prognostic frame (interview 16):

“There are things that you want but not at any price. Two years ago, it was very clear what we wanted: reduction of tide in the A Lake, salinization of the BC.... But now we see how they plan to finance it: everywhere wind turbines, housing, also in nature areas, hundreds of acres of new production area for the fisheries... and the attention to (other values) has decreased.”

The differences in the diagnostic and prognostic frames of the FA team and nature organizations caused dilemma 2. While the FA team framed as important to identify and develop functional combinations with a focus on financial profit, nature organizations framed as important to preserve environmental values and avoid functional combinations that could overexploit nature areas. Since both, the support of environmental organizations and financial resources were necessary to improve water quality, actors in the ABC project faced a dilemma caused by their different frames. This dilemma consisted of whether to focus on financial profitability of the functional combinations to get financial profit or to avoid an overexploitation of nature and focus on the preservation of existing nature.

4.4.2. Tidal changes

The next two dilemmas are related to the decision of changing the tide in the A Lake. Dilemma 3 surfaced as a result of the interaction of actors having dissimilar frames. Dilemma 4 was caused by differences in actors’ frames about the situation requiring a decision.

Dilemma 3 was related to the effects of changing the tide in the Lake A despite the detrimental effects on some environmental values. Dilemma 4 was related to the need of time to provide clarity about the effects of tidal changes, while having to make a decision in the short-term to get political support for the project. We first provide a brief description of the actors involved in the occurrence of these dilemmas, and we then elaborate on the interaction among actors' frames and the occurrence of both dilemmas.

The main actors involved in these dilemmas were the FA team, environmental organizations and entrepreneurs in sectors like recreation or fisheries. We described the first two groups of actors in the previous section. The latter group of actors were representatives of regional market parties with an interest in changing the water conditions in the ABC area to realize economic opportunities and obtain return of investment.

Dilemma 3. Change the tide in 50cm or change the tide in 30cm.

The third dilemma was related to the decision whether to change the tide in 50 cm or in 30cm. Although tidal changes could provide economic opportunities for the region, they could also be detrimental for environmental values. The interaction of the FA team and the environmental actors framing these effects differently caused this dilemma to surface.

Previous studies showed that changing the tide in the Lake A had both positive and negative effects. For example, tidal changes could improve water conditions and allow for the development of a tidal power plant that could supply energy for 30 000 houses. Furthermore, changing the tide in 50 cm could improve water conditions, and make the area more attractive. The environmental impact assessment (EIA) showed a positive impact on aquatic living conditions, birds (both for breeding and winter migrating species), and other species such as seals, and porpoises. These changes would have a positive effect on fisheries and recreation. For the fisheries sector, business cases showed that tidal changes would offer extra 200 ha of fish production. For the recreational sector, tidal changes would allow for extra 300 places for accommodation. Yet, an introduction of the tide would have negative impact on wet dunes and the protected 'fen orchid' among others. The A Lake was the main habitat of this kind of flower, endangered and part of the Natura 2000 policy.

Differences in frames of the FA team and the environmental organizations underscored a dilemma. First, the FA team had a 'financial' diagnostic frame. Although they did not disregard environmental aspects, their frame shaped their interpretation focusing on the financial profitability of functions to guarantee that an improvement of water quality occurred. Consequently, the FA team had a 'financial' prognostic frame. The FA team devoted their efforts on showing the benefits for functions like the tidal power plant, emphasizing that the innovativeness of a tidal power plant could be an export product for the Dutch Water Sector, attracting visitors and international attention. To illustrate the financial prognostic frame we include the following cognitive map of a member of the FA team in Figure 9. In the map, the nodes 'orientation', 'opportunities to earn' and 'support' include elements focusing on issues like earning potential for the government, exploration for the market and feasibility of the projects.

Figure 9 Cognitive map of member of FA team (interview 18)

Environmental organizations had a ‘nature’ diagnostic frame. Based on this frame, environmental groups interpreted that tidal changes were desirable, at the expense of terrestrial nature of an internationally recognized value like the fen orchid. Interpreting this situation with their ‘nature’ diagnostic frame, environmental organizations considered that they were at a crossroads, as the following quote shows (interview 26):

“Tidal changes will have a negative impact on some flowers in the island like a special kind of orchid. But we understand that we cannot achieve everything, and that there are trade-offs. The tidal changes benefit other areas improve water quality so we need to accept that...”

Figure 10 illustrates the ‘nature’ diagnostic frame of a member of the environmental organizations. The central node ‘improvement of the system’ is directly connected to the node ‘natural values’, revealing the emphasis on improving water quality to benefit natural values in the region.

Figure 10 Cognitive map of a member of an environmental organization (interview 28)

Under these circumstances, environmental actors interpreted that it was important not only to focus on the positive financial impact of functional combinations, but also consider the negative effects to balance the potential trade-offs of changing the conditions in the water. Regarding the decision of whether or not implementing tidal changes, they interpreted that the project's focus was moving from improving water quality to maximizing financial profitability through the development of functions like the tidal power plant. Although environmental actors did not have any objection to develop a tidal power plant, they interpreted as a concern that the process's priorities could shift, reducing attention to environmental aspects as the process evolved. This is illustrated by the following quote (interview 16):

“The question is: why do we want this project? And we keep creating new answers.... For instance, three years ago we wanted salinization because the fresh water quality in the BC Lakes was (bad). Now, we see that the fresh water quality is more or less stabilized (because of the quagga mussel) so now we want it because of the water quality in the A Lake is bad. ...And now we say that we want it because of the tidal centre.”

To reduce the negative effects on terrestrial nature, environmental actors framed changing the tide by 30cm instead of 50cm as desirable. 30 cm tidal changes would lessen the damage on vegetation in the dunes, sand banks, and nesting birds. The following quote shows this frame (internal communication, nature organizations):

“To reduce negative effects of the tidal changes on terrestrial nature, we consider that it would be desirable to reduce the tidal changes to 30 cm. This way, the water quality still improves considerably, and the effects on terrestrial nature are minimized.”

Tidal changes had both positive and negative effects. On the one hand, this measure could provide economic benefits and an improvement in aquatic nature. However, it could also negatively affect terrestrial nature. This intrinsic dilemma surfaced as a result of the different diagnostic frames of actors. The FA team framed that the financial aspects of the functional combinations were important to make a decision about the desirability of tidal changes in the Lake A. Simultaneously, environmental actors framed that the focus should be on the

environmental value of the area, and the possibility of looking for alternatives like changing the tide in 30 cm that did not jeopardize environmental values.

Dilemma 4. Make a decision in the short term or wait for clarity in quantified results.

The fourth dilemma was whether to make a decision in the short term about the functional combinations to be implemented or wait for clarity in the quantified results to get the support from regional stakeholders. The interaction of the FA team, and regional stakeholders like the representatives of the recreational sector or fisheries having different frames, and interpreting different aspects as priorities in the project caused this dilemma.

As it happened for the salinization of the BC Lakes, tidal changes required the financial contribution of regional stakeholders. As in the previous section, the FA team framed that the priority was to ensure the project's financial feasibility because of the high costs of tidal changes. Furthermore, the hydrological future of the ABC was part of the Delta Program. The 'delta decisions', part of the delta program, had to be ready before 2015. Consequently, it was politically required to have a concrete package of functional combinations ready by 2015. This created a sense of urgency in the process. As a result of a 'political urgency' diagnostic frame, the FA team framed as essential to make a decision about functional combinations in the short term to fulfil the political wishes. The following quote illustrates this diagnostic frame (interview 19):

"Ecology (water quality) is a bit of a dream. This is nice, but... how can you achieve it? You have to go to the political arena, and give concrete results related to ecology and economy... There is time pressure, there is a deadline and (we) must deliver concrete results and what is politically expected... The deadline plays an important role, you realize that (everybody) is steering the process towards the results."

Yet, making a decision in the short term required encouraging the commitment of regional stakeholders by showing clear substantiated results of the functional integration. Regional stakeholders had a 'financial' diagnostic frame, interpreting that they would only contribute to the project provided that there was certainty about the financial benefits of an improvement of water quality. Based on their 'financial' diagnostic frame, the FA team and regional stakeholders had similar prognostic frames. The FA team framed that encouraging the financial contribution of regional stakeholders required clarity about the integrated effects. Regional stakeholders framed getting clarity about the results to contribute to the project as important. Both framed that the desired course of action was to show the earning potential of functional combinations, as the following quote shows (interview 11):

"We need to show the earning capacity of the project for the investors. Regional parties that invest here need to be sure what is going to happen. For example, this is the case for fisheries and recreation. It is absolutely logic. Without numbers, you are asking them to jump in a moving car without knowing where it goes."

However, calculating the integrated effects was not straightforward. For example, tidal changes in the Lake A would modify the soil. Changes in the soil would increase the visits from

experienced divers. Experienced divers spend more money than beginners, so the recreational sector could benefit from more visits and an increased number of available recreational facilities.

Similarly the fisheries sector was willing to invest in the project, but they framed as important guaranteeing the ‘fish-friendliness’ of the solutions. One of the functions associated to tidal changes in the Lake A was the implementation of a tidal power plant. Developing a tidal power plant could supply energy for 30 000 households. However, the SCBA acknowledged the risk of developing unproven technology, leading to uncertainties related to the use of bubble screens for the separation of fresh and salt water, jeopardizing the migration of fish from the North Sea to the ABC Lakes.

As a consequence of the above, actors encountered a dilemma regarding the co-existing of conflicting frames. There was a need to provide clarity about the integrated project effects but providing this clarity would require more time. Furthermore, it was important to provide a decision within the short term to get political support. Postponing the decision would reduce the urgency, risking the political support to develop the project. So the FA team was in the horns of a dilemma. On the one hand it was necessary to wait to substantiate the results of the economic analyses but this would require time. On the other hand, having political support would require a decision in the short term. Figure 11 shows the cognitive map of a member of the FA team illustrating this dilemma. This member of the FA team connected the node ‘diligence’, ‘commitment’ and ‘improvement of calculations’ illustrating the need to satisfy conflictual process demands in the project.

Figure 11 Cognitive map of member of FA team (interview 20).

Improving water quality through changing the tide in the A Lake required the financial contribution from regional stakeholders and getting political support by providing a concrete package of measures in the short term. The interaction of the FA team and regional stakeholders in the recreational or fisheries sectors caused a dilemma, based on the divergent priorities to make a decision. The dilemma occurred as a result of actors framing conflicting

strategies as a priority: either providing flexibility to make decisions in the short term or substantiating the project effects to achieve the commitment of stakeholders in the long run.

4.5. Discussion

The main goal of this paper is to explore the roles of frames in the occurrence of dilemmas in the decision-making process of a multifunctional project. Our premise is that digging into the origin of dilemmas helps to understand what caused the dilemma in the first place, as a stepping stone to identify strategies that help to bridge seemingly competing choices. Evaluating the nature of dilemmas in a multifunctional project provides a relevant case to explore how actors can attend to competing demands simultaneously in a context of interdependent actors that bring their own interpretation to the project. Dilemmas do not occur in the vacuum but as part of a complex social context in which projects are developed. Consequently, this paper offers an important contribution to scholarship in dilemmas and frames, exploring whether dilemmas are intrinsic to decision-making processes or created by the co-existence of multiple frames (socially constructed). Our results reveal that (1) the coexistence of multiple frames can make intrinsic dilemmas explicit and that (2) differences in actors' frames cause dilemmas.

First, the required decisions in the ABC project had intrinsic dilemmas that surfaced because of the interaction of actors having different frames. In the situations requiring a decision 1A and 2A, salinization and tidal changes had both positive and negative consequences. In the BC, salinization would improve water quality and provide opportunities for recreation, fisheries and other sectors. However, salinization would reduce available fresh water supply for agriculture. In the A Lake, tidal changes would improve environmental conditions and the economy, but they would negatively influence the habitat of protected flora. These dilemmas surfaced through the interaction of actors holding different frames. Differences in priorities and preferred courses of action surfaced the dilemmas. In this case, we see that dilemmas surfaced, since they were intrinsic to the process but they became explicit through interaction. In this view, situations become a dilemma when actors make them a dilemma. How dilemmas surface through the interaction of multiple frames corresponds to Smith and Lewis' (2011) claim about how latent organizational tensions can become salient through a plurality of views at a given context.

