Arjan Hijdra

Waterways – Ways of Value

Planning for redevelopment of an ageing system in modern society

PhD series

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Waterways – Ways of Value

Planning for redevelopment of an ageing system in modern society

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Photo cover:
Section of the Maxima-canal towards the river Meuse in the Netherlands. This newly developed canal replaces the section of the canal 'Zuidwillemsvaart' running through the city of 's Hertogenbosch. In developing the section as seen on the photo the following elements played a major role: economies of scale for shipping, flood protection from the river Meuse, aesthetics and view from housing, safety and attractiveness of cycling paths, historic landscape, groundwater effects on agricultural land, migration route for fauna, cutting through toxic landfill (upper right), reduced congestion of city traffic as no bridge openings are required for the 'Zuidwillemsvaart'. Photo cover and chapter pages by Rijkswaterstaat (https://beeldbank.rws.nl, Rijkswaterstaat).

Never thought it would be such a fascinating journey. The warnings I've beaten in the wind, and with a large dose of enthusiasm I set course to uncharted waters. I felt like a cool explorer who seeks to discover new shores. My enthusiasm could also have been described as over-confident. As an experienced practitioner in the development of waterways, nationally and internationally, it did not seem overly complicated to pack this knowledge into a thesis. Now I feel wiser.
A PhD trajectory makes one humble again. It requires understanding what many bright minds already discovered, it requires listening carefully to interviewees withholding your own opinion, it requires leaving your familiar disciplines to understand new perspectives. Slowly but surely I started to understand that being an explorer means sharpening the senses and leaving convictions behind.

As I was initially convinced I understood the world around me, I'm now aware it can be understood in many ways. This insight remained a source of inspiration during the entire process. This inspiration was fuelled by the numerous discussions with fellow scientists, by reading literature, by doing interviews and by conducting fieldwork. Inspiration did not come without transpiration, however. Formulating findings, clear and concise, and repeatedly sharpening these formulations took lots of effort. The result was often rewarding though. Granted, this study was not free from setbacks and hurdles, but the experience has certainly remained a positive one, for the entire journey.

The journey of discovery was also a literal one. The research brought me to many places. The time spent at MIT, in Cambridge USA, was an absolute highlight. Together with my family we lived for a year in our beach house in the small town of Hull. It was a magic place, in a very welcoming and friendly community. As a family we experienced many small and big adventures, summarized our stay just exceeded all our expectations.

Scientifically it was an absolute joy to work in the energetic academic environment of Cambridge. Passionate students and scientist from all over the world make it a buzzing place, rich of ideas and lines of reasoning. Working in such a context was very helpful in finding my own research path. I warmly thank Prof. Larry Susskind for making this possible. It was an honour and pleasure to work with you, and your insights and tips have helped me shape this thesis. Many thanks are also due to Tijs van Maasakkers and Todd Schenk.

I dearly appreciate the many substantive discussions we had, but most of all for the excellent way you have familiarized me in my new world out there.
Most of the research, however, was conducted in the Netherlands.
In a stimulating professional and academic environment, numerous people have kept motivating and helping me to complete this journey. Hans and Polite, your support and encouragement were crucial in turning plans into reality. I also thank the many other Rijkswaterstaat colleagues who provided me with valuable insights and supported and encouraged me to keep going. Special thanks I owe to a group of trainees and students assisting me in the fieldwork. Bas, Tjeerd, Marthe and Joost, your contributions are very much appreciated.

My academic harbour for the entire journey was the University of Groningen. My monthly visits to the Faculty of Spatial Sciences, department of Environmental and Infrastructure Planning, always felt like a warm bath. Like-minded, sharing similar challenges and troubles; my fellow researchers were a source of knowledge, insight and inspiration. Jannes, Tim, Taede, Marije, Wim, Frits, Niels and all others, many thanks for your time and feedback.

At the University of Groningen, there are two persons I am particularly deeply indebted to. These are my promoters Jos Arts and Johan Woltjer. As said, I was perhaps a bit overly confident at the start of this journey, but at the same time it was indeed clear to me that having the right promoters is key for success. Jos, Johan: I do not think I could have chosen better. As a solid team, supportive, constructive and critical you have provided excellent guidance on this journey. The atmosphere was always cheerful, your mutual interactions quick and energetic. Our meetings, without exception, provided an abundance of pointers, ideas and suggestions and were a real pleasure and of invaluable support.

Grateful as I am for all the support and encouragement I received from those many people around me, without the enduring support from home this expedition could not have been successful. Angelique, Roos, Jorg, Arthur, it is difficult to find words to describe my thanks for your patience, support and tolerance in this journey. Not only did you have to endure my mental absences whenever I buried myself in research work, I also dragged the four of you to the other side of the ocean. I could not have done this if you did not hoist the sails when needed, and if there wasn't someone keeping our ship on course. Calm

seas or rough waters, you've been a terrific crew. Thanks to you I always felt the wind in the sails to complete this challenging journey.

And finally, after these words of thanks, I'd like to address the readers of this thesis. I hope the inspiration I found will reach you from in between the lines. And as a contemporary explorer, I truly hope these newly charted waters will be of help in finding a path forward, facing the challenges of modern society.

CHAPTER

1

Introduction: ageing waterways in modern society

ABSTRACT

For centuries development of society was closely related to nearby waters for a variety of reasons. Navigation often played an important role. Growth of transport over water provided a push to improve navigation conditions. This push led to wide scale alterations of natural river systems and initiated development of man-made canals. Today, preferences and perspectives for these waters are different than in those years. Moreover, assets like navigation locks, bridges and dams are ageing, and climatologic circumstances are changing. This raises the question how to plan for redevelopment. With this question this study aims to unravel the way waterways are currently valued in society and how planning for redevelopment can maximize stakeholder satisfaction. An integrated approach on the basis of cooperation between actors is key, but practice requires a balance between potential synergetic effects and efforts to realize those. Transaction cost theory is exactly addressing the balance between these elements; it provides a tool to economize on the multitude of interests of actors involved in balance with the efforts to come to agreement. In this chapter the stage of the study is set; the problematic character of waterways in modern society is analyzed, associated research questions are provided together with theoretical and methodological approaches to come to clear answers.

1.1 Background

Waterways can be considered the world-wide-web avant-la-lettre. These arteries connected people, connected economic centers and played a vital role in building societies all over the world. Or perhaps one could say it was the other way around; societies have generally emerged at particular places *because* there were waterways. Early cities developed at riverbanks for a reason. These streams provided drinking water, irrigation water, a line of defense and a mode for transportation. Many of these systems have been expanded, altered, and improved by waterworks such as weirs, dams, revetments, man-made canals, navigation locks and so on. As such, these systems could serve societal needs even better. These systems have become a highly valued part of society in terms of its economic use (Crompton, 2004.; Filarski & Mom, 2008; Filarski, 2013).

Nowadays, many economies still rely on their waterway system for transport and other functions (Bonnerjee et al., 2009). Table 1-1 shows countries with large and intensively used waterway systems. It is no coincidence that these countries do have such large systems. In contrast to many other types of infrastructure, the extent to which waterways are developed is highly dependent on the geographical characteristics of a country. Determining geographical characteristics are for instance the availability of rivers and lakes, and the differences in altitude of the landscape. In retrospect, the evolution of waterway systems has taken form on the basis of geographical possibilities and societal needs. Societal needs are, however, in continuous evolution.

In contemporary Western societies, life is no longer that closely knit around these waters (Filarski & Mom, 2008; Lonquest et al, 2014). Does this mean these are obsolete? Certainly not. Through all societal changes, many waterways still serve as massive transportation corridors, especially for freight (Bureau Voorlichting Binnenvaart, 2010; US Army Corps of Engineers, 2009). Traditionally, the economic importance of waterways has been largely determined by the transportation function. By optimizing for this single function, other societal interests can easily be overshadowed (De Kok et al, 2009; Heeres et al, 2012; Waddell, 2011). Examples of such other interest are recreation, ecosystems services, aesthetics and waterfront development (Bouwer, 2003; Butterworth, et al 2010). For the more quiet waterways, the question is almost reversed.

Table 1-1: Navigable waterway networks in the world larger than 5000 km (source: Central Intelligence Agency, 2011)

Country	Waterways (km)	Waterway density (km/1000 sqkm)	Inhabitants (millions)	Country	Waterways (km)	Waterway density (km/1000 sqkm)	Inhabitants (millions)
China	110,000	11	1,337	Bolivia	10,000	9	10
Russia	102,000	6	139	Peru	8,808	7	29
Brazil	50,000	6	203	Nigeria	8,600	9	155
United States	41,009	4	313	France	8,501	13	65
Indonesia	21,579	11	246	Bangladesh	8,370	58	159
Colombia	18,000	16	45	Finland	7,842	23	5
Vietnam	17,702	53	91	Germany	7,467	21	81
Congo	15,000	44	72	Malaysia	7,200	22	29
India	14,500	4	1,189	Venezuela	7,100	8	28
Burma	12,800	19	54	Netherlands	6,214	148	17
Argentina	11,000	4	42	Iraq	5,279	12	30
Papua New Guinea	11,000	24	6				

The economic importance as a transportation corridor might have been diminished while other interests have grown in importance but are institutionally insufficiently addressed.