Second, the interaction of actors having different frames caused dilemmas. In the situations requiring a decision 1B and 2B, dilemmas were not necessarily intrinsic to decision-making processes. On the contrary, dilemmas resulted from the different frames of participants about what was the issue at stake, and how to approach it in the project. For example, in decision-context 1B, the project team framed that the priority was to find financially profitable functional combinations. Environmental organizations framed that some financially profitable combinations could overexploit nature, interpreting as necessary to align decision arenas to reconsider priorities. In this case, dissimilarities in frames caused differences about the focus of the project, resulting in dilemmas. The co-existence of multiple frames reveals different ways

of perceiving and giving meaning to the same situation. Different actors include and exclude different aspects, and interpret differently what advantages and disadvantages are. In a context where actors are interdependent, multiple desired courses of action are equally valid and legitimate. In other words, all frames have equal weight in the process. This is particular prominent in situations in which actors are interdependent. Diversity of frames will not only lead to ambiguity (Dewulf *et al.*, 2004; Brugnach *et al.*, 2011) but also to dilemmas. Indeed, Salet *et al.* (2013) pointed out that the co-existence of multiple strategic perspectives often translates into dilemmas. Often, perspectives clash, and solving a dilemma requires a frame to prevail over other frames. If no frame becomes predominant, it is often the case that actors start to contest their frames to make their own prevail over others as Kaplan (2008) has acknowledged. Other times, new ideas develop as a result of emergent dilemmas, aiming at finding compromise in the threat of a decision impasse (Salet *et al.*, 2013).

These two views do not exclude one another. Whether considered as intrinsic to the situation requiring a decision or caused by the interaction of actors having different interpretations, our results reveal the relevance of surfacing frames to understand the occurrence of dilemmas. Our results shed light on the importance of treating dilemmas as part of a social context in which situated actors operate. The ABC project showed that actors are constantly wrestling their way through opposing forces, and dealing with different dilemmas in framing their approach in the decision-making process. Dilemmas in the ABC case originated as an either/or approach, and actors struggled when trying to connecting both demands. The occurrence of these dilemmas resulted in actors' hesitancy. Understanding the occurrence of dilemmas in decision-making processes is the stepping stone to exploit the potential of bridging seemingly competing excluding demands. Although dissimilar frames and dilemmas might lead to situations in which it is not clear which course of action to follow, they can also trigger the exploration of solutions that bridge apparently competing interpretations.

First, by incorporating various frames, actors can involve more orientations and concerns about issues at stake, reducing the tendency for solutions to be one-sided, and encouraging the consideration of multiple demands. The inclusion of multiple frames can be productive since it avoids potential bias in decision making and encourages looking at issues at stake from different angles (Kaplan, 2008). Analyzing the interaction of dissimilar frames, we can understand how actors interpret issues at stake, as well as their solutions within a context. Second, the presence of dilemmas opens up spaces for contestation and deliberation (Höijer *et al.*, 2006). Although some dilemmas might not be solvable, as Höijer *et al.* (2006) acknowledge, they offer opportunities for deliberation and to reflect about potential solutions considering opposing demands. Being aware of dilemmas helps to make informed and transparent choices, enacting reflection as Mantere and Ketoviki (2013) point out. As Storey and Salaman (2010) acknowledge, dilemmas offer opportunities to take advantage of the tensions between conflicting priorities, and to use this drive to go beyond dualities. 'This entails working with, rather than against the dilemmas, it means finding advantages in the seemingly opposing options, and seeking to harness their logics into a new, higher level, form' (Storey and Salaman,

2010; p.13). Accepting organizational tensions like dilemmas, and embracing the existence of opposing forces is an invitation for creativity and opportunity (Beech *et al.*, 2004).

Regardless their challenges, dilemmas should not be a pretext for indecision. On the contrary, dilemmas can help to create deliberative spaces where various actors can provide input (Höijer *et al.*, 2006). As Gibbs and Krueger (2012) acknowledge dilemmas trigger change since actors respond to the dilemmas by reconsidering their practices. In decision making, actors need to be conscious about the implications of their choices and how they are interpreting the dilemmas. If decisions support one value, actors may try to counterbalance its harmful effects. The key is to be aware of the existence of the dilemma, and the unintended consequences or tradeoffs choosing one side over the other. As Johnson (2012) recognizes, accepting the presence of a two-sided coin and appreciating the interplay between divergent points of view helps to reconcile them in the decision-making process. The presence of opposing forces is crucial to organize future activities (Mäntysalo *et al.*, 2015).

Given the need to integrate competing demands in multifunctional projects, it is important to recognize that opposing forces can complement each other by finding approaches that facilitate change, and invite for reconciling multiple interpretations while considering the existing frameworks in which actors operate.

Despite the theoretical and practical contributions of this study, there are some limitations. A main limitation stems from the analytical choices of this research. During data analysis, we considered the FA team as a single actor. Although there was unanimity regarding the issues here described, there were some individual differences in their maps and narratives that we have not presented in this paper. This was an analytical choice, but we are aware of the drawback of considering this team a single actor. Organizing a workshop session in which the FA team developed a group cognitive map could have helped to provide a group cognitive map to avoid any potential nuances existing in the individual maps.

In this paper we have not evaluated how accepting the complementarity of opposing forces requires that actors adopt what Lüscher and Lewis (2008) and Smith and Lewis (2011) call 'paradoxical thinking'. This requires a 'both/and' approach that overcomes paralysis, and helps to connect seemingly conflicting demands. Indeed, we could argue that the ABC project was not about making a choice between having financial restrains or meeting the needs and expectations of concerned stakeholders, but connecting the benefits of improved water quality with the constraints in framing a solution. Instead of focusing on whether to focus on X or Y, 'paradoxical thinking' (Smith and Lewis, 2011) considers to successfully involve X and Y. We encourage further research exploring how dilemmatic situations can be synergistic.

Another limitation concerns the influence of dilemmas on how the decision-making process unfolds. In this paper we have focused on understanding how dilemmas surface and are caused by differences in frames in the decision-making process of a multifunctional project. However, we have not presented how the existence of dilemmas influences the evolution of the decision-making process. We consider it important to provide studies that fill this research gap. Furthermore, our results have hinted at the path-dependency of dilemmas, and how the

occurrence of dilemmas leads to more dilemmas in return. However, we did not elaborate in depth on the dynamics of the continuous occurrence of dilemmas. We encourage the development of rich longitudinal studies evaluating this path-dependency. Furthermore, we would like to encourage studies exploring the motivations behind developing multifunctional projects. Based on our results, we could consider multifunctional projects as strategies to bridge dilemmas, or as a trigger for the occurrence of more dilemmas as a result of the involvement of multiple frames in the decision-making process. In the first view, multifunctional projects could be seen as a bridge between multiple demands to deal with dilemmatic situations. In the second view, we consider that the fact that multifunctional projects cause more dilemmas means that they offer potential to look at the same project from multiple perspectives, stimulating the exploration of more inclusive solutions that satisfy a great array of demands.

4.6. Conclusion

The main goal of this paper was to explore the role of frames in the occurrence of dilemmas in the decision-making process of a multi-actor context. To this end, we studied a multifunctional project located in the South West Delta in the Netherlands. The need to integrate competing demands, and the involvement of multiple actors in the decision making of multi-functionality make these projects a breeding ground to understand the relationship between frames and dilemmas. In contrast to much of the existing literature that focuses on either frames on multi-actor contexts, or dilemmas separately, this study brings together two streams of literature and explore the relationship in practice between frames and dilemmas. Our analysis of an in-depth case study in the South West Delta in the Netherlands shows that decision contexts often have intrinsic dilemmas that remain concealed until the interaction of actors' frames surfaces them. Besides, the co-existence of various frames leads to dilemmas since diverse actors prioritize and prefer different courses of action. We conclude that frames cause dilemmas and are the vehicle through which dilemmas surface. Understanding the occurrence of dilemmas in decision-making processes is the stepping stone to exploit the potential of dilemmatic situations. Rather than choosing between opposites, it is important to understand dilemmatic situations as synergistic, embracing opposing forces as an invitation for creativity and opportunity.

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Chapter 5.

Chapter 5. Making dilemmas explicit through the use of a three-dimensional cognitive mapping collaborative tool⁵

Abstract

Dilemmas are pervasive in decision making. Although they offer the potential of reflecting about issues at stake from different perspectives, dilemmas often lead to paralysis for those encountering them. Surfacing dilemmas allows discussing them, and exploring strategies to bridge seemingly competing orientations about issues at stake. The assumption is that revealing and debating dilemmas encourages finding solutions that bridge the apparently competing demands that resulted in dilemmas in the first place. This study presents a three dimensional cognitive mapping tool specifically developed to collaboratively surface dilemmas in a multi-actor context. The tool, called the ‘dilemma cube’, allows a diversity of participants to share their interpreted actions, effects, and connections among different issues at stake. We tested our tool in a collaborative workshop for a multifunctional land use project in the Netherlands. Our results show that the ‘dilemma cube’ guided participants to share their interpretations about the project, surfacing the interrelatedness of issues and actors. Revealing the socially-constructed nature of dilemmas in multi-actor contexts is the stepping stone to explore strategies that stimulate deliberation, and the opportunities of exploiting opposites in light of dilemmas.

5.1. Introduction

For decades, dilemmas have been a topic of reflection for practitioners (Gheballi, 2006; Christensen, 2013; Vringer *et al.*, 2015) and scholars (Rittel and Webber, 1973; Benner and Tushman, 2003; Höjjer *et al.*, 2006; Northcraft and Tenbrunsel, 2011) in different fields. Dilemmas manifest in decision making when actors need to make a choice and the available options exclude one another, and have consequences that make them equally desirable and undesirable.

Dilemmas can occur at the individual and at the group level. Individuals may encounter situations in which they have conflicting orientations towards an issue. Individual dilemmas might be ethical (Reinecke and Ansari, 2015) or ideological (Billig *et al.*, 1988) since they involve contradictory moral imperatives related to tensions between diverse matters like

⁵ This paper is currently under review in *Futures* as: Matos Castaño, J., van Amstel, F., Hartmann, T. & Dewulf G.P. R. M. ‘Making dilemmas explicit through the use of a three-dimensional cognitive mapping tool’.

freedom and necessity, individualism and collectivity, equality and hierarchy. Furthermore, individuals involved in groups might face social dilemmas, when weighing the desirability of pursuing self-interested goals or the benefit of the group. At the group level, dilemmas occur when various actors need to make a decision together, but different actors consider desirable dissimilar courses of action. The increasing presence of multiple interconnected issues (Sardar, 2010; 2015) in different fields and disciplines are encouraging the involvement of a larger number of organizations and actors in planning and decision making. For example, in regional and urban planning, there is growing attention to the incorporation of approaches that combine social, economic, and environmental goals in the same area to respond to future demands (Eggenberger and Partidario, 2000; Ghai and Vivian, 2014; Cowel and Lennon, 2014).

Creating awareness about dilemmas is relevant because they offer the potential of looking at issues from different angles. However, if actors are not aware of them, dilemmas often lead to paralysis and impasse since actors do not know which course of action to choose. As a result, dilemmas are ignored or avoided. Since dilemmas are not situations with straightforward solutions, they force actors to examine their values, and provide their rationales and motivations before making any decision. In other words, the presence of dilemmas can stimulate deliberation, and the creativity of exploiting opposites (Höijer *et al.*, 2006).

Despite the relevance of dilemmas in decision making, there is a lack of approaches that focus on making dilemmas explicit in a multi-actor context. Previous tools and techniques have been used to bring together multiple stakeholders to enable cooperation and communication by creating awareness about the interdependence of issues (Soetanto *et al.*, 2011), or to represent the interpretations of participants about complex issues (Tegarden and Sheetz, 2003; Eden, 2004; Eden and Ackermann, 2004; Ackerman and Eden, 2005). However, the main focus of these tools is not on surfacing dilemmas. To fill this gap, this study reports on the development and use of a collaborative tool to make dilemmas explicit in a multi-actor context. Our collaborative tool, called the ‘dilemma cube’ acts as a three-dimensional (3D) collaborative cognitive mapping tool that allows for visualizing actors’ desired actions, effects, and connections in the project. The 3D nature of the tool allows showing the interrelatedness of issues across actors and issues at stake. We tested the dilemma cube in a workshop setting with actors involved in the decision-making process of a multifunctional project in the Netherlands. The project involved various organizations from different administrative levels and sectors that were exploring potential functional combinations to develop in the future. Actors in the decision-making process of this project wanted to understand each other’s interpretations and surface dilemmas to start reflecting about solutions to deal with them. Our results reveal that the use of a collaborative tool like the dilemma cube guided and structured the contribution of participants, allowing to surface different interpretations about actions and effects in the project. The use of the dilemma cube allowed participants to build on their own contributions, and contributions of other participants using the cube. This way, participants could create the content included in the cube, surfacing the dilemmas specific to the context in which they interacted. Particularly, the 3D nature of the dilemma cube allowed surfacing the

interrelatedness of issues in the project, revealing dilemmas in the project that would have remained concealed otherwise.

This article is structured as follows. First, we introduce our theoretical points of departure. Furthermore, we elaborate on existing literature about collaborative tools. Second, we describe our method, elaborating on how we designed and developed the dilemma cube, and how we collected and analyzed the data. Third, we present our results of using the ‘dilemma cube’ in a workshop session. Fourth, we discuss our research results, reflecting about how the ‘dilemma cube’ makes dilemmas explicit, and the contribution of our research to the state of the art of existing collaborative tools. The last section provides conclusions of our study.

5.2. Dilemmas and collaborative tools

In multi-actor and multi-criteria decision making processes, actors need to make choices in contradictory situations where various options look equally desirable or undesirable and exclude one another. Looking at the future is therefore a process of facing dilemmas, and having to assess multiple desirable or undesirable futures depending on the perspective from which actors look at it. As a result, dilemmas often lead to paralysis or indecision because it is not clear which course of action to take. Different options seem equally desirable or undesirable for various reasons. Nonetheless, the opposing poles of a dilemma are complementary and can reinforce each other if the tension is appreciated (Sachs *et al.*, 2006). In other words, dilemmas offer the potential to provide spaces for deliberation and the creativity of exploiting the opposites (Höijer *et al.*, 2006), since they enable the vetting of ideas and avoid one-sided views on options. Exploiting dilemmas requires comprehending their origin and escaping from the limitations of binary, polarized categories (Storey and Salman, 2010). Understanding dilemmas helps actors to deal with complex issues, creating awareness about solutions that realize the potential of various coexisting and often conflicting demands. When actors communicate about dilemmas, collaboration increases (Northcraft and Tenbrunsel, 2011). To navigate through dilemmas, it is important to create awareness about their existence since actors often avoid them.

Surfacing dilemmas requires understanding their origin. In groups, dilemmas often occur as a result of conflicting orientations about issues at stake, also known as ambivalence (Ashforth *et al.*, 2014). Diverse actors interpret issues in different ways, leading to situations in which various courses of action seem desirable and exclude one another. Furthermore, dilemmas often originate as a result of the interrelatedness and emergent nature of issues at stake. Choices have multiple effects in different areas, and what might be desirable for an actor is undesirable for another one. Understanding dilemmas requires a holistic appreciation of issues at stake, encouraging actors to engage and appreciate their interrelatedness, and exploring contrasting views and interpretations (Flood, 2002).

Particularly, surfacing dilemmas requires collaborative tools that (1) support actors to voice their interpretations and (2) represent the interrelatedness of issues and divergent interpretations about issues at stake. Despite the relevance of surfacing dilemmas to increase

collaboration and find strategies that bridge competing demands, the use of collaborative tools that help to make dilemmas explicit has been unexplored in literature. Previous research has shown that collaborative tools used in activities like scenario planning can help to gain insights into how the future would look like under different circumstances. For decades research has focused on scenario planning (Street, 1997; Goodier *et al.*, 2010; Soetanto *et al.*, 2011; Van Vliet *et al.*, 2012; Zegras and Rayle, 2012; Milestad *et al.*, 2014; Sisto *et al.*, 2015) including variants combining scenario planning and real options (Van Reedt-Dortland *et al.*, 2014) and participative back-casting (Carlsson-Kanyama *et al.*, 2008). These studies focus on engaging stakeholders to discuss issues of mutual importance (Soetanto *et al.*, 2011), encouraging ‘cross-sectoral’ thinking, emphasizing the importance of understanding the interdependency of actors within multi-actor contexts (Goodier *et al.*, 2010). Other authors focus on the organization of workshops to bring together actors having dissimilar interpretations. Turn-taking is an effective way of structuring the interactions among participants as shown in recent studies on business interactions (Blass and Hayward, 2015). Blass and Hayward (2015) suggest the use of artifacts to structure the contributions of participants, and slow down and deepen conversations. These authors acknowledge that by allowing turn-taking, actors much more aware of how much they are talking within the circle as some people tend to take many more turns at speaking in a conversation.

Literature about collaborative tools focuses on the importance of concrete materials to contribute to collaboration in design (Lahti *et al.*, 2004), emphasizing the cooperative use of objects to improve collaboration in teams (Rahman *et al.*, 2013). Others have presented collaborative tools using systems thinking (Videira *et al.*, 2014), digital collaboration tools like the Internet (Lum, 2002), virtual worlds (Koutsabasis *et al.*, 2012), or low-tech visualizations (Van Amstel *et al.*, 2015). A context in which collaborative tools are commonly used to make decisions and bring together multiple stakeholders is regional and urban planning. In this context the focus is on making decisions regarding the future of an area, while attempting to obtain political and public support for the project (Mayer *et al.*, 2005). The use of collaborative tools during land use planning workshops is common to stimulate collaboration and reach consensus among multiple stakeholders (Arciniegas and Janssen, 2012; Gill *et al.*, 2013). Land use planning collaborative tools focus on engaging with stakeholders and on the role of visualizations of plans and areas to communicate scenarios about the future of the project, and incorporate the demands of a wide array of stakeholders.

Used in groups, cognitive maps can be collaborative tools that enable gaining an understanding of actors’ interpretations. Cognitive mapping involves representing people’s thinking about an issue at stake, representing the mental models through which people perceive and make sense of complex problems. Other definitions of cognitive maps refer to graphical representations of unique ways in which people interpret a particular domain (Axelrod, 1976). The use of cognitive maps to depict and explore the cognitive structures of actors who experience complex problems is growing (Eden, 2004; Van Vliet *et al.*, 2012; Goodier and Soetanto, 2013; Jetter and Kok, 2014). Cognitive maps consist of three main parts: (1) eliciting concepts, (2) refining concepts, and (3) identifying relationships between concepts (Tegarden and Sheetz,

2003). These techniques, also called mental model techniques, have been applied in different contexts to analyze and comprehend unstructured problem situations (Kolkman *et al.*, 2005). These are often used as problem structuring processes (Eden, 2004; Damart, 2010). Cognitive mapping techniques are believed to facilitate effective management of messy problems by groups of actors (Eden and Ackermann, 2004). In these contexts, maps are instruments of depiction and representation, which aid the discussion (Nicolini, 1999).

Cognitive maps can be used individually or in groups. In group settings, some studies suggested the use of the oval technique to develop group cognitive maps (Eden and Ackerman, 2002) which is a technique that allows groups and individuals to represent their assumptions about relationships between beliefs and assertions. This way, actors in a group are able to see other actors' perspectives, add their own contributions, and see how the group map unfolds. Other authors have suggested the use cognitive mapping techniques with group support systems (GSS) (Ackerman and Eden, 2005; Tegarden and Sheetz, 2003). GSS are computer based systems that structure discussion among various participants by electronically generating statements. Each participant can contribute and add nodes to create a collective understanding of an issue at stake. For Ackerman and Eden (2005) the use of cognitive maps in groups was to retrospectively assess what went wrong in a number of projects, describing how the method created a rich and detailed analysis of critical incidents over the life of the projects. Ackerman and Eden (2005) acknowledged that using group cognitive mapping techniques helped to build a holistic picture of what happened in the project, exploring and managing conflicting views. Furthermore, developing collective cognitive maps allowed representing chains of argument, not only illustrating the facts, but giving meaning to them since participants could build on one another's contributions. Since cognitive maps surface values and interpretations, they have potential to reveal dilemmas. Dilemmas are a common consequence of the recognition of multiple ramifications or goals (Bryson *et al.*, 2004); since nodes can have both positive and negative consequences indicating the recognition of a problematic condition (Eden, 2004).

5.3. 'The dilemma cube'

Inspired by the potential of cognitive mapping tools to show the interpretations of multiple actors, we developed a 3D collaborative tool to make dilemmas explicit. Our intention was to provide a tool that helped to (1) support actors to voice their interpretations about the project, and (2) represent the interrelatedness of issues and interpretations about issues at stake. To this end, we designed the tool and the conditions under which it would be used by various participants.

To design the tool, cognitive mapping seemed relevant to support actors to voice their interpretations about a situation. However, most cognitive mapping techniques are two-dimensional representations of the individual or collective models of participants. Being two-dimensional, cognitive mapping lacks an explicit representation of the interrelatedness across issues and actors that can lead to dilemmas. We wanted to develop a tool which allowed

including multiple themes and connections, and representing the interrelatedness of issues at stake. Consequently, we decided to choose a 3D cognitive mapping collaborative tool. A design of the collaborative tool in 3D allowed seeing, manipulating and distinguishing multiple relationships among issues, including the crossovers from one issue to another.

To incorporate the 3D aspect, we designed the tool with the shape of a cube and call it the 'dilemma cube'. Each side of the cube represented a theme or issue at stake. For example, applied to a multifunctional project themes represented purposes that the project could include such as recreation, heritage, energy or housing.

In each side of the cube, participants could add post-it notes in the upper and lower edges. In the upper edge of the cube, participants could write down *actions* related to the different themes included in the 'dilemma cube'. These actions were courses of action that participants considered relevant for the specific theme. In the lower edge, participants could add *effects*. Effects represented the consequences that actions had according to the participants.

To show cause-effect relationships, participants could connect actions and effects in the different sides of the cube. Figure 12 shows a concept of the 'dilemma cube' and the 'dilemma cube' in action during a workshop setting, showing actions and effects in the upper and lower edges respectively.

Figure 12 Concept of the cube and image of the cube during the workshop

To share interpretations and make dilemmas explicit, we designed the context and environment in which actors could use the 'dilemma cube'. We decided to use it in a workshop setting with a turn-taking structure. The use of the cube in a workshop setting seemed relevant. Workshops are meetings in which groups of participants engage in intensive debate on a particular subject. Consequently, a workshop setting seemed a relevant environment to invite participants and make dilemmas explicit by using the 'dilemma cube'.

To enable participants to voice their interpretations about the project, we designed a turn-taking workshop session including 4 different rounds. Per round, participants could individually add at will: 1 action, 1 effect, and 1 positive or negative connection between actions. Participants would write down their actions and effects in post-it notes and actors

could add positive or negative connections. To add a positive connection, actors could tie an action and an effect with a green wool yarn. For negative connections, participants used a red wool yarn. During rounds 1 and 2, participants could add either a positive or a negative connection. During rounds 3 and 4, participants could add either positive/negative, or both simultaneously. Importantly, actors could add connections to their own actions and effects or build their contributions based on previous contributions included by other participants in the workshop. For this reason, the third and fourth rounds allowed including various connections among actions and effects, so participants could react on other participants' previous contributions and had more options than adding a single connection. Using the cube, the presence of one action with a red and a green connection indicated the existence of a dilemma. The 'dilemma cube' resembled a 3D group cognitive map that participants could create by adding their desired actions, effects, and connections.

In the next section we describe our research activities, describing the project in which we tested the collaborative tool, and our process of data collection and analysis.

5.4. Testing the dilemma cube in a multifunctional project

At the beginning of 2015, we got the opportunity to test the 'dilemma cube' in a workshop setting with participants involved in a multifunctional project in the Netherlands. Multifunctional projects combine multiple functions in the same area such as flood protection, recreation, nature, or real estate (Priemus *et al.*, 2000; Wiggering *et al.*, 2006; Vreeker *et al.*, 2004). Since multiple functions are combined in a single project, both the effects of functions, and the resources of actors are interrelated. Consequently, multifunctional projects increase interdependencies among effects and actors, and offer opportunities to find reinforcing combinations (Salet *et al.*, 2013; Swart *et al.*, 2014). The involvement of more actors and more interdependence increases the organizational complexity of the project, making it difficult to select functional combinations that satisfy a number of interests. Various functional combinations might seem equally desirable, leading to dilemmas about which functions to implement. Since there are limited resources to allocate in the project, and given the regulatory and policy frameworks in which actors must operate, actors have to choose among functional combinations that might seem equally desirable for different stakeholders. Given the interrelatedness of effects, actors and issues, this multifunctional project seemed an ideal case to test the 'dilemma cube'.

We became involved in the multifunctional project with the fictional name of Blue-Valley Deltadike. The Blue-Valley is a flood defense located in the Netherlands. This dike has a length of 5.5 km protecting the four important Dutch towns and cities. Next to the river, a neighboring city of 37 000 inhabitants coexists with farms, nature areas, a riverside reserve, a marina, and industrial and business areas. There were plans to reinforce the dike in the near future. Consequently, the water board of the area, local municipalities, and the two provinces involved in the project started to explore the possibility of building a multifunctional flood defense (or delta dike). The concept of delta dike combines the flood protection component

with spatial functions in the area where the dike is located. Given the economic value of the protected area compared to the relatively small portion of the dike that needed to be reinforced, actors were enthusiastic about the opportunities of this development. However, a delta dike required a large investment, and there were more flood defenses in the region that needed to be reinforced and required attention. In 2015, stakeholders were exploring potential combination of functions to be developed in combination with the delta dike to attract more investors and make the project possible.