The changing society and its changing preferences bring a variety of new coordination issues and pose questions about the value of waterways in modern society. Due to changes in user requirements and transformation of areas adjacent to waterways, the current values of waterways are under pressure (Bonnerjee et al., 2009). This raises the question of whether coordination efforts and institutional arrangements sufficiently take these new circumstances into account. Potential benefits do not seem to be exploited or captured. The discrepancy between the original role and development of waterways and the potential value for modern society can be considered a challenge in waterway redevelopment (Pahl-Wostl, 2007; Reuss, 2005).

Redevelopment of waterways is needed for other reasons as well. Climatologic conditions are changing operational circumstances. It needs no explanation that climate change will influence the behavior of rivers in a variety of ways. Changing hydrological dynamics, extended periods of drought and more frequent periods

of water abundance require adaptation of the system. The situation of canals can sometimes be even more fragile. The balance of inflow and outflow is often very delicate, and with sea level rise around the corner, salt intrusion becomes yet another concern (Jonkeren et al, 2011a, 2011b; Pahl-Wostl, 2007; United Nations, 2010; World Bank, 2010)

In addition to the aforementioned changing societal needs and climate change, there is a third, and perhaps most pressing driver for redevelopment: the ageing of assets. Typically, many assets like locks, dams and weirs have been constructed early in the 20th century, during the financial crisis. These assets are approaching their economic or even technical end of lifetime and therefore urging for action (Department of Homeland Security, 2010; Doyle et al., 2008; Hale, Woolridge, & Stogner, 2008; Ministry of Infrastructure and the Environment, 2012).

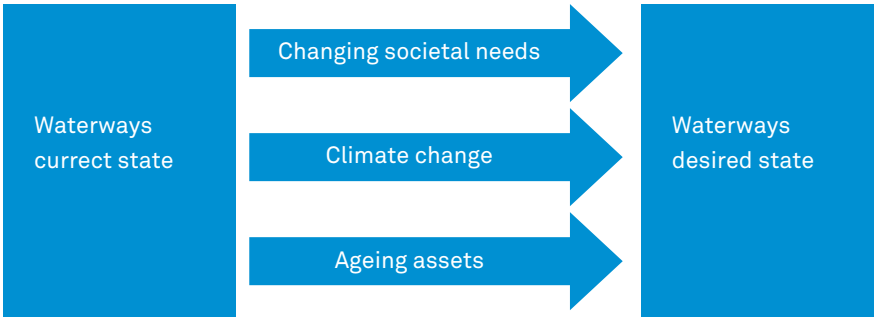

Figure 1-1: Urgency for redevelopment of waterways.

With these three challenges, changing societal needs, climate change and ageing of assets, a sense of urgency to act cannot be denied. The wide set of issues covered by these challenges requires institutional renewal to align coordination activities with the challenges faced. These coordination activities should lead to a desired state of waterways, which addresses these issues properly. Phrased more generically; the desired state addresses the urgency for redevelopment in a comprehensive way. Figure 1-1 shows this urgency for redevelopment. In the water sector, the widely embraced IWRM framework and Adaptive management framework may provide some guidance. The general idea is that watersheds should be viewed holistically, and an inclusive approach is needed with regard to stakeholder issues (Global Water Partnerschip, 2004;

Jeffrey & Gearey, 2006; Pahl-Wostl et al, 2012; Pahl-Wostl, 2007; UN Water and Global Water Partnership, 2007). This guidance can be taken as a lead, but is not tailor-made for 'asset-heavy' navigable waterways, nor does it provide practical pointers on the optimization process and the focal point of this process.

Contemporary literature on public administration does fill this gap. A shift towards public value management is advocated, reflecting contemporary societal dynamics (Bardach & Moore, 1997; Bryson, Crosby, & Stone, 2006; Bryson & Crosby, 2014; Bryson, 2004; Fisher, 2014; Kelly & Mulgan, 2002; Stoker, 2006b; van der Wal, Nabatchi, & de Graaf, 2013; Williams & Shearer, 2011; Woltjer & Al, 2007). The public sector is adopting a market-oriented type of governance and an entrepreneurial style of operating (Bryson & Crosby, 2014; Saleth, 2000; Stoker, 2006a). The contemporary societal dynamics imply that developments in the public arena are not dominated by sectoral governmental actors, but instead rely on involvement of a variety of actors, efficient coordination and inclusion of interests in a broad sense. In other words; not just solving a critical problem becomes the pivoting point, but delivering value for society. The focus shifts from addressing sectoral interests, such as navigation and public investment, to including broader values associated with waterways, and delivering efficient coordination.

This proposition is exactly what this study focuses on. Waterways are in need of adaptation. Climate change, ageing assets and changing societal preferences are key driving forces behind this. Modern society calls for solutions, which build on the variety of aspects valued by stakeholders of all sorts. It is key to address this in a practical way. By taking value as the pivotal point, the road opens up for better returns on investment for funding agencies, broader and better appreciation of the results, and efficient interaction between public agencies and stakeholders during planning and development activities.

Although many Western countries are pressed towards redeveloping their waterways, literature on planning for redevelopment in modern society is limited. This study aims to provide guidance for redevelopment of waterways in modern society with a focus on delivering value to society. A focus on value is useful as results are broader and better appreciated, and resources are spent more efficiently and effectively. Such a focus on value requires waterway authorities to interact and cooperate with a variety of stakeholders. In order to provide guidance in this process, three steps are essential. First, the current

practice of decision-making needs to be understood. Second, societal value needs to be understood in the context of waterway redevelopment. And third, interacting and cooperating with stakeholders needs an optimization framework in order to achieve maximized value.

In order to find out where and when steps can be made towards societal value, it is key to understand the decision-making of waterway authorities in the current situation. Such decision-making is dependent on its institutions; institutional analysis would be useful to gain understanding of the decision-making process. The Institutional Analysis and Development framework is suitable for this purpose, as it breaks down the action arenas of the process into concrete elements. This framework is used in this study to determine which steps are suitable (Dietz, Ostrom, & Stern, 2003; Ostrom, 2005, 2010).

Comprehending value in the context of waterway redevelopment builds a bridge between current practice and broad optimization for societal value. Such understanding directly correlates to the ways stakeholders value different aspects of waterways and how they relate to organizations responsible for redevelopment (Alexander, 2008b; Brown & Farrelly, 2009; Whittington, 2012) research strategy, and findings: Public agencies traditionally request bids and award contracts to private firms after infrastructure designs are complete (bid-build. These valued aspects can become part of redevelopment through interaction and cooperation between stakeholders and these organizations.

Interaction and cooperation with stakeholders typically involves transactions (Alexander, 1992a; Buitelaar, 2004; Coase, 1960; Williamson, 1981). Therefore, classic transaction cost theory is operationalized and instrumentally used for analysis. The power lies in the fact that transaction cost theory performs strongly at revealing the hindrances in striving for societal value, going beyond the normative perception that water issues should be dealt with in an integrated way. The rational economic line of reasoning in transaction cost theory, and applying this in real-life rich contexts, helps to reveal the practical pointers today's practitioners need.

Western countries with an intensively used waterway system are most in need of a renewed perspective (Filarski & Mom, 2011; Rodrique et al., 2006). These countries experienced a similar, simultaneous process of development of their waterway systems. Hence, ageing of assets is at play in many of these countries,

which cannot be ignored due to the importance of navigation. Climate change and changing societal preferences are also omnipresent in these countries, adding to the challenge faced by these countries, such as the Netherlands and the United States of America (USA), for example. These countries offer a rich context of real-life waterway cases, which can be analyzed using theory mentioned above. Such a rich context is helpful in gaining insight in issues at play. This study assumes that a theoretical framework about coordination and value, and related empirical findings, will deliver a useful way forward for the redevelopment of ageing waterways in modern society.

1.2 Challenges in waterway redevelopment

Waterways are in need of redevelopment in many Western countries for three major reasons. These waterways were developed a long time ago, mostly in the 19th and early 20th centuries. Societal needs related to these waters have evolved since then, along with societal changes in general. In the past decades, a second issue has come into play: climate change. A variety of effects can be expected for the dynamics of waterway systems and the use of these waters. And finally, a third driver comes from the ageing of assets. Assets are reaching the end of their economic or technical lifetime. This presses responsible agencies to take action, if current uses and functions are to be maintained. In the next three sections, these three drivers for action are described in more detail. Subsequently, section 1.2.4 will focus on the entanglement of these drivers building momentum for redevelopment of waterways.