As a preparation for our workshop session, we held exploratory interviews with seven participants of the project. During these interviews, we identified the main functions relevant for the Blue-Valley namely: recreation, nature, and business. These functions were in the side of the cube, representing the different relevant topics. For the fourth side, we added the category 'other' so participants were free to add some elements without feeling restricted by the themes we chose beforehand. Since the project revolved around the reinforcement of the flood defense, we located a stone in the center of the cube representing the dike as shown in Figure 13.

Figure 13. Overview of the functions and stone in the 'dilemma cube' after the workshop session

5.4.1. Data collection

In March 2015, we conducted a workshop with the project team. Selecting the participants that would attend the workshop was a decision made by the project leader. Nevertheless, the group of participants attending the workshop was diverse, belonging to different disciplines and

sectors. In total, seven participants joined the workshop session: two members from local municipalities, two representatives of two different provinces, a representative of an environmental organization, and a representative of the water board.

Three researchers took part in the workshop. The first author of this paper functioned as workshop leader. The second author videotaped the workshop session. A third researcher took notes and helped to facilitate the discussion at the end of the session.

The workshop had four rounds in which participants interacted with the cube. When the four rounds finished, participants could add actions and effects if desired. In total, there were 18 potential actions, 17 effects, and 39 connections. 26 out of 39 connections were added during the four workshop rounds (5 negative, 21 positive). The remaining 13 connections (3 negative, 10 positive) were added after the workshop, when participants got few minutes to add more connections if desired. At the end of the workshop, the discussion focused on identifying dilemmas. To this end, we asked participants whether or not they perceived a dilemma when looking at the cube. As a wrap up of the workshop, we encouraged participants to discuss strategies that combined could help to deal with the identified dilemmas. Data collected were 3 hours of video recording, and the 'dilemma cube' itself with all the issues, effects and relations surfacing during the workshop.

5.4.2. Data analysis

Our data analysis consisted of two phases. In the first phase, we aimed at identifying the participants' dilemmas that surfaced during the workshop session. In the second phase, we analyzed the role of the cube in the workshop session.

We started transcribing the four workshop rounds, and the discussion after the workshop session. We structured the transcripts showing the actions and effects that each participant added per round. We coded the transcripts by identifying the actions and effects added by each participant. The actions and effects that participants added revealed how they were interpreting the project, and their priorities at that point in the process. Then, we identified the dilemmas that emerged in the discussions during and after the workshop rounds. This was relevant to identify how the cube helped to visualize dilemmas in-situ, and how it helped to trigger discussions about the dilemmas a-posteriori. Then, we could identify at which point of the workshop participants discussed the dilemmas.

In the second phase of data analysis, we analyzed the videotape again to analyze the role of the cube in the identification of dilemmas, reflecting about the features of the cube enabling this role. This phase of analysis helped us to confirm whether or not the cube helped to show the interpretations of participants and how the interrelatedness of issues. We started coding the interactions of participants with the cube. First, we provided open codes, naming the actions of participant such as 'writing in the cube' or 'turning the cube'. Then, we looked for patterns in these interactions throughout the different rounds, observing interactions that were constantly occurring across rounds and across participants. Then, we reflected about the role of these interactions in surfacing the frames and dilemmas previously described. Consequently,

we came up with a number of categories that helped us to identify the role of the ‘dilemma cube’ in surfacing dilemmas. In the next section we describe the results of this process.

5.5. Results

This section describes how the dilemma cube made dilemmas explicit, and how participants used the ‘dilemma cube’ in a workshop session. We structure our results section in two sub-sections. We first explain the dilemmas that surfaced and the role of the cube supporting this. Then, we explain the role of the cube during the workshop session. Table 6 summarizes our research results.

Table 6 Summary of our research results based on our analysis

	Role of the dilemma cube
Influence of the cube surfacing dilemmas	Help to visualize coexisting positive and negative connections between actions and effects.
	Display simultaneously actions, effects, and connections, showing dissimilar interpretations
Influence of the cube on participation and interaction among participants	Filter to focus on what is relevant for participants
	Be precise about the meaning of words
	Voice multiple interpretations

5.5.1. Use of the cube making dilemmas explicit

In total, six dilemmas surfaced while using the cube, as presented in Table 7. Three of these dilemmas emerged during the four rounds of turn taking. Three other dilemmas were discussed after the turn-taking rounds. The emergence of these dilemmas can be explained by the role of the cube during the workshop.

Visualizing in 3D the connections between actions and effects created awareness about dilemmas because it helped to see that participants interpreted that some actions had simultaneously positive and negative effects; or one action could have simultaneously multiple effects on different functions. For example, dilemmas 1, 2 and 3 surfaced during the four rounds of the workshop and became apparent because of the addition of positive and negative connections. The next passage shows the emergence of dilemma 2. During round 3, participants 2 and 3 included the action of developing wind turbines next to the dike or along the dike, and emphasized the importance of developing wind turbines to fulfill the energy ambitions of the province. However, participants 2 and 3 that added developing wind turbines would have a negative effect on nature and the perception of living. This dilemma was discussed as a result of observing the coexisting negative and positive connections about an issue.

P2: There is a discussion with (one of the organizations) about wind turbines in the area next to the harbor. And well.... This is interesting. [Taking the cube and turning it to look for functions] And I connect 'adding wind turbines in the haven' to the climate ambitions of the municipality. [Taking two lines simultaneously, and turning the cube to connect them to existing effects] But I create two links: one positive for the climate ambitions, and other negative for the landscape.

....

P3: [Triggered by the previous intervention of participant 2, participant 3 added an action related to the development of wind turbines along the flood defense] (Regarding the development of wind turbines) you see that there might be a negative perception, probably negative for the construction of the dike, there is no support from the neighbors... well, you can see it everywhere.

P5: It is also an area part of the (environmental policy).

P3: Indeed, so there is some emotional resistance. There are a lot of parties that need to give consent, and it is difficult.... However, it needs to happen because it is an agreement to develop the wind turbines... So we know that we must do it, but we don't know where. And I think this is a big dilemma.

The passage above illustrates the presence of simultaneous conflicting interpretations about the same issue. Participants considered fulfilling the energy policies of the province as desirable but realized that developing wind turbines could have negative effects. Consequently, participants interpreted that keeping the support from other parties that could oppose to the wind turbines was important.

Furthermore, dilemmas 1, 2 and 3 revealed that the coexistence of multiple interpretations led to diverse priorities, which caused dilemmas. For example, dilemma 3 became clear when participant 3 emphasized the wish to relocate the companies in the northern side of the harbor, whereas other participants interpreted that was not desirable for the economic development of the area.

P3: I know the (municipality) wants to bring the water closer, so I think that (if we move the companies) we could develop nice housing areas close to the dike.....

P2: And what about the ideas of using the haven only for recreation?

P3: I know this is another league, but nevertheless I think that many people could see the housing project as desirable.

....

P7: So the idea would be to leave the northern area free of businesses.

P3: Yes. This is water related so you could not have them anymore I don't know exactly how many businesses there are but... Well, I think that would be nice, apartments next to the water.

P1: That is personal. I like a bit of industry

P2: Well, not in my backyard.

The previous passage shows that participants interpreted the project differently. Participant 3 interpreted as desirable the relocation of companies to develop housing areas, whereas participant 1 did not consider it as desirable. Later in the workshop, participants added negative connections for business related to the relocation of the companies suggested by participant 3 earlier in the workshop session.

Table 7 Dilemmas that surfaced during the workshop

Dilemmas discussed during the manipulation of the dilemma cube	Moment in which it was initiated
1. There are opportunities to relocate the recreational harbor, but it is difficult under environmental policies and because of the lack of clear political support from the province and the municipality.	Round 1- Participant 5 Round 1- Participant 6 Round 2- Participant 2 Round 2- Participant 3 Round 2- Participant 4
2. Developing wind turbines is politically desired and part of the climate neutral policy of the province and municipality, but it would have a negative impact on nature, and the livability of the area.	Round 3- Participant 2 Round 3- Participant 3
3. Relocation of businesses in the north side of the dike allows building residential areas, being good for spatial quality and nature; however, it would have a negative impact on business activities.	Round 1- Participant 3 Round 4- Participant 3
4. There are great opportunities for recreation and business but environmental policies, the size of the area and existing nature limit the options to realize these opportunities.	After rounds.
5. The potential budget should be allocated to implement functions associated to a reinforcement of the dike, but most of the ambitions focus on the area where the dike is already strong.	After rounds.
6. Optimizing the industrial port offers opportunities but there is a lack of space to do so.	After rounds.

After the four rounds, participants observed the cube and the connections they created. Showing these dilemmas was facilitated because the cube helped to make sense of what was previously discussed. For example, dilemma 5 surfaced as a result of the observed connections of various actions with the dike. The stone in the center of the cube represented flood protection, and only presented three positive connections. Observing the cube, participant 1, whose organization is responsible for the maintenance and finance for flood protection, started a discussion about the role of the dike in the project, and how the cube and its connections showed a dilemma.

P1: [Pointing at the cube] you see in the cube that there are connections everywhere, red and green, in many different directions. It is very interesting that for flood protection [pointing at the stone in the middle], there are only positive connections. And everybody takes it for granted... What I wonder is that, regarding the size of the dike, I also see a dilemma. On the one hand, it is small and that makes it more manageable, but on the other hand, is that a problem?

....

P4: What I wonder is whether it is possible to realize the ambitions on the dike? Is that actually possible? For example, nature and flood protection ok, but what about the rest.

P1: Indeed, and that is precisely what we should look at in depth and carefully. We should have a look at the extra room that we could get to realize the other ambitions that could exist there.

This passage shows how reflecting about the existing network of connections afterwards helped to reveal additional dilemmas. The cube created awareness of the connections among multiple actions revealing constraints to achieve their ambitions which surfaced dilemmas. For example, dilemmas 4 and 6 were related to the limitations to develop the ambitions identified during the workshop.

P1: You need to look somewhere where you might have room to do something, to take into account the functions, and this is a dilemma, because if you want to optimize something, then you need some room for maneuver.

Visualizing the connections was key to make dilemmas explicit by using the dilemma cube. However, using the cube influenced the participation and interaction among participants as we describe in the next section.

5.5.2. Influence of the cube on the participation and interaction among participants

Each turn, participants selected and described the actions and effects they included in the cube, allowing them to steer the discussion towards what they considered relevant. For

example, the next passage illustrates the explanation of participant gave in round 1 before adding the action and effect that he considered important.

P3: (My organization) thinks that nature, economic development and spatial quality are important. If you couple these three... then you need to consider the industrial activities in the area and the floodplain. And I think they should be moved...

The previous excerpt shows that participant 3 interpreted that there were different coupling opportunities in the project, and that realizing these opportunities required moving the industry. Across rounds and turns, participants could elaborate on what was important to them.

Furthermore, having to select one action and one effect per round stimulated participants to be *precise* in the use of their words. The following dialogue shows a passage in round 4 in which the meaning of words was crucial to determine the cause-effect relations of some actions.

P7: What did you write down? [Looking at the note of participant 3].

P3: Relocating the industrial area within the boundaries of the municipality [In Dutch 'verplaatsen'].

P7: Within the boundaries or out of the boundaries? [In Dutch: 'verplaatsen' or 'uitplaatsen'?].

P3: You are very precise, eh?

P7: Well, it is crucial.

P3: You mean that that influences the possibilities in practice.

P7: Well, you know, it is important. [After a discussion about the role of the industrial harbor for the municipality, participant 3 agrees to write down 'uitplaatsen' of the companies in the north side of the harbor].

This passage shows a crucial difference in interpretations between participants 3 and 7. Participant 3 mentioned it was important to relocate the harbor to improve the living conditions, whereas participant 7 interpreted that it was 'crucial' to consider the consequences of relocating the companies for businesses. While participant 3 did not emphasize the boundaries within which the industrial area should be relocated, participant 7 created awareness about the importance of this. This attention to semantics was present throughout the workshop. Following the interaction illustrated above, in the same round, participant 7 included an action which was 'relocating the recreational harbor *within the boundaries of the municipality*', contrary to the previously discussed action that should be moved out of the boundaries of the municipality.