1.2.1 Changed societal preferences

In the late 18th and early 19th centuries, many waterways were developed. New canals were dug, and rivers were modified to accommodate shipping traffic. It was during this era that the foundations for the current waterways systems in Europe and the USA were laid (Lonquest et al., 2014). Western societies in the early 19th century had different characteristics from current Western societies. A substantial portion of the people lived in poverty, recreation and leisure were only for the happy few, and ecological consciousness was practically absent, to name just a few differences (Crompton, 2004; Filarski, 2013; Tockner, Uehlinger, & Robinson, 2009). With regard to transportation, waterborne transport had

almost no competition from other modalities. This was certainly true for bulk products. The development of a waterway system had made it possible to industrialize in economic centers at other geographical locations which were close to coal mining areas at the time. Industrialization in the US, UK and France are examples of such development. Waterways also accommodated the traffic that resulted from trade of agricultural products and other goods, which allowed specialization of regions, and growing regional and national economies instead of local ones. During the many decades since the rise of waterways systems, societies have changed and waterways have been adapted more or less successfully. In the UK, the inland waterway network suffered from the rise of the railway companies, and has gradually shifted to a heritage network (Crompton, 2004). In France, the finely-mazed network of small canals and navigable rivers is tough to finance and maintain, as it has a tremendous number of assets to be kept in operation. The French network has over 2,100 navigation locks alone, but traffic is rather limited (Minvielle, 2007). By contrast, Germany, Belgium, the United States and the Netherlands are examples of Western countries, that still have intensively used networks (Bonnerjee et al., 2009; Bureau Voorlichting Binnenvaart, 2010). Their networks are critical systems (Petrenj et al, 2011) for their national economies.

Not only the transportation needs have changed considerably, in current Western societies waterways are viewed from new perspectives as well (Arts et al, 2015; Brink van den, 2009; Lonquest et al., 2014). In the past, one function – or just a few – were valued, nowadays it is many more. To name but a few, water management, recreational boating, aesthetics and ecological functions have all become key aspects (Nassauer & Larson, 2004; Vigar, 2009). Less visible is the wide spectrum of uses and functions which have been linked to these waters during their existence. Water supply for households, agriculture, industrial processes, cooling water, fire fighting; all of these are found (Brink van den, 2009; Global Water Partnerschip, 2004; Jackson et al., 2008; Lansing, Lansing, & Erazo, 1998). Ecosystem services (Boyd & Banzhaf, 2007; Costanza et al., 1987; Thorp et al., 2010), sand and gravel mining, flood alleviation and hydropower can be added as well. Recreation along the embankments, like fishing, hiking, running and cycling, is omnipresent. From the social cultural perspective, these waters can also play a role in terms of heritage and social cohesion. In fact, the mix of elements valued will vary from individual to individual, and from community to community.

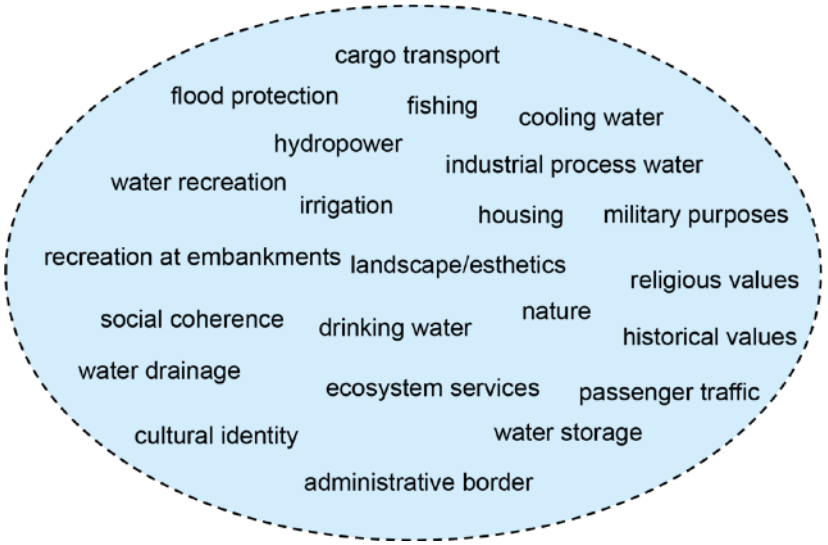

Figure 1-2: Waterways can be appreciated for many reasons (PIANC Working Group 139, 2013).

For waterways, this context is made more specific by an international group of waterway experts from a variety of waterway authorities, the Permanent International Association for Navigational Congresses (PIANC). Figure 1-2 shows

the many ways in which waterways can be appreciated as highlighted by this group. The committee makes explicit that nowadays waterways are valued for many more reasons than in the age in which they were developed.
As social and economic activities evolve, the uses of water and ways in which it is valued will change as well. For some waterways, this means that the original purpose and importance has become overshadowed by a new set of purposes. For other waterways, the transportation of goods is still the 'reason of being', but other valued elements can no longer remain ignored. It is up to the responsible institutions to react to, or preferably anticipate, these evolving needs to ensure that the current networks and new investments serve society in an effective way.

In many Western countries, the organizations responsible for operation and maintenance of waterways have long track records. Examples are Rijkswaterstaat (Netherlands, since 1798), die Wasserstrassenschifffahrts-verwaltung (Germany, umbrella organization of regional offices dating back to early 19th century), and the US Corps of Engineers (USA, since 1775). In other

countries, these agencies go back a long time as well, but have at some point been reorganized and renamed. Examples are Voie Navigables de France, NV de Scheepvaart, Belgium, or ViaDonau, Austria. These institutions are usually aligned for a restricted set of goals and responsibilities, and have neither incentives nor value-capturing possibilities for activities beyond these limitations. Furthermore, these agencies are settled in a complex system of legislation and have many instruments and tools at their disposal to maintain their course if desired (Geels & Schot, 2007; Mostert et al, 2007; Raadgever et al, 2008; Walker, 2000). In other words, adapting to new societal preferences can be countered by inertia of these agencies.

1.2.2 Ageing assets

After the massive waterway development in the 18th and 19th century in many Western countries, large investments also took place in the 20th century (Pointon & Grier, 2004; Myung, 2006; Reuss, 2005; Sherwood & Jay, 1990; Tockner et al, 2009). In that century, Western countries have typically been investing in waterways in the 1930s and 1960s-1970s. Investments took place by means of engineering works such as navigation locks, weirs, and dams, as well as by adapting, deepening and widening of canals and rivers. The construction works from the 1930s were often built in concrete and steel. Steel parts like gates, hinges, mechanical parts were replaced from time to time, but this has not been the case for the concrete structural elements. As these elements form the backbone of these systems, these are almost impossible to replace. And although good-quality concrete can last for a very long time, degradation and damage is observed in many situations (American Society of Civil Engineers, 2013; Department of Homeland Security, 2010; Doyle et al., 2008; Hale et al., 2008; Lewis et al., 2008; Rijkswaterstaat, 2013, 2014). Structures of the second investment period, the 1960s and 1970s, are much younger. However, as a result of the enormous push for development in those years, the term 'good-quality concrete' does not always be apply (Mehta, 1999). For some structures, this means retirement is approaching earlier than expected (Fig. 1-3). These developments are, however, just one part of the ageing problem. Unfortunately there are two more issues at play.

Degradation of structures as described above is, not the only element of the ageing problem. A second issue is the advancement of Western standards, such

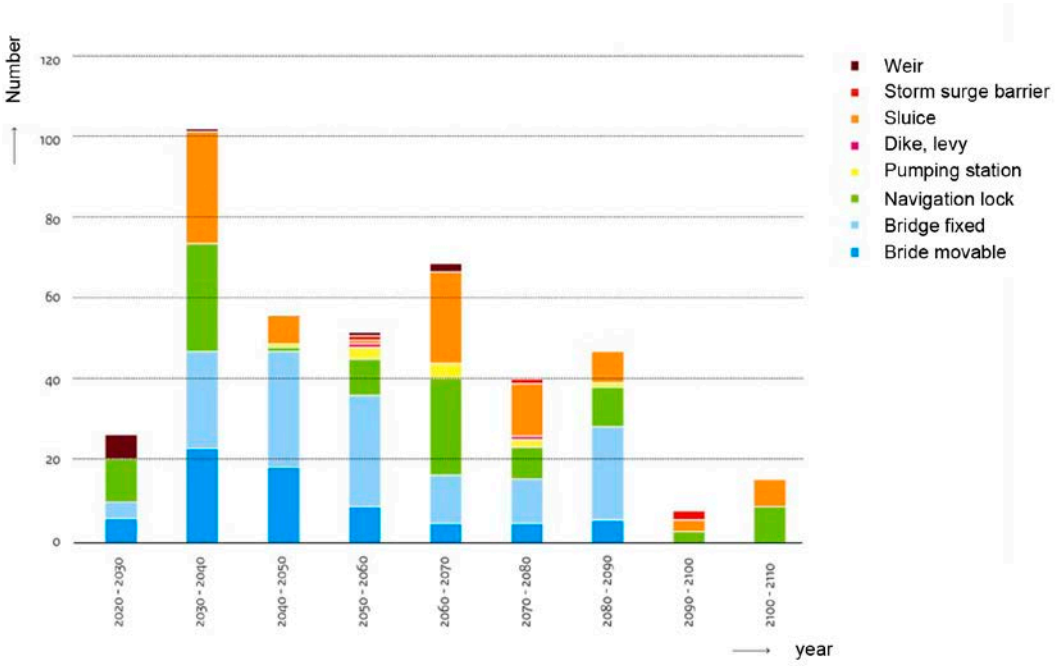

Figure 1-3: Number of assets and expected moment of replacement of assets on the basis of end of design lifetime (Delta Commissioner, 2014)

as building codes and regulations for machinery, for the performance and quality of constructions in general. Safety, quality and reliability have become important issues. Building codes have been adapted from time to time, and in most cases the requirements regarding these issues have become stricter (Department of Homeland Security, 2010; Hale et al., 2008; Rijkswaterstaat, 2013; Willems et al., 2016). Considering the size and function and possible impact of malfunction or failure of the constructions in the water systems, a decision needs to be made as to what point a discrepancy between the state of the old structures and the modern requirements is acceptable. So even if a construction is still performing perfectly to original design goals, it could still be considered inadequate to modern requirements.