One of the rules of using the cube was taking turns. This encouraged participants to elaborate on what they considered important without some members dominating the discussion. Taking

turns gave time to participants to describe what they wanted to voice in the workshop, allowing for clarifications. At the end of the workshop, all the participants contributed and voiced their interpretations about the project.

Although the cube helped participants to equally contribute, they often intervened to present their preferred options and effects even if it was not their turn. For example, in round 1 participant 7 added that relocating the recreational harbor within the boundaries of the municipality was an important action in the project. Participant 7 intervened during round 2 before her own turn. In this round, participant 4 selected an action related to storing water and creating wet nature in the project. Participant 4 related this action to the relocation of the harbor that was previously added by participant 7, and reflected about the effect that the creation of wet nature would have on recreational activities. The relation between the development of nature and the relocation of the harbor was a contested topic during the workshop, and encouraged the discussion of various participants, including participant 7. Participant 4 was hesitating about how to connect his own action of 'development of wet nature'. In total, participant 4 took 5 minutes to reflect about a connection. During this waiting time, participants 3 and 7 stood up and looked at the existing actions and effects already placed in the cube to help participant 4 to add a connection. After 5 minutes, participant 7 decided to intervene, and related the action discussed by participant 4 and added a new connection to an action that she previously added (relocation of recreational harbor). The following picture shows the moment in which participant 7 stood up, took one of the red wires to add a connection, and contributed during the turn of participant 4.

Figure 14 Instance in which participants 3, 4 and 7 intervened simultaneously

The cube allowed including alternative interpretations about an issue. When participants described an action, it was sometimes difficult to decide about the effect of that action on the project. Using the cube allowed other participants to make suggestions, and debate *alternative interpretations* about the same issue. As shown in Figure 3, participants would stand up, look at the actions and effects included in the cube, turn it and add suggest adding connections that

they considered relevant for the project. Sometimes, these suggestions were accepted, and encouraged discussing alternative actions and effects. For example, in round 1, participant 2 doubted about the positive effects of providing optimal land use. After some moments of silence, participant 5 suggested the positive impact on nature and ecological values. This suggestion was accepted by participant 2.

P2: I am going to add an action that is 'optimal land use' and I will add a positive connection to the function nature. I want to add a concrete positive connection but I am not sure which one. [Silence]

P5: (You could write) room of maneuver for connections with ecological values.

P2: Sure. [He writes down the suggestion of participant 5, pulls the cube in his direction and places the effect on the side for nature]

In the previous passage, taking turns provided time for participants to intervene and share interpretations that complemented each other. However, participants did not always accept including alternative interpretations about the issues, as in the example below, in which participant 4 suggests that moving existing companies could positively influence flood protection since it would allow to get extra room for the dike. However, participant 3 did not agree on this view, not adding the suggested connection to the cube.

P3: I think that moving existing companies can have an influence on nature.

P4: And what about connecting it to the stone? [Pointing at the stone in the middle of the cube] To flood protection? You could get extra room for the dike.

P3: No. no.

The cube allowed keeping track of previously added actions, effects and connections. Throughout the rounds, participants often stood up, looked at the cube and turned it to see the effects on different functions in the cube so they could build on previously discussed topics and refresh their memory about the existing functions. Figure 15 below shows an instance in which participant 5 stood up to look at the different functions to decide to which function she would like to add an action and an effect.

Furthermore, the cube allowed visualizing different connections. The 3D design of the cube allowed showing how participants interpreted connections between actions on multiple functions, and negative and positive effects. First, the cube helped to surface in a structured way that one participant could have multiple interpretations about the same issue. For example, in round 1, participant 1 mentioned that his selected action (closing the flood defense to traffic) could impact either business, or recreation. When he finally chose to add a positive connection to businesses, another participant questioned why he did not connect his action to recreation, stimulating discussion about the role of recreation to stimulate business development in the region. This is illustrated by the following dialogue:

P1: I think that this action (closing the dike for traffic) has an impact on business and recreation. [He turns the cube to look for the functions to add the effect]. I will add a positive connection to business. I think that for (the neighboring towns) closing the dike for traffic has an added value, and also for the development of nature in the floodplain. Overall, it is an improvement.

P4: And why don't you trace a connection with recreation then? [He points at the side of the cube related to recreation].

P1: [He looks at the upper edge of the cube] Well, I think that recreation and businesses are very connected. But anyway, if you want you can add your own line during your turn.

The previous dialogue shows how participant 1 considered that there were multiple associated effects to the action he chose, and the cube gave the opportunity to represent this impact in the workshop. This way, it was possible to see how a single actor could have multiple interpretations about the same issue. Participants explicitly asked if the cube could provide this possibility, as the following dialogue between participant 3 and the researcher shows:

P3: Ok, so now I only can add one connection, right?

Researcher: Yes

P3: But later I can add another line to the action I chose in this turn?

Researcher: Yes you can.

P3: Then it's ok. [Next, participant 7 added in round 1 the action 'relocation of the recreational harbor' having a positive impact on the quality of the harbor for recreation, and in round 2, she added a positive effect for businesses, given the positive effect on restaurants and hotels in the area].

Since the cube presented the previous discussions related to the actions and effects in the cube, it allowed keeping track of previous contributions of participants, facilitating building discussion on these previously discussed contributions. In this way, the cube allowed keeping track of the actions and effects presented by participants. The information about a particular subject was collected, presented, and available on the table for participants. In some instances, participants stood up and looked at the cube to memorize what was discussed before so they could add their own connection based on what had been previously discussed as the following figure shows.

In this instance, participant 6 stood up, looked at the cube for a while to recall what had been previously discussed. Throughout the rounds, the complexity of the cube increased, since there were more actions, effects, and connections in the cube. Consequently, the cube helped to *record* what had been previously discussed, and triggered other topics of discussion or start new ones that were not discussed before.

Figure 15(Left) Participant 5 turning the cube and looking at the functions and existing actions, effects, and connections. (Right) Participant 6 looking at the cube to recall what was previously discussed

5.6. Discussion

The previous section describes the role of the collaborative tool to make dilemmas explicit. Our results show participants were able to make dilemmas explicit and to meaningfully engage in discussion about them in the workshop session.

First the ‘dilemma cube’ guided the contribution of participants. Particularly, the dilemma cube encouraged participants to filter what was relevant to them in the project. By having limited rounds to add actions, effects, and connections to the cube, participants had to focus on what was important to them. Every time participants added an action, an effect, or connection, they needed to reflect about what was relevant to discuss in the workshop session. Providing a mechanism to filter what was relevant helped to reveal priorities to themselves and to other participants attending the session. As Ackerman and Eden (2005) acknowledge, the act of saying and writing down their actions and effects helped to reveal what was important for participants. Furthermore, having to write down the actions and effects on the cube encouraged participants to be precise about their use of words. Using the cube had an important effect on providing focus and helping participants to prioritize.

Second, the ‘dilemma cube’ acted as a canvas in which participants could create the substance and content of the cube while discussing their interpretations about the project. By taking turns participants could voice what they considered important. This way, the cube allowed including a divergence of views rather than being driven by the strongest actors in the group (Ackerman and Eden, 2005). Adding actions, effects, and connections was a path dependent process in which participants could build up their contribution based on what other

participants added. Being a path-dependent process of creation, the ‘dilemma cube’ acted as a stimulus to identify alternative and complementary interpretations about the project. The cube was therefore a vehicle to *materialize* the interpretations of participants, causing them to become real and visible in the process.

Moreover, the cube informed participants about the dilemmas by means of visualization. Visualizing the dilemmas and the connections between actions and effects allowed discussing interconnectivities and interdependencies among actors and functions. As Goodier *et al.* (2010) acknowledge, identifying and exploring interconnections help to extend actors’ sphere of thinking, facilitating communication and enhancing understanding of the contexts in which actors are involved. The ‘dilemma cube’ revealed the interconnections and interdependencies of issues, rather than the individual issues alone. Furthermore, the 3D nature of the cube showed the relatedness between actions and effects. Often, it is important to see the interconnections of issues given the interdependencies of effects and issues in complex projects (Soetanto *et al.*, 2011). The cube surfaced how a single actor had multiple interpretations, and how the same issue could be interpreted differently by diverse participants. As it was intended with the design of our collaborative tool, its 3D nature allowed showing dilemmas since it represented the interrelatedness of actions and effects not only across participants, but also across themes in the project. This was one of the main strengths of the dilemma cube, since, compared to other cognitive mapping techniques, the 3D nature of the collaborative tool revealed the interrelatedness of issues better than would have been possible using a two-dimensional cognitive map.

Throughout the workshop rounds, the cube acted as a ‘witness’ of what was relevant for the project participants. Participants could go to the cube and connect their own actions, effects, and connections to what was already discussed. Previous work in visual representations (Ewenstein and Whyte, 2007) has acknowledged the role of objects like visual representations to act as external memory, ‘as well as being sites of reasoning, reflection and projection’ (Ewenstein and Whyte, 2007; p. 82). Ackerman and Eden (2005) also acknowledged that the use of cognitive mapping and GSS acted as a live ‘repository of knowledge’, providing a soft copy of all the intertwined elements that were discussed by participants. In our case, the ‘dilemma cube’ represented the complexity of the project, incorporating multiple interpretations and revealing the dilemmas in this context.

By analyzing the interpretations of participants, we could infer and distil how participants were framing the project. Frames (Goffman, 1974) are actors’ schemata of interpretations. The actions and effects that participants added revealed how they were framing the project, and their priorities at that point in the process. Consequently, for each intervention it was possible to distil what was a participant’s diagnostic (what is going on) and prognostic (what should we do) frame. The dilemma cube was a valuable research tool to reflect about the co-existence of multiple frames in the project. Using collaborative tools like the dilemma cube has the potential of giving insights into how the presence of multiple frames gives rise to dilemmas in multi-actors contexts. Since frames are schemata of interpretation that belong to participants but remain concealed without a trigger to reveal them (Kaplan, 2008), the use of collaborative

tools seems relevant to materialize what would remain hidden otherwise. The dilemma cube revealed that a single actor could have a dilemma by identifying multiple co-existing negative and positive connections about an issue. In other words, a participant could hold multiple frames about an issue. Furthermore, revealing multiple actors framing differently the same issue surfaced group dilemmas. Consequently, the cube helped to surface the socially-constructed nature of dilemmas.

The use of collaborative tools like the dilemma cube can help to gain insights into the social context through the interaction among participants, allowing for deliberation and participation, surfacing and discovering the issues at stake. The cube helped to surface dilemmas existing in the project, and some intrinsic dilemmas that became salient as a result of the discussion of actors by using the cube. This way, it was possible to reflect about the project as a whole. This is similar to the use of some cognitive mapping tools that help to represent the past of the project and what triggered certain events, or gaining an understanding about the project as a whole retrospectively (Ackerman and Eden, 2005).

An interesting insight of using the 'dilemma cube' is its low-tech configuration. Our results revealed that actors engaged in interactions with the cube by touching and turning it, and manipulation its connections. The dilemma cube was engaging, and participants 'got their hands on something' (Al-Kodmany, 2001, p. 27). Most of the group cognitive mapping techniques are computerized or supported by the use of software. Using the 'dilemma cube' allowed for face to face interaction among participants without the use of any computer support. As previous research has acknowledged (Al-Kodmany, 2001; Van Amstel *et al.*, 2015), the use of a low tech visualization tool like the 'dilemma cube' provided more social interaction between participants, particularly effective when participants belong to varied stakeholder groups as it was in our case.

Despite the relevance of our study, it is not exempt of limitations. Since the involvement of actors was not anonymous, we did not eliminate potential power-based conflicts emerging from data capturing procedures as other researchers have done by using computerized anonymous methods (Tegarden and Scheetz, 2003). However, some other researchers emphasize the potential of understanding this dynamics in the process, offering the opportunity to observe power dynamics and interactions (Eden and Ackerman, 1998). A second limitation is related to testing the 'dilemma cube' in a single workshop session. Although our results provided insights into the interaction of participants with the cube, and the role of the dilemma cube making dilemmas explicit, testing it in more cases could help to meaningfully validate the tool and provide generalized claims. Another limitation is related to the encouragement to find relationships of complementarity to overcome dilemmas. Although the dilemma cube helped to surface dilemmas relevant for participants, reflecting about potential strategies to bridge competing demands was difficult. One of the main rationales behind developing and using the 'dilemma cube' is to make dilemmas accessible to those facing them. In particular, our motivation was to create awareness about the dilemmas of participants so they could be ready to reflect about strategies to overcome them. However, it is not enough to only make dilemmas visible, it is also important to encourage actors to find

relationships of complementarity to deal with the dilemmas and bridge seemingly competing demands. We encourage further research bringing forward the use of collaborative tools to not only allow for surfacing dilemmas but also reflect about relationships of complementarity to realize the potential of the use of the collaborative tool.