The former two issues, degradation and advancement of standards, are closely tied to the structural elements built in and around waterways. A third issue at play is the functional end of lifetime-dilemma and stretches out to waterway features in a broad sense. Functionality can be limited when dimensions,

conditions or other aspects of waterways including its assets do not meet contemporary functional requirements (Arts et al., 2015; Hale et al., 2008; Willems et al., 2016). Modern ships, larger and more powerful than before, use the system day and night (Bureau Voorlichting Binnenvaart, 2010). Modern use of the assets requires these assets to perform at a level in line with the societal and economic demands. In this respect, modern society calls for other regimes than the original ones. Examples are a high level of availability of the assets, low maintenance downtime and the ability to operate assets from remote locations. Another typical issue at play with regard to the assets facilitating transport over water, is the size of ships that are able to pass. Shipping firms strive for economies of scale, therefore the dimensions of the fleet using the waterways have increased to the limits of admission to these waterways. In some cases this is not enough, and commercial use of waterways becomes uneconomical, which affects the region's economic position. Especially for the larger waterways, this means assets have to be replaced to keep up with current needs for shipping, or cargo route-function will diminish in time.

1.2.3 Climate change

Much has been written about climate change and its consequences (Beuthe et al., 2014; Jonkeren et al., 2011b; Kabat et al., 2005; Marsden et al., 2014; Pahl-Wostl, 2007; United Nations, 2010). With regard to consequences for waterway management, a broad study was done by the PIANC committee on climate change (PIANC, 2009). This study shows the variety of effects due to climate change on both the waterways and the assets in place (table 1-2).

Increased precipitation can lead to a variety of effects. Changed water levels and velocities are to be expected, but these can also lead to changes in sedimentation processes influencing the need for channel maintenance activities (Palmer et al., 2008). Loads on structures can be affected as well (PIANC, 2009), requiring adjustments or repairs. Foundations and sheet piling in particular are vulnerable for changed sedimentation processes.

Decreased precipitation, or even periods of draught, will obviously affect the water levels, velocities and sedimentation processes as well (Nijssen, Donnel, Hamlet, & Lettenmaier, 2001). Periods of draught can be particularly harmful for a variety of users of water (Jonkeren et al., 2011b; United Nations, 2010), such as

Table 1-2: Drivers and impacts to inland navigation due to climate change (from Pianc – Envicom Taskgroup Climate Change and Navigation, 2009)

Drivers due to climate change	Impacts	Rivers, channels, canals, lakes	Locks, dams, and infrastructure	Operational control	Vessels
Water supply: increased precipitation. Extreme conditions: more extreme floods.	Increased water level and velocity	■	■	■	■
	Changes in sedimentation process (bank failure, local scour, locations of aggradation and degradation)	■	■	■	
	Manoeuvrability		■		■
	Increased loads on structures		■		
	Decreased development land area available		■		
	Reduced regularity of the port		■	■	
	Reduced capacity of natural systems to recover	■			
Water supply: decreased precipitation. Extreme conditions: more extreme droughts.	Decreased water level and velocity	■	■	■	■
	Reduced regularity of the port		■	■	
	Changes in sedimentation processes (locations of aggradation and degradation)	■	■	■	
	Reduced capacity of natural systems to recover	■			
Water supply: changes in form and quantity of seasonal precipitation	Change in timing of seasonal high water and seasonal low water	■	■	■	■
	Changes in sedimentation processes (locations of aggradation and degradation)	■	■	■	■
Water temperature increases	Ecosystem impacts affecting habitat	■		■	
	Oxygen depletion	■		■	
	Reduced capacity of natural systems to recover	■			
River morphology	Changes in sedimentation processes (locations of aggradation and degradation)	■	■	■	■
	Reduced capacity of natural systems to recover	■			
Changes in ice cover	Shorter duration of river ice	■	■	■	■
	Changes in locations of ice jams	■	■	■	

Grey cells indicate a possibility of effects.

farmers, industry, or shipping business; as ships can often not be fully loaded. Increased variability of precipitation can cause changes in timing of seasonal high water and seasonal low water, influencing the navigability of the waterway (PIANC, 2009).

Changes in temperature could lead to a different set of effects. Ecosystems can be affected, oxygen could be depleted and this could lead to reduced capacity of the natural system to recover (Chen et al, 2006; Christensen et al, 2004). This could, for instance, reduce the possibilities for the use of industrial cooling water. For systems located in colder climates, climate change could also have its effect on the duration of ice covers and the location of ice jams (PIANC, 2009). This is particularly important for the current and future structures in waterways.

Although much attention in climate change research is paid to effects on river systems, canals seem to be often overlooked. The balance of inflow and outflow of water is often a delicate one, and disturbance in either of these can lead to shortages in the system. This is particularly true for canals crossing watersheds as these climb over an elevation where the most elevated stretch of the canal needs to be fed with water, often from a small diverted creek (PIANC, 2009). These water balance issues can be dominating factors, as they are for instance for the Seine Nord project and the Panama Canal expansion program. Another particularly problematic aspect of canals in relation to climate change is the increased probability of salt-water intrusion (Day et al., 2007). As for rivers where water is flowing, this can be difficult; for canals with very low water velocities it is even harder to keep the salt water out. Additional barriers can be required to prevent the systems to change in salinity.

All these possible effects together certainly make a case for the carefully analysis of a situation before investment for waterway improvements is considered. Vice versa, in some cases the effects require investments to keep a waterway functioning properly.

1 . 2 . 4
At a crossroad of urgencies

The previous three sections described the challenges for waterway redevelopment. Out of the three challenges, two can be considered to be slowly adding to the pressure. Changes in society and the appreciation of waterways

will start pushing for change more and more. On the other hand, climate change will gradually decrease the navigation conditions. Perhaps both developments are important, but can still be tolerated for quite some time. The most urgent question, in many cases, is the end of technical lifetime of assets. If structures are not performing up to standards, if these are not safe, malfunctioning, or not functioning at all anymore, an acute need to act will arise. Repairs and quick fixes will perhaps delay large investments, but at some point the asset owner will need to determine whether the function is no longer available, or redevelopment will be initiated (Department of Homeland Security, 2010; Hale et al., 2008; Rijkswaterstaat, 2014; Willems et al., 2016; World Bank, 2009). In the latter case, other challenges, societal preferences and climate change rise back to the top of the agenda again.

Redevelopment usually has long-lasting impacts, it needs to take into account both today's circumstances as well as future scenario's (Arts et al., 2015; Rijkswaterstaat, 2014; Willems et al., 2016). Society would be served best by waterway redevelopment delivering most value for its stakeholders. Together, these issues require considerable thought, debate and research; no ready-to-use solutions can be taken off the shelf. It is for this reason that planning for redevelopment is important now before time is running out.

1.3

Sailing ahead, guided by value

As current values of waterway systems are under pressure, agencies responsible for waterways need to seek an appropriate response for redevelopment. Such a response should fit contemporary policy frameworks, and has to be effective in addressing the issues at play. Value appears to be a common concept in the action arenas relevant for redevelopment (Halbe et al, 2013). The technical engineering perspective has a focus on efficiency and cost-benefit analysis, policy arenas are shifting towards pubic value management, and in implementation-oriented arenas stakeholder involvement and integrated approaches have become key components. All these levels are relevant for waterway redevelopment, however, they all need to be aligned for best results. As all agree on improving societal value, a practical way forward guided by such concepts would be helpful. In the next sections, the central concept of value and its current understanding is addressed. Furthermore, both academic and societal relevance is discussed.

1.3.1
Value as a concept

Value is a concept with a long history of debate amongst philosophers and economists. This has resulted in a wide variety of concepts and ideas regarding value in literature. When we limit ourselves to the rational choice perspective of this study, and application of value in the waterway redevelopment domain, it is needed to understand value in this context. Considering value in such a multi actor setting requires understanding of how value can be defined, how value perception can differ between multiple actors and finally understanding how these perceptions can be brought into a multiple actor optimization process. Literature offers guidance to gain understanding of these three fields.

Value definitions

Value is a central concept in this study. The Oxford English Dictionary defines value as: '*the regard that something is held to deserve, the importance, worth, or usefulness of something, the material or monetary worth of something, the worth of something compared to the price paid or asked for it*' (*Oxford English Dictionary*, 2010). This description shows there is much room for interpretation. Also, in academic literature, the term 'value' is often used in different contexts and from different perspectives (Debreu, 1959; Miles, 1961; Moore, 1997; Stoker, 2006c). Value is used in the economic, but also the technical and public policy domain. When we consider the concept of value in the context of infrastructure, it is often framed in terms of cost optimization or delivery of economic gains for mobility and transportation. Cost optimization is often covered in literature in terms of asset management, whole life costing and design methodologies (Boussabaine & Kirkham, 2004; Hale et al., 2008; Hooper, 2009; Miles, 1961; Scholtes, 2010). Expressing value in terms of economic or financial gains is widespread through the use of cost-benefit analysis for transportation studies (Gille, Harmsen, & Minne, 2010; Litman, 2009; Minvielle, 2007; Mishra, Khasnabis, & Swain, 2013; F. A. Ward, 2009).

Value is often perceived differently

The above-mentioned definitions strongly relate to a service provider and its users valuing an object, condition or service in a single way (e.g. cost optimization) or for a specific use (e.g. transportation). If we enter the broad public arena, the number of stakeholders increases and the value of a good or service can suddenly be perceived through multiple perspectives. This is often

addressed by *monetizing* the costs and benefits of such a good or service for the entire public, and the balance between those two determines the economic performance. This method, however, falls short when aspects are valued but cannot be monetized, or when individual stakeholders appreciate aspects differently. An example: the aesthetics of a landscape can weigh heavily for one stakeholder, but be of no concern to another.

By stepping from the quantitative cost-benefit methods to qualitative Pareto optimizations, these differences in appreciation can be included in the equation. Instead of monetizing value, the focus is put on whether people prefer one situation over another (Smelser & Baltes, 2001). This enables planners to determine whether improvements in a situation can be made. In the Pareto definition, efficiency is not achieved as long as the situation can be altered in such way that at least one stakeholder is better off without a single stakeholder being worse off. The process can be further enhanced by including the possibility to compensate stakeholders. If a single stakeholder can improve his situation in such a way that he would be willing to compensate the losses of others, the situation can be regarded as of higher value than before. This *pareto efficieny* concept relates well to the situation of waterways, where a multitude of perspectives and ways of appreciation play their parts (Mishra et al., 2013).

Optimizing value in multiple actor setting

A theory useful in the process of optimizing value in 'a' multiple actor setting is *negotiation theory* (Lax, 1986; Raiffa, 1982; Susskind, 1999). Carefully designing the negotiation process and working through this can optimize gains of involved parties. However, in order to avoid ineffective negotiated results, process should not be separated from content (Riet van, 2003). Gains can come from differences or similarities of what parties' abilities are, what they have, what they expect, and what they want. By carefully analyzing each individual variety of interests behind their positions in the negotiation process, mutual gains can be found which do not appear on the basis of position alone.

In institutional economics, the concept of *transaction costs* is often used to optimize the value of internal production versus buying items or services (Coase, 1937; Williamson, 1979, 2000). Firms do have the liberty to decide on this, and can decide whether or not something is done in-house or if it is outsourced. The determining factor in this evaluation is the transaction cost. If it is easy and without risk to purchase a required service or item, it will be hard to provide

better value yourself as this means you have to beat specialized firms. And vice versa, it is to be recommended to produce a service or good yourself if it takes a lot of effort and includes high risk to purchase it from the market.

Although this concept has been discussed and used intensively in free market make-or-buy decisions, the framework has been operationalized for the public sector (Williamson, 1998, 1999) and the planning arena as well (Alexander, 1992b, 2001, 2008a). In essence, it provides a way of evaluating the value of cooperation. This can be very helpful for waterway authorities acting in the public realm. When cooperation can be operationalized without effort, mutual gains can be achieved where possible. This leads to realizing the entire potential of value when redeveloping waterways. However, when cooperation with synergetic potential brings with it transaction costs that are too high to overcome, value will be left undeveloped. In such cases, it would not be economically advantageous to cooperate, so actors can either prefer not to join in, or otherwise try to find ways to decrease transaction costs in order to improve the balance.

As described earlier, waterway development with a focus on providing value for society highly depends on cooperative arrangements. Having a way to select productive cooperative arrangements, and a way to legitimize these actions to the public would add to the effectiveness of these agencies. Transaction cost theory therefore seems very suitable as a tool for analyzing value propositions in the waterway sector.

1.3.2
Value in the public realm, a beacon for waterway redevelopment

In the 1980s, the traditional public administration gradually made room for the paradigm of New Public Management (NPM)(Giddens, 1998; Gruening, 2001). Public agencies were more target-driven, and managed on efficiency and performance. NPM is still the governing paradigm in many Western countries, but new accents are being placed. The inclusion of public value is one of those accents providing new ideas for public management (Bardach & Moore, 1997; Brink van den, 2009; Bryson & Crosby, 2014; Fisher, 2014; Kelly & Muers, 2002; Kelly & Mulgan, 2002; Smith, 2004; Stoker, 2006b; van der Wal et al., 2013; Williams & Shearer, 2011).

According to this accent on public value, often referred to as public value management, governmental services are supposed to deliver valued social or economic outcomes. It puts public management central, and, as stated by Moore (1997), the managers should focus on delivering public value: *'Public managers create public value.'* But he simultaneously raises the question: *'The problem is that they cannot know for sure what that is. . . . It is not enough to say that public managers create results that are valued; they must be able to show that the results obtained are worth the cost of private consumption and unrestrained liberty forgone in producing the desirable results. Only then can we be sure that some public value has been created.'* And as this might seem complicated altogether, breaking it down into pieces does not provide answers straightaway. The simple remark of 'results that are valued' has been described by Graf and Maas (2008) in a broad literature study. Although the emphasis was put on customer value, they concluded that '*customer value is a subjective construct and made up of multiple components'*.

It is clear that public value management provides guidance for waterway redevelopment, but it is still lacking implementable concepts. Public managers should deliver public value and indeed politicians and officials have a legitimacy to decide on public matters, when they have been elected to do just that. But stakeholders like waterway users and affected communities, businesses and so on cannot be simply overruled or ignored by playing the political card (Goss, 2001). This does lead to the notion that there is a need to give more recognition to the wide range of issues valued by the stakeholders. Applying this in a very specific domain, waterway redevelopment, might provide more specific understanding of this issue.

The domain of waterways and its development is a part of the public realm. Public value is of particular interest due to its wide range of, valuable, linkages to its surrounding and blends public and private interests. Delivering public value would mean addressing keeping a keen eye on these interests when creating efficient solutions for the challenge to be addressed. Blending these altogether is challenging. A navigation function, usually provided by the public agency, often gives rise to a multitude of conflicting interests on a local and regional scale (Brown & Farrelly, 2009; Innes et al, 2006; Islam & Susskind, 2013; Jackson et al., 2008; Meijerink & Huitema, 2010; Metcalf et al, 2010). Capital projects attract extra attention from all its stakeholders as these projects change the status quo. Such projects have a major influence on the physical

appearance and functionality of these waters to society, and these often require considerable funding. For these reasons, waterway projects can be considered to be in the eye of public value management, and are certainly in need of implementable strategies based on optimizing its value propositions.

1.3.3
Theoretical Framework - Institutional Analysis and Transaction Cost Theory

The theoretical framework of this study binds together the elements identified in the previous sections. In short, the theoretical line of reasoning follows three steps. First, the changing context asks for institutional renewal. Second, this renewal involves all sorts of coordination due to the wide set of issues and interests at play. And third, transaction costs determine the reach and effectiveness of the coordinative efforts. An institutional economics perspective (Williamson, 1981; North, 1990; Hall & Taylor, 1996) is taken. Such a perspective helps to identify tangible implementable strategies and fits the technocratic nature and economic line of reasoning of waterway agencies (Brink van den, 2009; Pahl-Wostl, Jeffrey et al, 2010). Fundamentally, the study starts with understanding the current situation and explores coordination strategies to increase value in future situations.

The context is a multi-actor setting with a multitude of interests at play around waterway development. An understanding of the current situation is gained through institutional analysis, as institutions reflect the rules, patterns, structures and uses (Olsen, 2009; Kim, 2011; Gonzàlez & Healey, 2005, Ostrom 2005) and provide a degree of robustness to the decision-making processes (Koppejan & Groenewegen, 2005; Leroy & Crabbe, 2008). In a multi-actor setting, institutions guide the decision-making processes. Understanding of this process is key for determining where opportunities and hindrances to improve the value proposition can be found. By applying the Institutional Analysis and Development framework (Ostrom, 2005, 2010), the institutions and rules governing the decision-making process can be mapped out. Amongst the frameworks suitable for institutional analysis, the IAD framework is particularly useful as it provides insight into multi-actor decision-making by unraveling the process towards the set of rules determining the game. Using the IAD framework generally leads to identifying a set of key hindrances and opportunities in the decision-making process.

Transaction cost theory is instrumental in analyzing and optimizing multi-actor settings (Coase, 1960; Williamson, 1981, 1998). It aligns well with previously mentioned institutional analytical thinking, but is more focused on optimization of the institutions. Transaction cost theory provides fundamental insight into the trade-offs made in multi-actor optimization problems. These trade-offs determine whether actors will be eager to engage in the process, and determines to what extend the broad set of interests related to waterways will be part of the optimization process.

Applying transaction cost theory makes it possible to build a theoretical framework for understanding coordination strategies fitting the institutional context of waterway redevelopment. Obviously, waterway authorities play a part in this, but other organizations and stakeholders do as well.