5.7. Conclusion

Our results show that the use of a collaborative tool like the dilemma cube helps to make dilemmas explicit in a multi-actor context. The dilemma cube played an important role guiding the contribution of participants, acting as a ‘canvas’ in which they could create the content contained in the cube while debating their interpretations about the project. The dilemma cube was a witness of what had been discussed, and participants could build in previous contributions allowing to show alternative and complementary views about the same issue. Given the 3D nature of the cube, the dilemma cube informed participants about the existing dilemmas in the project, since it allowed visualizing co-existing conflicting interpretations about issues at stake. Revealing the socially constructed nature of dilemmas is the stepping stone towards finding strategies that reconcile opposites in light of dilemmatic situations.

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Chapter 6

Chapter 6. Conclusions

The main goal of this thesis was to unravel the role of frames in the occurrence of dilemmas in multifunctional projects. To fulfill this goal, this thesis has provided answers to the following research questions:

1. How do predominant interpretations mobilize actors and influence their choices in the decision making process of a multifunctional project?
2. What are the intervention, regulation and investment dilemmas that actors encounter in the decision making of multifunctional projects?
3. What are the roles of frames in the occurrence of dilemmas in a multifunctional project?
4. How does a collaborative tool help to make dilemmas explicit in a multi-actor setting?

By answering these questions, the contribution of this study is twofold. First, it provides insights into the social dynamics of multifunctional land use projects, filling a knowledge gap by comprehending the unexplored role that frames and dilemmas play in the decision making of these complex projects. Second, the organizational complexity of multifunctional projects makes them an interesting case to gain insights into the role of frames in the occurrence of dilemmas in multi-actor contexts. This chapter concludes the thesis by summarizing the answers to these research questions

- How do predominant interpretations mobilize and influence their choices in the decision-making process of a multifunctional project?

Chapter 2 studied the influence of frames of reference on the decision-making process of a multifunctional project. To this end I followed a case study to analyze a multifunctional project in the harbor area of Rotterdam. My results revealed how the interdependencies among functions and resources in the project triggered the emergence of a predominant frame, showing the influence of power frames in this process. Given the interdependence of actors, frames that become predominant change depending on the authority and resources required for a specific decision context. The main contribution of this chapter is to provide insights into how frame differences have an effect on the definition and selection of functions in multifunctional projects. Shedding light on the influence of a variety of frames on multifunctional projects is the first step towards identifying approaches that help to involve multiple interpretations in multifunctional projects.

<p>Chapter 2 revealed the role of divergent frames in the definition and selection of functional combinations, shedding light on how predominant frames prevail.</p> <p>Power and authority influence the frames that becoming predominant determining the selection of functional combinations.</p>
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- What are the intervention, regulation and investment dilemmas that actors encounter in the decision making of multifunctional projects?

With insights into the influence of frames on the definition and selection of functional combinations, the next step was to identify prominent dilemmas that actors encounter in this process. To this end, I drew on a previous categorization of dilemmas provided by Savini *et al.*'s (2013; 2014). This categorization identifies three main types of dilemmas in planning namely: intervention, regulation and investment dilemmas. I followed a case study approach to analyze the occurrence of these three dilemmas in a multifunctional project located in the South West Delta in the Netherlands. By empirically analyzing dilemmas I evaluated how actors made sense of them, and how this had an influence on the formulation of final solutions in the project.

This chapter showed the preponderance of the investment dilemma in multifunctional projects. Safeguarding the financial viability of the project required a focus on the earning potential of functional combinations. However, encouraging the commitment of regional stakeholders needed satisfying stakeholder demands that were not always aligned with those that provided the highest earning potential. Although functional integration is the strategy to bridge multiple demands and ensure financial viability, actors in multifunctional projects encounter dilemmas while identifying and selecting functional combinations. Furthermore, these results show that integrating functions leads to tensions between transforming the area, and preserving existing values. As a consequence of the dilemmas, actors emphasized the financial profitability of the functional combinations to guarantee stakeholder commitment, so the occurrence of dilemmas steered the process towards placing more attention to functions that had a higher earning potential. The importance of this chapter lies in creating awareness of the dilemmas during decision making for multifunctional projects as a vehicle to identify practices that bridge seemingly competing demands.

Chapter 3 provided insights into the dilemmas that actors encounter organizing a multifunctional project. The investment and regulation dilemmas are prevalent while identifying functions that provide financial profit while satisfying regional demands.

- What are the roles of frames in the occurrence of dilemmas in a multifunctional project?

After understanding the role of frames and dilemmas in multifunctional projects, chapter 4 explored the influence of frames on the occurrence of dilemmas in a multifunctional project. Contrary to much of the current literature that focuses on either frames in multi-actor contexts or dilemmas, chapter 4 explored the relationship in practice between frames and dilemmas. Following a case study approach I analyzed the influence of frames on the occurrence of dilemmas in a regional multifunctional project in the South West Delta in the Netherlands. This in-depth case study elucidated the influence of frames on dilemmas since diverse actors' prioritize and favor different courses of action. Furthermore, decision contexts have intrinsic

dilemmas that remain hidden until the interaction of actors' frames surfaces them. I conclude that the co-existence of frames leads to dilemmas, and are the vehicle through which dilemmas manifest. Understanding the occurrence of dilemmas in decision-making processes is the stepping stone to exploit the potential of dilemmatic situations. Rather than choosing between opposites, it is important to understand dilemmatic situations as synergistic, embracing opposing forces as an invitation for creativity and opportunity.

Chapter 4 provided insights into the influence of frames on the occurrence of dilemmas in a multi-actor context. The co-existence of various frames leads to dilemmas since diverse actors prioritize and prefer different courses of action. Besides, decision contexts often have intrinsic dilemmas that remain concealed until the interaction of frames and actors' interpretations surfaces them.

- How does a collaborative tool help to make dilemmas explicit in a multi-actor setting?

Finally, chapter 5 presented a three-dimensional collaborative cognitive mapping tool that I designed to make dilemmas explicit. This chapter revealed that the use of a collaborative tool like the 'dilemma cube' helped to surface dilemmas in a multi-actor context. The dilemma cube guided the contribution of participants, acting as a 'canvas' in which they could create the content contained in the cube while debating their interpretations about the project. The dilemma cube was a witness of what had been discussed, and participants could build on previous contributions allowing to show alternative and complementary views about the same issue. Given the 3D nature of the cube, this collaborative tool informed participants about the existing dilemmas in the project, since it allowed visualizing co-existing conflicting interpretations about issues at stake. My findings revealed the socially constructed nature of dilemmas, being the steppingstone to explore strategies that stimulate deliberation, and provide opportunities of exploiting opposites in light of dilemmas.

Chapter 5 provided a three-dimensional collaborative tool based on cognitive mapping techniques which demonstrates how collaborative tools can be used meaningfully to make dilemmas explicit in a multi-actor context. This chapter is the stepping stone towards studies that consider the relevance of making dilemmas explicit to identify relationships of complementarity that aim at bridging competing demands.

6.1. Discussion

This section elaborates on six topics of discussion originating from this thesis. First, I discuss how realizing the potential of dilemmas requires understanding their origin and embracing opposites. Second, I describe that understanding frames helps to reveal dilemmas in multi-actor contexts. Third, I discuss the emergence of predominant frames and their influence to deal with dilemmas. Fourth, I reflect on the use of multifunctional projects as a case to reflect on the role of frames in the occurrence of dilemmas. Fifth, I reflect on the methodological

choices of this thesis. Sixth, I suggest further research based on the limitations and inspiration provided by this thesis work.

6.1.1. Reflections on dilemmas and frames

Realizing the potential of dilemmas requires understanding their origin and embracing opposites

Dilemmas are pervasive in decision making. When various interdependent actors need to make a decision collectively, several options look equally desirable or undesirable based on different criteria. Actors' reactions to the dilemmas (whether conscious or not) influence the formulation of solutions, because dilemmas encourage actors to reassess the situation to take collective action. Since dilemmas trigger actors to reassess the situation and decision context, dilemmas can be considered as a cues for actors to make sense of the situation as presented by Weick (1995; 2005). Dilemmas as a sense making trigger stimulate looking for solutions that integrate seemingly conflicting demands, and reconsidering the situation by looking at it from different angles. As a result, dilemmas offer the potential of including more views about issues at stake, avoiding a one-sided decision-making process. However, not having a clear and straightforward preferred choice tends to paralyze actors that perceive dilemmas as a source of delay and conflict in decision making. The standpoint of this thesis is that, instead of suggesting approaches to deal with dilemmas in a prescriptive manner, it is important to understand their origin in the first place to stimulate finding strategies that bridge seemingly competing demands. This thesis began under the premise that realizing the potential of dilemmas requires creating awareness about what caused the dilemma in the first place.

Following preceding debates on dilemmas in organization studies (Northcraft and Tenbrunsel, 2011) and drawing on a previous categorization of dilemmas in planning (Savini *et al.*, 2013; 2014) I explored specific dilemmas in multifunctional projects. Exploring the occurrence of dilemmas reveals that opposites are necessary to realize a project's potential. Actors are constantly pulled and pushed in opposing directions because of conflicting and often mutually exclusive choices. The more actors emphasize on the opposites, the more the other opposite proves to be essential for the project (Sachs *et al.*, 2006). For example, in the case of the South West Delta, the more actors highlighted the need to implement financially profitable functions, the more the achievement of other regional demands proved to be important to increase commitment. As a result, accepting a tradeoff or leaving out the dilemmas jeopardizes achieving the project's objectives. Therefore, this thesis confirms that realizing the potential of dilemmas to look at situations from different perspectives requires devoting attention to both *sides of the spectrum* (Lewis, 2000; Storey and Salaman, 2010). However, actors tend to break down interwoven elements and treat dilemmas as either-or situations, practices and understandings. This black-white thinking leads to hesitancy, hiding the opportunities that conflicting orientations offer if exploited concurrently. This concurrent exploitation of opposites requires working *with* rather than *against* dilemmas (Storey and Salaman, 2010).

Making dilemmas a source of deliberation to look at situations from different angles requires finding approaches to understand where dilemmas come from in the first place. Surfacing dilemmas involves exploring the underlying issues which caused the dilemma, to stimulate

collaboration (Northcraft and Tenbrunsel, 2011). Debating dilemmas among various actors enables an informed understanding of the project context. Particularly this thesis reveals that making dilemmas explicit can be facilitated by understanding the coexistence and presence of various dissimilar frames about issues at stake. Creating awareness of the dilemmas that actors encounter during decision making helps to suggest practices to take advantage of seemingly opposing demands. Similarly, digging into the origin of dilemmas is important to understand the underlying reasons behind those dilemmas, before finding strategies to solve them. Like Northcraft and Tenbrunsel (2011) state, more than understanding how actors deal with dilemmas, it is important to understand who is taking part in the dilemmas. Consequently, surfacing dilemmas requires incorporating those who are going to make a decision together and communicate their interpretations.

This thesis argues that instead of encouraging solutions that aim at cutting off one of the opposing forces leading to dilemmas, comprehending their origin offers a fruitful avenue to explore solutions that help not only to overcome dilemmas, but to exploit their potential.

Understanding frames reveals the nature of dilemmas

Understanding the origin of dilemmas required gaining insights into why different choices seemed desirable and undesirable. Consequently, this thesis began under the premise that when various actors make a decision collectively, they interpret differently issues at stake leading to situations in which they prefer dissimilar courses of action. The point of departure was therefore to understand the role of interpretations in decision making to unravel how the presence of various frames has a role in the occurrence of dilemmas in decision making. To this end, I used the lens of *frames* to evaluate the interpretations of actors that belong to various sectors and disciplines, preferring or supporting courses of action over others. Particularly, the categorization into diagnostic and prognostic frames (Kaplan, 2008; Benford and Snow, 2000) reveals how problems and solutions are subject to interpretation. Diagnostic frames shape actors' interpretations of what the issues at stake were, and prognostic frames guide actors' views of the solutions. This way, frames offer a valuable lens to depict how actors interpret the situation at stake and have different considerations of how their efforts should be oriented.