1.3.4 Scientific relevance

In planning literature, little attention is given to the field of waterway planning. Literature on waterway development is scarce; literature on planning waterway *re*development is almost non-existent. However, there is a great deal of literature that is relevant for waterway development, which can be useful. Literature on watershed approaches, integrated water resources management (IWRM), planning ideals for river systems and alike is abundant (Global Water Partnerschip, 2004; Meijerink, 2008; Pahl-Wostl et al., 2010; Pahl-Wostl et al., 2012; Pahl-wostl, 2002). Waterways in terms of transportation corridors use central elements of watersheds such as the main rivers and lakes, and are dependent on water resources management in terms of navigable hydraulic conditions. Waterways and watersheds also have in common that both have to deal with a multitude of stakeholders and issues.

Nevertheless, this literature is only of limited assistance, for three reasons: First, waterways which have been developed or altered to serve navigation, are often ‘asset heavy’ (Crompton, 2004; Lonquest et al., 2014). Long-lasting technical items have been built, like weirs, navigation locks, quay walls, revetments, bottom protection and so on. These are not natural systems, nor lightly altered natural systems. Man-made canals are perhaps the most striking example. Not only are these completely constructed, but often these cross watershed boundaries as well. In fact, these violate the very definition

of a watershed (Brack et al., 2009; European Parliament and Council, 2000; Petersen et al, 2009)risk-based management of river basins is presumed to be an appropriate approach to achieve that goal. The approach of focusing on distinct hazardous substances in surface waters together with investment in best available technology for treatment of industrial and domestic effluents was successful in significantly reducing excessive contamination of several European river basins. The use of the concept of chemical status in the WFD is based on this experience and focuses on chemicals for which there is a general agreement that they should be phased out. However, the chemical status, based primarily on a list of 33 priority substances and 8 priority hazardous substances, considers only a small portion of possible toxicants and does not address all causes of ecotoxicological stress in general. Recommendations for further development of this concept are 1.

Second, from an institutional perspective, the river and watershed literature often adopts a stance which promotes cooperation between various institutes responsible for a part of the watershed (Brugge van der, Rotmans, 2007). Water is the linking medium and the central element determining action. Transportation and logistics on a national level is quite often the focal point for waterways in the navigation domain. Transportation efficiency, traffic delays and incentives for modal shift are often key issues in this domain. This means the perspectives and policies for optimization are very different. For inland navigation, as a subsystem of inland transportation, these perspectives and policies are not restricted to watershed boundaries. These cover and cross multiple watersheds and need to be worked out as symbioses of transportation systems and water systems.

The third reason the literature on rivers and waterways is of limited assistance in waterway redevelopment, is that it often lacks practical implementation relevance (Biswas, 2004). An integrated and adaptive approach is advocated widely. But the fact that such a fully integrative level is not often witnessed in practice must have a reason. And an adaptive approach might very well work for policy making, but what if a navigation lock needs to be replaced? The current practice is still set in concrete, literally and figuratively (Pahl Wostl, 2010; Brink van den, 2009). As literature on watershed planning is of only limited assistance, and literature on planning for redevelopment of waterways is scarce, this study aims to contribute to those fields. As national waterway agencies, e.g. those in the Netherlands and the US, have a restricted mandate, linking and integrating

functions in the planning process requires cooperation between actors. Such cooperation to build public value is based on voluntary agreements. This is a new perspective on planning in this sector, which opens the way to use classical theory for considering when to cooperate and when not to cooperate. In other words; transaction cost theory. In this study, transaction cost theory is chosen for two reasons. First, it is a strong analytical theory connecting the multitude of values of water (the IWRM framing) with the focused rational decision-making by waterway authorities. And second, this theory is strong in revealing practical implementation issues, the element missing in contemporary IWRM literature.

In order to find the hurdles and opportunities for planning redevelopment, and fulfill the ambition to come to practical recommendations, it is important to understand the actual decision-making process in waterway development practice. It is for this reason that the study is built on case study research. Cases in both the Netherlands and the US are investigated with transaction cost theory as the instrument. The findings from these case studies are checked by a focus group to counter the risk of jumping to conclusions or a bias due to the nature and specifics of the cases (Yin, 2013).

By building the study as described, the scientific relevance can be found above all in the contribution to the scarce literature on waterway planning. Secondly, the application of transaction cost theory will tell us more about the resistances when pursuing a widely advocated integrated approach. While adding fresh empirical data to the waterway literature, this last notion can be seen as a theoretical operationalization in a field is where this has not yet been applied.

In a broader sense, the application of transaction cost theory in the public field of waterway planning offers insights into the fundamental idea of creating value in infrastructure planning. The study focuses primarily on the waterway sector, but other infrastructure fields show similar attributes. Planning (re)development of roads and railroads is confronted with many effects, stakeholders and a desire to provide value just the same (Heeres et al., 2012; Heeres, Tillema, & Arts, 2010). Due to these similar attributes, the approaches and findings of this study contribute to the wider scientific field of infrastructure planning. For infrastructure planning and the field of planning in general, the contribution of this study lies in strengthening understanding of coordination through institutional economic thinking.

1.3.5
Societal relevance

The dependency on waterway infrastructure varies greatly amongst nations. Although it can be considered the earliest system for mass transportation, tracing back to ancient Egyptian and Sumerian civilizations, other modalities have emerged over time. The Chinese, Incas, Mayas and Romans developed early road systems. Railways became competitive in the 19th century. Highway systems suitable for fast and massive transportation arose after WWII (F. W. Geels, 2007; Heeres et al., 2012), and air transportation developed soon after (Grübler, 1990). In many countries, rail and road transport became dominant modes for overland cargo transport (Bureau Voorlichting Binnenvaart, 2010; Crompton, 2004; Filarski & Mom, 2008). However, for some of the largest economies in the world, waterway systems still play a vital role. Navigation evolved from sailboats and towing boats to steam-driven and later motor-driven ships. Today's fleet consists mainly of efficient and large ships and barges.

In Western countries, planning of waterways has been low-key for decades. This does not mean nothing has been done, but the activities that did take place were usually small-scale, addressing specific local problems. But the tide seems to be turning. Drivers for redevelopment, as discussed in section 1.2.4, are getting stronger; ageing of assets, climate change and changing societal preferences (Arts et al., 2015; Brink van den, 2009; Filarski, 2013; Jonkeren et al., 2011a; Kabat et al., 2005; Willems et al., 2016). The combination of these drivers and systems that were developed a long time ago raise the question how to plan for redevelopment of such system.

Redevelopment plays a role in Western countries where waterways were developed a long time ago, which is why Western countries are most interesting. Western countries where inland waterway transport is significant are Canada, USA, Russia, Germany, Finland, Poland, Netherlands, Belgium, France, Austria, Switzerland and the Czech Republic. Amongst these, both the Netherlands and the US are illustrative examples of nations where planning for redevelopment of ageing waterways in modern society is an issue. In this study, these two nations, Netherlands and the US, were chosen as empirical fields. Both have fully developed waterway systems in need of redevelopment. Both have central national agencies responsible for managing and developing these waterways.

Also, there is much at stake for both these countries, as their respective waterway systems are intensively used, and a selection of economic sectors is highly dependent of the well-functioning of these systems. Both countries also offer a variety of different institutional, geographic and physical settings where elements and mechanisms can be found, which can contribute to finding a way to forward in improving the value proposition in waterway redevelopment. Studying these two waterway systems offers a rich context, which can provide a variety of insights relevant for the broader international waterway practitioners' community.

The contribution in practical terms can be found in findings and recommendations for waterway practitioners. These officers need to find their way through complex and multifaceted planning challenges. Structuring the findings from the cases similar to what they are familiar with, and explaining the mechanisms behind this, enhances understanding of this field. Transaction cost theory will help practitioners to reveal and understand the resistances in real life when trying to optimize waterway development.

1.4 Scope of the study

1.4.1 Description of the problem

As described in the previous sections, many waterways in Western countries are in need of redevelopment. Societal preferences have changed significantly since these waterways were developed, assets are ageing and due for renewal, and climate change is imposing different conditions for operation. Superimposed on these issues is a general shortage of public funds to satisfy all needs, if known, and troublesome implementation of projects as public resistance can be significant for infrastructural projects.

A sense of urgency for investments is therefore felt, but the question arises what the desired state of waterways should be and how to get there. The desired state is often referred to as a state that takes into account the wide variety of stakeholder issues, related to the waterway. This is advocated by means of integrated approaches. Such approaches are often used in the riverine context

(Brack et al., 2009; De Kok et al., 2009; Pahl-Wostl et al., 2012; UN Water and Global Water Partnership, 2007)risk-based management of river basins is presumed to be an appropriate approach to achieve that goal. The approach of focusing on distinct hazardous substances in surface waters together with investment in best available technology for treatment of industrial and domestic effluents was successful in significantly reducing excessive contamination of several European river basins. The use of the concept of chemical status in the WFD is based on this experience and focuses on chemicals for which there is a general agreement that they should be phased out. However, the chemical status, based primarily on a list of 33 priority substances and 8 priority hazardous substances, considers only a small portion of possible toxicants and does not address all causes of ecotoxicological stress in general. Recommendations for further development of this concept are 1, taking into consideration the functionality and relations of a location in the entire catchment area. It is also advocated in the planning context of infrastructure development, often by means of inclusiveness (Heeres et al., 2012; Vigar, 2009; Waddell, 2011).

Whether it is called an integrated approach or an inclusive approach, both concepts suggest seeking cooperation in order to harvest mutual gains and to try and optimize a problematic situation in a broad sense. Optimization in a broad sense requires a shift from sectoral planning to integrative planning. It is not only solutions that need to be generated with such integrative concepts in mind, but problems as well. Basically, this can be called the third step in public project planning. From (1) cost-effective solutions for singular defined problems, to (2) broadly balanced solutions for singular problems, to (3) maximized value based on an integrative defined problem (table 1-3).
In contemporary planning there is wide consensus that the broad set of stakeholders issues should be taken into account when initiating large infrastructure projects. If the scope of the problem is defined broadly as well,

Table 1-3: Problems, solutions and their outcome based upon Heeres et al. (2012)

Solution-> ***Problem***	***Sectoral***	***Integrative***
Sectoral	Cost-effective outcome (1)	Balanced outcome (2)
Integrative	Ineffective outcome	Societal value (3)

the number of issues to be taken into account rises quickly. This raises the problem to be addressed: *Waterways are in need of redevelopment, building societal value is the goal to be achieved, but it is unclear what this is, and how planners should get here.*

1.4.2 Objective of the study

As described in the previous section, waterways have high potential societal value and many are in need of redevelopment. Realizing this potential, when redeveloping waterways, is the complex puzzle to be resolved. This leads to the following general research objective: *Understanding how societal value in waterway development can be realized, and finding practical ways to increase the value of waterway projects.*

The research objective carries with it several research questions addressing specific issues of this objective. The next section will elaborate on these research questions.

1.4.3 Research questions

The research objective of finding ways to increase value of waterway projects can be decomposed into a series of research questions, which are discussed below.

*1 **How can waterway redevelopment deliver optimized societal value?***

This generic question addresses the broad challenge for waterways. Optimizing in a broad sense requires a perception of the elements valued, and how these elements can be considered in a process for redevelopment. Answers to this question provide a general outline as a basis for development of practical approaches and it demonstrates the relevance for such approaches in the waterway sector. This general outline leads to a more detailed question about hindrances and opportunities.

2 When in the process of planning for redevelopment are opportunities and hindrances to be found?

The 'when' question aims to find entries in existing processes where improvements can be made. This question aims to unravel the relations between the value to society and its responsible actors and action arenas. In order to come to practical relevance, it is key to use existing planning processes for development. And as contemporary planning processes have evolved and matured during the years, it is important to hold on to the strengths while finding the elements where improvement is needed. Considering improvements in a setting with many actors and issues at play needs to take transaction costs into account.

3 How do transaction costs affect the outcome of examples of redevelopment?

When digging deeper from general institutions and processes towards projects and implementation, it is important to find out how value comes to realization in its local and regional context. Coordination is required due to the many actors and issues at play; transaction costs affect the efficiency and effectiveness of such coordination. This question aims to clarify the driving principles behind the realization of value in practice. Examples of projects can provide the empirical information needed to answer this question. Transaction costs theory is the tool to extract the answers on how value is realized and provide pointers to come to effective coordination arrangements.

4 What are useful ways to establish coordination arrangements and acknowledge value in waterway projects?

When understanding of the potential of waterways for society is realized, this understanding needs to be translated into ways to realize this potential. Realizing this potential means including a wide variety of interests and actors in the process, and requires effective coordination in such settings. However, such coordination should address transaction cost and benefits effectively, as these lie at the heart of coordination in a multi-actor setting with the aim to improve overall value. Tools and methods as used for coordination in practice can be evaluated on such effectiveness. Insight into the effectiveness of these tools and methods can be helpful for coming to concrete recommendations for planning practice of waterway redevelopment.

5 *How can waterway planning be improved when striving for optimized societal value?*

Answers to this fifth question provide practical implementation guidance for waterway authorities. From the mere general answers for waterway practitioners that have come forth from the previous questions, this question addresses the very specifics of the institutions, dynamics and context for waterway redevelopment. Theory and empirical findings are made practical and applicable.

1.5 Research approach

1.5.1 Description of the approach

Section 1.4.1 explained that efficient solutions for strictly defined problems leave value on the table, which can be considered a loss for society. Understanding how this can be done differently and finding practical ways for doing so, implies understanding the system of creating societal value.

Understanding where societal value comes from, means finding out on what value principles societal value relies. If we do know the principles - the backbone of societal value - the next question would be how these principles can be made of practical use. In other words; how can these principles be made applicable? Although in specific contexts a variety factors can play a role, on a general scale systemized responses are typically caught by deployment of tools and instruments. Or inversely, if certain value principles are key, these tools and instruments should be supportive of those. Knowing this brings us one step further, but it does not yet tell us how value comes to realization. This can only be understood once the way of deployment of tools and instruments in actual waterway projects is understood. And with this step, the circle is almost closed. The application of tools and instruments in waterway projects will lead to value realization, but it will only be realized as it is appreciated as such. Realized value in waterway development then brings value for society and closes the circle. The described circle is shown in figure 1-4 and describes the conceptual framework of the study.

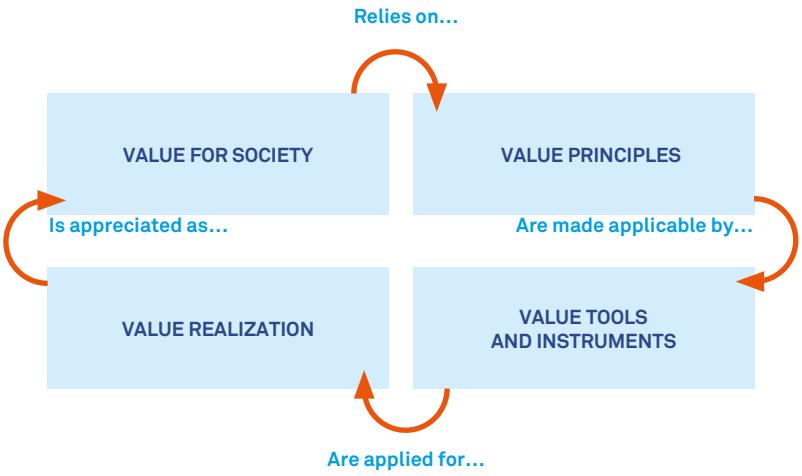

Figure 1-4: Conceptual framework

If this framework is explained in more practical terms, the same circle can be followed. If we look at the waterway systems in Western societies, the first step is understanding for what purpose these were developed and what societal need is reflected (value for society). When redeveloping these waterways with the aim to increase the value, one should know what the principles behind creating value are (value principles). And principles are good to know, but are usually not directly implementation-ready. Understanding the institutional setting and the way these principles are addressed is crucial in understanding where improvements can be made (value tools and instruments). And then, if we wish to understand how value can be increased in waterway projects, we need to know how the tools and instruments are actually made to be of use. This, again, will lead to improved value in specific redevelopment project, which in its turn delivers value to society in a broad sense.

1.5.2 Materials and methods

As waterways as a type of infrastructure have not been studied extensively, this study takes an explorative approach. With such an explorative approach, the objective of the study and associated research questions will be addressed in a qualitative way. A qualitative research method would fit these questions well as

it typically can provide answers to the central 'how' and 'when' in the research questions. The research questions are closely related to waterway development practice. The aim of the study is to provide both practical and scientific pointers; case studies are typically suitable for providing the needed insights. For this reason, case study research was chosen as the method for investigation. Real-world problems can be investigated through case studies; this method takes into account the rich context and can indeed provide practical pathways as searched for. Furthermore it secures practical relevance and provides fresh data contributing to the scientific field of waterway development.

The issues at play in waterway redevelopment such as changing societal needs, climate change and ageing of assets, are of typical relevance in Western countries with well-developed and matured waterway systems. The Netherlands and the US are examples of these. These countries offer a rich context of relevance for the waterway development in a broader sense. And although these countries have different socio-economic systems - an Anglo-saxon vs Rhineland model - the waterway authorities show remarkably similar attributes. Both are strong central agencies, with a long track record of managing and developing these waterways. Their respective networks are used intensively, are of high economic relevance for specific sectors, and are in need for redevelopments due to the ageing assets. As these two nations offer such a relevant and rich context, case studies are based on situations from these two nations. An additional argument is that both nations have transparent and accessible data sources available for research, and data can be extracted in either Dutch or English.

The cases used in this study for providing insight into the research questions were selected on the basis of the elements of study for the particular question. The elements of study were applied tools and methods (chapter 2 and 5), realized projects (chapter 4) or organizations responsible for waterway development (chapter 3 and 5). The selection and legitimization of specific cases for the individual research questions is described in more detail in each chapter.