By understanding the role of frames in the occurrence of dilemmas, this thesis contributes to previous debates about the influence of multiple diagnostic and prognostic frames. Although Kaplan (2008) provides insights into the role of frames in dealing with strategic uncertainty, she does not provide accounts on how frame divergence and strategic uncertainty lead to dilemmas. This thesis shows that contextual factors like uncertainty or scarcity of resources influence how actors frame the decision context. A lack of financial resources to finance an improvement of water quality, the involvement of multiple actors in the decision-making process and the need for change are *catalyzers* for dilemmas. In other words, situations in which plurality, change, and scarcity are present, tensions like dilemmas emerge as a result of the interaction of actors holding different frames. This is similar to what Smith and Lewis (2011) acknowledge. If actors do not hold different frames, but there is no scarcity of

resources or uncertainty, these dilemmas would not emerge. The situated nature of actors' frames interacting in a context to achieve a common goal influences the occurrence of dilemmas.

This thesis concludes that dilemmas can both be intrinsic to a decision context and surface through the interaction of actors having dissimilar frames or caused by frame differences. The first case reveals that actions have negative and positive effects. When actors interact and frame these effects, intrinsic dilemmas surface. At the same time, the interaction of frames can cause dilemmas, particularly related to how to organize or define the priorities in the decision-making process. Both views highlight the importance of frames to make dilemmas explicit. Understanding the influence of frames on the occurrence of dilemmas has two main contributions.

First, it shows how dilemmas originate from multiple interpretations about issues at stake revealing that, by embracing the coexistence of multiple frames, dilemmas can offer the potential of looking at situations from multiple angles. Although the incorporation of multiple frames increases the complexity of the decision making process, a diversity of frames is productive because it results in 'the vetting of ideas and balances potential bias in decision making', as Kaplan (2008, p.745) acknowledges. Involving various frames allows including more views in the project and has a positive effect on the creativity and range of options, reducing the risk of having a one-sided decision-making process. In other words, multiple frames increase complexity but offer the potential of incorporating more views in the project. Realizing the potential of involving multiple frames requires finding a balance between the benefits of the involvement of more actors with their associated frames, and the increased complexity that this involvement entails (Elsbach *et al.*, 2005).

Second, it shows that revealing frames helps to make dilemmas explicit. The use of collaborative tools supports making dilemmas explicit in a multi-actor context. Supporting actors to voice their interpretations about issues at stake, representing the interrelatedness of issues helps to show dilemmas. By making dilemmas explicit, actors make sense of the project as a whole triggering discussions about strategies to deal with dilemmas. As a result, the use of collaborative tools like the 'dilemma cube' presented in this thesis helps to gain insights into the social context through the interaction of participants.

Coping with dilemmas and predominant frames

Despite the potential of having multiple frames and encountering dilemmas, differences in frames often result in situations of impasse or conflict. When conflict arises, actors try to make their own frame predominant. Frames become predominant when actors use their power and authority to make their own interpretation prevail and mobilize other actors around it. This thesis shows that understanding how some frames prevail over others offers an interesting account to understand the dynamics of power in multi-actor contexts. Having divergent frames about issues at stake, the emergence of a predominant frame helps to move the process forward and mobilize actors around a particular interpretation.

Understanding predominant frames provides insights into how actors react in light of dilemmas. Dilemmas occur as a result of dissimilar frames, revealing the presence of conflicting orientations towards issues at stake. When a dilemma occurs, actors use their power or authority to make their frame prevail and overcome the dilemma. In this situation, actors would follow a strategy of 'domination' (Ashforth *et al.*, 2014) to deal with the presence of conflicting orientations towards issues. However, as Ashforth *et al.* (2014) acknowledge, following a strategy of domination misses the opportunity of bridging the seemingly competing demands and providing a solution oriented towards 'holism'. Holism requires that in light of conflicting orientations actors accept and embrace opposing orientations in a proactive manner instead of diminishing one of the options. This is similar to paradox thinking (Smith and Lewis, 2011). However, realizing holism or having a holistic response requires actors to be aware and willing to embrace the interpretations of other actors.

Actors should therefore search for strategies that stimulate the emergence of predominant frames that help to achieve various seemingly conflicting interests. Differences in how actors frame the scope of the context and the selection and definition of options could be considered as explicit inputs in decision making. Organizing open processes that allow for the inclusion of a range of divergent frames helps to create awareness and deal with frame differences. Treating key framing assumptions as explicit inputs in decision making offers a means to bring to the surface stakeholders' interpretations about how dissimilar actions are preferable under different frames, and how these dependencies relate to stakeholder interests.

Defining and selecting functional combinations in multifunctional projects benefit from making frames and dilemmas explicit

Multifunctional projects offered a relevant case to understand the influence of frames and dilemmas on multi-actor contexts. As previous research has acknowledged (Salet *et al.*, 2013) multi-functionality is a key source of complexity and uncertainty requiring different approaches than those of mono-sectorial and mono-functional projects. The incorporation of multiple actors in the decision making all belonging to different sectors and disciplines entails the involvement of multiple interpretations about issues at stake, making the decision-making of multifunctional projects prone to ambiguity (Brugnach *et al.*, 2008; 2011) and ambivalence (Ashforth *et al.*, 2014). Furthermore, the tight integration and interconnection of actors, effects and resources increase the level of interdependence of actors. Actors cannot make decisions unilaterally, requiring the support of other stakeholders, and achieve both individual and collective interests. As a result actors are constantly encountering options that seem equally desirable and undesirable, leading to dilemmas.

Moreover, while defining and selecting functional combinations actors rely on the use of economic instruments and ex-ante evaluation methods like environmental impact analysis. Actors frame the project differently based on the results from these methods. The use of ex-ante evaluation tools is crucial in how actors frame the project and the dilemmas that occur. Indeed, different actors interpret differently the results from the economic instruments. The associated uncertainty to some of the effects make it difficult to identify a straightforward and

preferred course of action. This has been debated in literature about economic instruments, emphasizing on how the results are interpreted differently by different actors leading to ambiguous situations (Beukers *et al.*, 2014).

Given the relevance of the occurrence of dilemmas and the coexistence of various frames in the decision making of multifunctional projects, two main conclusions originate from this thesis that are relevant for the organization of multifunctional projects.

First, achieving the potential of multifunctional projects that combine various demands in the same area could be enabled by using approaches that surface actors' frames together with the use of ex-ante evaluation methods. Despite the importance of frames on actors' preferences and choices, these often remain hidden, limiting the potential of incorporating more views to the decision making process. Choices in multifunctional projects often rely on quantified effects, avoiding the confrontation between multiple interpretations that actors might have about these effects. Innovative planning practices like multi-functionality need to allow involving multiple voices and frames; otherwise they might fail to achieve their main rationale.

Second, multifunctional projects attempt to bridge demands that could seem irreconcilable. Defining and selecting functional combinations actors are constantly encountering crossroads and situations that do not provide a clear path to follow. Exploiting the potential of multifunctional projects to combine multiple demands requires making actors aware of the dilemmas they encounter. Using approaches or tools that support making dilemmas explicit would help to stimulate dialogue and the exploration of relationships of complementarity which are the motivation to develop multifunctional projects in the first place.

6.1.2. Reflections on the method

To achieve my research goal, I used various research approaches and methods. In this section I reflect on my methodological choices to achieve the final research goal. Using case studies is a common denominator throughout the thesis. Following a case study approach fitted my research goal since I wanted to investigate contemporary phenomena (frame differences and occurrence of dilemmas) within its real life context (Flyvbjerg, 2006; Yin, 2013). Context dependent experience lies at the heart of expert activity, which lies at the heart of case studies. Since my cases were anchored in real-life situations involving actors in a project, I could get a holistic and rich account of the phenomenon under study. Each chapter of the thesis had a different research goal; consequently, I needed to select the cases, and chose an approach for data collection and analysis, that required being adaptable.

Although case studies are a common denominator, for each chapter I followed a different approach that deserves some reflection. In chapter 2, I chose a grounded method. This was a starting point to explore the kind of challenges that actors encountered in the decision-making process of a multifunctional project. To this end I reconstructed the decision-making process of a multifunctional project by conducting exploratory interviews with actors that were part of this project. I let the actors in the project to be the storytellers of the process, encouraging them to elaborate on what was relevant from their perspective. I analyzed the interviews with

open and axial coding techniques, identifying patterns in the data. Going back and forth from theory to data, I could theorize about the results, and identify the relevance of frames in the decision-making process of the project under study. This way, instead of starting with predefined categories based on existing literature, I distilled what was relevant for multifunctional projects based on the insights from my analysis of the case.

Following an inductive approach allows getting a holistic view on multifunctional projects, and 'let the data speak'. Although grounded theory provides an understanding about phenomena in its context, one of its main limitations lies in its failure to recognize the involvement of a researcher in the project and the influence of her agency in data interpretation. Working in close collaboration with other researchers that co-authored the articles included in this thesis during data analysis helped to reduce research bias. Furthermore, constant interaction with practitioners working with multifunctional projects assisted me to reduce my potential research bias by sharing research reports and articles to them. However, none of the practitioners, or what Bartunek and Louis (1996) call 'insider team', participated in the analysis of the data. As a result, I was an outsider working together with other outsiders, a research team that studied a phenomena and observed 'insiders' (practitioners) without being fully involved in the project. Involving 'insiders' as co-inquirers throughout the research process could have reduced bias, and contributed to the external validity of the study as suggested by Bartunek and Louis (1996).

Then, I followed inductive and deductive approaches. I used inductive reasoning to identify the dilemmas presented in chapter 3. In chapter 4, the analysis of the influence of frames on the occurrence of dilemmas was based on deductive reasoning. The mix of inductive and deductive reasoning proved to be complementary. I started looking for patterns across the data in chapters 2 and 3, trying to make sense of those patterns by theorizing about them. Once I found a compelling theory (frames and dilemmas), I used deductive reasoning for chapter 4 to evaluate the influence of frames in the occurrence of dilemmas.

Apart from the type of reasoning used in this research, it is important to reflect on the strategies for data collection. In chapters 3 and 4 I used cognitive mapping techniques for data collection. The reason to select cognitive mapping techniques was their usefulness on representing the interpretations of actors involved in a complex context. The decision-making process of multifunctional projects was characterized by multiple interdependent actors that belonged to different sectors and disciplines. In my second case study, there were more than 18 regional stakeholders dealing with issues that concerned more than seven different sectors. The use of cognitive mapping techniques helped to make manageable the amount of data because it allowed capturing a large amount of qualitative data in a structured manner.

Using cognitive mapping techniques requires being critical and reflective about their use and limitations (Swan, 1997). In this case, I used cognitive mapping as a data collection, and not as data analysis. Many cognitive mapping techniques involve researchers developing the cognitive map of participants based on the excerpts of interviews. For this study, I encouraged participants to develop their own map. This way, it was the respondent who created the map,

and provided a structured and organized view of how they perceived the world around them. Compared to regular interviews, cognitive maps helped to depict the emergence of issues, and provide a straightforward overview of the complex structure of the project.

Furthermore, there are multiple approaches for cognitive mapping. In this case, I used an open Conceptual Content Cognitive Map (3CM) technique (Kearney and Kaplan, 1997). This exercise has been widely used in the field of natural resource management (Kearney *et al* 1999, Kearney and Gordon 1998, Tikkanen *et al.*, 2005, Biedenweg and Monroe, 2013) to explore the interpretations of individuals, and the differences of individuals in those interpretations. I chose this method because (1) it was useful in assessing people's perspectives concerning complex domains, and (2) it focused on important factors for participants, providing links between factors through a process of exploration (Kearney and Kaplan, 1997). Compared to a structured implementation of the 3CM technique, using an open 3CM provides freedom to participants to add what they considered relevant. The open 3CM technique allowed actors to elucidate what they considered important, and how they comprehended the complex system. It allowed actors to represent concepts that they perceive as important, and organize these concepts along multiple dimensions. Despite the richness and amount of data, it was difficult and time consuming to analyze. Since I used the open 3CM technique, I did not provide any indication or predetermined category to guide the development of the maps. Consequently, maps had differences in semantics and categories, making the analysis of 30 cognitive maps time consuming. Supplementing the analysis of the cognitive maps with the narratives that actors provided proved to be a very useful support to depict the interpretations of participants about the project.

Using cognitive maps allows structuring large amounts of data, and encourages actors to reflect about their interpretations of the project. However, analyzing cognitive maps leads to results that are interpretations of interpretations. Cognitive maps are the interpretation of actors that required the analysis of a researcher that is using her own interpretation. Consequently, analyzing frames and dilemmas by using cognitive maps requires using them in conjunction with other sources like document analysis, observations, to validate the links and observe the outcomes in the process. This way, I could analyze the maps as a part of a complex evolving context, and not as a snapshot of the perceptions of actors, as if they existed in a vacuum. This allowed validating the analysis, by contrasting the findings with other data sources. Furthermore, I validated my study providing the articles here included to practitioners in the project, testing my own assumptions about frames and dilemmas in the process.

For chapters 3 and 4 I collected individual cognitive maps to understand the similarities and differences in interpretations across actors. From an analytical perspective, in chapter 4, I considered the FA team as a single actor since based on my analysis they shared frames. Although members of the project team shared their frames, there were some individual differences in the maps and narratives that were not represented in the study. Although I presented individual maps to illustrate the frames of the FA team, I was analytically using a unified group cognitive map for the FA team. Previous research has acknowledged the

difficulty and challenges of grouping individual cognitive maps to represent the interpretations of a group (Tergarden and Sheetz, 2003). Organizing a workshop to create a group cognitive map could have allowed taking potential nuances into account. In the attempt to represent a collective cognitive map to make dilemmas explicit, the development of the 'dilemma cube' in chapter 5 addressed this issue.

By providing a tool that allowed developing a three-dimensional cognitive mapping tool that actors could use collaboratively to share their interpretations about the project, and by doing so, making dilemmas explicit. The three-dimensional nature of the dilemma cube allowed visualizing the interrelatedness of issues, helping to identify dilemmas. Furthermore, using the dilemma cube by following a turn-taking workshop structure helped participants to voice their interpretations individually. Although adding positive and negative connections among actions and effects allowed visualizing dilemmas. However, since there were only two options and types of connections, the type of dilemmas were binary, focusing on positive and negative connections, without providing insights into other type of relationships among actions and effects that could cause a dilemma. Allowing for a semantic connection would enrich the types of dilemmas discussed. Furthermore, I tested the dilemma cube in a single project in a workshop session. Testing the cube in a single workshop setting poses validity issues that should be explored further in a different case to generalize results related to the use of the collaborative tool to make dilemmas explicit.

Nevertheless, this was out of the scope of this thesis. This thesis identified dilemmas in multifunctional projects unraveling their origin. Consequently, its purpose was neither to understand how actors deal with dilemmas nor to provide guidelines of how to deal with potential dilemmas in the future. On the contrary, the focus is on the understating nature of dilemmas to create awareness about their existence so actors can make informed and transparent choices, enacting reflection. After analyzing the results of the workshop, it was possible to infer actors' frames. The actions and effects that participants added revealed how they were framing the project, and their priorities at that point in the process. However, whether or not participants became aware of other actors' frames was not analyzed. The dilemma cube helped to dialogue and discuss interpretations and dilemmas. For the research team, the cube was a valuable tool to analyze frames, but it was not tested to what extent actors became aware of other participants' frames. This offers opportunities for further research, as I elaborate on the next section.

6.2. Suggestions for future research

This section presents suggestions for further research based on the limitations of the study and inspired by the insights gained throughout the chapters of the thesis.

The first suggestion for further research is related to the occurrence of dilemmas and predominant frames in decision making. Chapter 2 provides insights into the emergence of predominant frames to make choices and chapter 4 reveals that dilemmas occur as a result of multiple frames. However, this thesis does not provide insights into the influence of

predominant frames to deal with dilemmas. Given the relevance of frames in the occurrence of dilemmas and the importance of predominant frames to make choices, studies analyzing how the emergence of predominant frames can solve dilemmas, and how to encourage frames to prevail that help to achieve mutual gains seems an interesting path to understand how actors deal with dilemmas in light of conflicting frames.

The second suggestion is related to the treatment of dilemmas in this thesis. Dilemmas occur at different levels: individual, group, institutions. This thesis focused on group dilemmas without analyzing individual dilemmas nor the interaction among the different levels at which dilemmas can occur. The occurrence of dilemmas in groups does not mean that an individual perceives the same dilemma. On the contrary, actors involved in a group dilemma might not distinguish its presence because they have clear defined interpretations of the situation at stake, and the preferred course of action to deal with it.

In respect of the types of dilemmas studied in this thesis, chapter 2 discussed the *tragedy of the commons* (Hardin, 1968) where actors attempt to maximize their own self-interest without considering the public good and leading to an undesirable situation for all involved actors. This is a social dilemma, or dilemmas that individuals have when they interact with other actors to achieve a collective goal. If actors attempt to act based on their own self-interest, there is a risk that the collective interest will not be fulfilled. However, the interdependence of actors in multifunctional projects makes their resources and actions interrelated, being not possible to act independently without considering the effect on others. Taking the example of the case presented in Chapters 3 and 4, without water quality or nature development, there would not be economic development or recreational areas. However, the progress of the project was shaped by the actors' priorities, which were influenced by their frames. I encourage further research to evaluate the influence of frames on the occurrence of social dilemmas.

Understanding social dilemmas would provide an important account to support actors to achieve both collective and individual interests. Given the strong interdependences of actors in multifunctional projects, requiring one another to make decisions, it seems relevant to evaluate if actors frame situations based on self-interest instead of considering collective gains.

Regarding the analysis of dilemmas in this thesis, a main limitation concerns the examination of the influence of dilemmas on how the decision-making process unfolds. Chapter 3 focused on analyzing how dilemmas occur in the decision making of a multifunctional project describing how actors made sense of the dilemmas, influencing the definition and selection of functional combinations. The results pointed out the path-dependency of dilemmas, and how their emergence leads to more dilemmas in return. However, I did not elaborate on the dynamics of the continuous occurrence of dilemmas. I encourage the development of rich longitudinal studies evaluating this path-dependency, analyzing how actors deal with the unescapable nature of dilemmas.

Moreover, although discussed in chapter 4, this thesis did not evaluate how accepting the complementarity of opposing forces requires actors adopting what Lüscher and Lewis (2008) and Smith and Lewis (2011) call 'paradoxical thinking'. This necessitates a 'both/and' approach

that overcomes paralysis, and helps to connect seemingly conflicting demands. Instead of focusing on whether to focus on X or Y, ‘paradoxical thinking’ (Smith and Lewis, 2011) considers to successfully involve X and Y. I encourage further research exploring how dilemmatic situations can be synergistic. It would be particularly interesting to analyze how to make a frame prevail that bridges seemingly competing demands, and helps to adopt a ‘both/and’ approach, or a ‘holistic’ strategy (Ashforth *et al.*, 2014) as described above.

One of the points of attention of this thesis is to create awareness about dilemmas by using a collaborative tool. Chapter 5 discusses how the use of a collaborative tool helps to make dilemmas explicit. One of the main rationales behind developing and using the dilemma cube is to make dilemmas accessible to those facing them. In particular, my motivation was to create awareness about the dilemmas of participants so they could be ready to reflect about strategies to overcome them. However, it is not only about making dilemmas visible, but also to encourage actors to find relationships of complementarity to deal with the dilemmas and bridge seemingly competing demands. I encourage further research bringing forward the use of collaborative tools to surface dilemmas and reflect about relationships of complementarity to realize the potential of the use of the collaborative tool. Moreover, longitudinal research on how actors manage competing demands and encourage deliberation can help to open up spaces in which it is possible to exploit the potential of dilemmas.

The use of the ‘dilemma cube’ helped to surface dilemmas by encouraging actors to share their interpretations about the project with others. During analysis it was possible to evaluate the frames that actors held while assessing issues at stake in the project. However, I did not validate whether participants using the ‘dilemma cube’ became aware of other actors’ frames. I encourage further research evaluating how using the ‘dilemma cube’ supported actors to become aware of other actors’ frames.

Last, I would like to encourage further research to complement studies about multifunctional projects. Further research could explore the motivations behind developing multifunctional projects. Multifunctional projects can be seen as strategies to bridge dilemmas or as a trigger for the emergence of more dilemmas as a result of the involvement of multiple frames in the decision-making process. In the first view, multifunctional projects are a bridge between multiple demands to deal with dilemmatic situations. In the second view, the fact that multifunctional projects create more dilemmas means that they offer potential to look at the same project from multiple perspectives, stimulating the exploration of more inclusive solutions that satisfy a higher number of demands. This last suggestion is related to the type of dilemmas identified in this thesis. Chapters 3 and 4 discussed dilemmas that were reduced to two opposing views or excluding options. However, multifunctional projects include multiple dimensions; hence reducing dilemmas into two opposing choices or demands is not representative of this multi-dimensionality. I suggest expanding this study and identifying trilemmas, quadrilemmas, or even penta-lemmas that might emerge in a multifunctional project.

6.3. Concluding remarks

When defining and selecting functional combinations, actors often need to prioritize various functions based on the demands that they need to fulfill and the available resources for the project. In these settings dilemmas naturally occur. Dilemmas are situations in which actors are confronted with various options to make a choice, all being equally desirable or undesirable. Dilemmas are often associated to situations of paralysis or impasse. Not knowing what to do leads to a deadlock. However, encountering dilemmas also offers the possibility of looking at issues from different lenses, stimulating deliberation about the issue at stake from different angles. Consequently, dilemmas have great potential to foster creativity, and to think about solutions that bridge seemingly competing demands. To this end, it is important to create awareness about dilemmas. Yet, dilemmas often remain hidden. Given the diversity of actors involved in decision making for multifunctional projects, actors often do not perceive certain situations as dilemmas. On the contrary, a desirable course of action might seem obvious and straightforward for any one party involved guided by their own interpretations about the issue at stake. Others, might have a different perspective. Therefore, one-sided thinking should be avoided while developing multi-functional projects.

List of publications

Published articles

Matos Castaño, J., Hartmann, T., Dewulf, G. P.M. R., & van Huffelen-de Kort, I. A. (2015). 'What is going on and what should we do? 'Divergent frames in multifunctional projects. *Engineering Project Organization Journal*, 5(1), 36-48.

Journal publications under review

Matos Castaño, J. Hartman, T. & Dewulf, G.P.M.R. (under review in *Town Planning Review*) 'Understanding the dilemmas of multifunctional regional planning'.

Matos Castaño, J., van Amstel, F. M. C., Hartmann, T. & Dewulf G.P.M.R. (under review in *Futures*) 'Making dilemmas explicit through the use of a three-dimensional cognitive mapping tool'.

Conference papers

Matos Castaño, J., Hartman, T. & Dewulf, G. P.M.R. (2015) "From frames to dilemmas? Understanding the manifestation of dilemmas in a multifunctional project". Presented in *Engineering Project Organization Society Conference*, June 24-26, 2015, Edinburgh (UK).

Matos Castaño, J., Hartman, T. & Dewulf, G. P.M.R. (2015) "Dilemmas in the appraisal of multi-functionality" Presented in *International Association for Impact Assessment Conference*, April 20-23, 2015, Florence (Italy).

Matos Castaño, J., Hartman, T. & Dewulf, G. P.M.R. (2014) "Understanding the ex-ante evaluation process in strategic spatial planning. An integrated area development example". Presented in *Engineering Project Organization Society Conference*, July 29-31, 2014, Colorado (USA).

Matos Castaño, J., Hartmann, T. & Dewulf, G. P.M.R. (2013). "Measuring shared understanding about the costs and benefits of integrated area development". Presented in *EURA Conference* July 3-6, 2013, Enschede, (The Netherlands).

Matos Castaño, J., Mahalingam, A. & Dewulf, G.P.M.R. (2012) "The complex interplay between the institutional context and PPP project outcomes". In: *Engineering Project Organization Conference (EPOC 2012)*, July 10-12, 2012, Rheden, The Netherlands (pp. 1 - 32).

Published articles during PhD trajectory not included in this thesis

Matos Castano, J., and Mahalingam, A., & Dewulf, G.P.M.R. (2014) Unpacking the path-dependent process of institutional change for PPPs. *Australian journal of public administration*, 73(1), 47 - 66.

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About the author

Julieta Matos Castaño was born on the 4th of December in Madrid (Spain). In her hometown, Julieta studied airport planning at the Technical University of Madrid where she had the opportunity to carry out an internship at the Madrid-Barajas airport and develop a 6 month research project in the Université Paris X in Paris. In 2008-2009, Julieta gained professional experience in airport planning. Triggered by the complex organizational context in which infrastructure projects were developed, she decided to expand her

career path and moved to the Netherlands to pursue a master in Construction Management and Engineering at the University of Twente. After writing her master thesis on public private partnerships in India, Julieta got the exciting opportunity to start a PhD to study multi-actor decision-making processes in the context of multifunctional projects. As part of her research, Julieta developed a collaborative tool to surface different interpretations in decision making and create awareness about dilemmas to encourage collaboration. At the moment, Julieta is going to work as a consultant with the main drive to contribute to society by supporting organizations to deal with complex societal problems. Besides, Julieta has a great interest in literature, art, travelling and sports. Someday, Julieta would like to be a well-known writer and illustrator.

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