As described in section 1.3.1, a variety of theoretical approaches can be used to study waterways. The study aims at understanding and finding room for improvement in waterway planning, and takes place in a multi-actor environment. Such a multi-actor environment leads to all sorts of interaction and associated transaction costs determining the playing field. Considering the research objectives, and the technocratic nature of waterway management,

a rational economic angle would make a logical fit and could provide practical ways to increase the value. Keeping in mind the shifting orientation of the public sector towards market-oriented types of governance, a rational economic approach was chosen for analysis of the cases. Two theories from the economic institutionalism were used. These are the Institutional Analysis and Development (IAD) framework (chapter 3) and Transaction cost theory (chapter 4, 5 and 6). These two fit well together as both are related closely to the rational school of thought in institutional economics. The IAD framework is typically suitable to investigate the decision making process in complex multi-actor settings (Dietz et al., 2003; Ostrom, 2010). Transaction cost theory builds on the solid foundations as laid by Ronald Coase (1937, 1960) and Oliver Williamson (1979, 1981, 1998) and has been made more specific for planning issues by Ernest Alexander (1992, 2001). The transaction is the central element in this approach and determines whether or not parties engage in interaction, and how they organize themselves and coordinate the interactions in order to optimize results.

Both theories align well and are useful for improving understanding of waterway authorities responsible for asset management in a context of a variety of correlated interests of other entities. These theories also closely relate to the entrepreneurial, market-oriented style of governance as witnessed in Western countries. Following the dynamics of the action arenas and related transactions could therefore be the guiding light providing answers to the research questions of this study.

1.6 Outline of the study

This publication can be outlined in four parts. The first part is the introduction (chapter 1), followed by a set of two chapters setting the agenda and sketching the field (chapters 2 and 3). The next three consecutive chapters are in-depth studies working from theory towards practical guidance (chapters 4, 5 and 6). Finally the fourth and last part wraps up all the issues as discussed and comes to generic conclusions and recommendations (chapter 7). Figure 1-5 shows how the chapters correlate to the research questions as discussed in section 1.4.3.

Chapters 2 through 6 have been published as articles, or are in the process of being published. Together, these articles form a logical string of arguments, but each chapter/article can also be read independently.

In more detail, the articles can be summarized as follows. In chapter 2, the problematic situation of waterways is described, together with a perspective on value as a way to handle these problems. This chapter emancipates the sector of waterway development as an area of study. This section demonstrates the relevance of optimizing for value instead of delivering sectoral solutions for strictly defined problems.

In chapter 3, the relations between the value of waterways to society and its actors responsible for decision making is clarified. For this purpose, the institutional setting of waterway development in the USA and the Netherlands is studied and described. The purpose of this chapter is to unravel the complex relationship between organizations, action arenas and the delivery of societal value. The results show the elements in the development process where typically value can be increased. The analysis is based on the Institutional Analysis and Development framework.

Chapter 4 gives a more in-depth theoretical description on how value works and according to which principles. This chapter describes the relationships between the general processes for waterways developments and the principles driving value as found in practice. Transaction cost and transaction benefit theory is used to cut through these issues. Two American case studies are used to illustrate how transaction costs and transactions benefits reveal the often-implicit value considerations.

In chapter 5, a broad empirical study reflects how tools and methods work in practice and where strengths and weaknesses can be found. A total of six cases were studied. The tools and methods coming forward from these cases have been identified and classified using the earlier described transaction cost and transaction benefit theory. By doing so, clarification is given on which strings of the value proposition these tools actually pull. This improves the understanding of the effectiveness and efficiency of application of these tools in practice. As a result, this chapter provides the elements for practitioners to develop effective strategies to improve value of their projects.

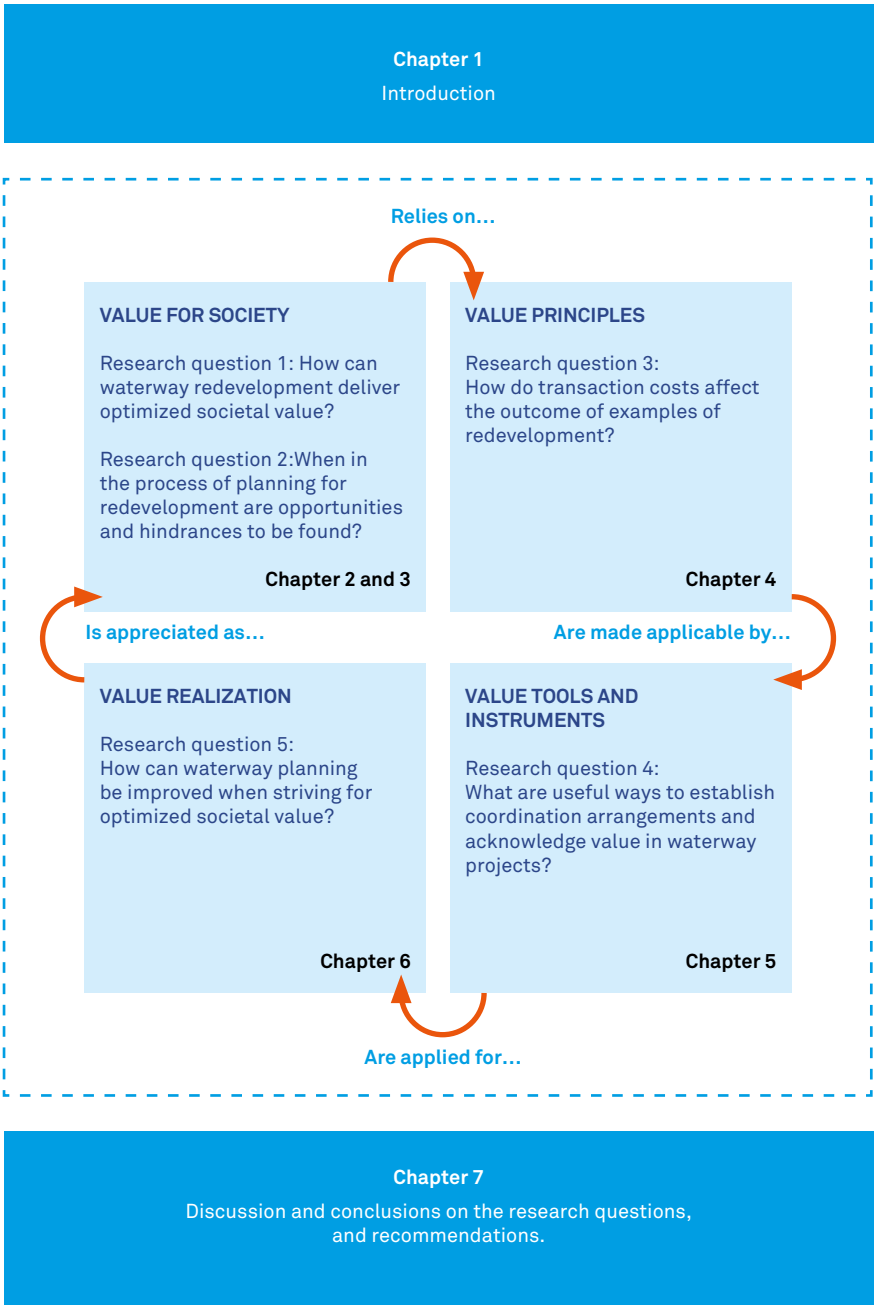

Figure 1-5: Outline of the study

Finally, chapter 6 provides an in-depth take on Dutch waterway development. The central agency responsible for Dutch waterway development, Rijkswaterstaat, is analyzed. A generic representation of value in waterway projects is provided and recommendations are given addressing the various planning stages in the Dutch context. Special emphasis is put on the issue of redevelopment of assets, as this plays an important role in the current Dutch context.

In chapter 7, overall conclusions are drawn. These conclusions cover the topics as discussed in chapters 2 through 6, but also address the research questions, as defined in section 1.4.3. Recommendations are given, also for practitioners, as the purpose of this research was not only to provide academic insight, but to advance contemporary practice as well.

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CHAPTER

2

Do we need to rethink our waterways? Values of ageing waterways in current and future society

ABSTRACT

In the past canals were developed, and some rivers were heavily altered, driven by the need for good transportation infrastructure. Major investments were made in navigation locks, weirs and artificial embankments, and many of these assets are now reaching the end of their technical lifetime. Since then the concept of integrated water resource management (IWRM) emerged as a concept to manage and develop water-bodies in general. Two pressing problems arise from these developments: (1) major reinvestment is needed in order to maintain the transportation function of these waterways, and (2), it is not clear how the implementation of the concept of IWRM can be brought into harmony with such reinvestment. This paper aims to illustrate the problems in capital-intensive parts of waterway systems, and argues for exploring value-driven solutions that rely on the inclusion of multiple values, thus solving both funding problems and stakeholder conflicts. The focus on value in cooperative strategies is key to defining viable implementation strategies for waterway projects.

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2.1 Introduction

Waterways are navigable waters, such as rivers, canals and lakes. These waterways have often been altered or developed for transportation purposes. The purpose of navigation did not only alter the characteristics of waterways in the past, it will most probably persist in doing so in the future. In several Western countries, investment waves in the past resulted in step-wise development of the navigation system. For instance the waterway systems in countries like Germany, France, United States and the Netherlands followed such a development.

Many of the assets in these systems, which have been build in the past, reach their end of technical lifetime or functional lifetime due to climate change or changed societal requirements. Projects to update, renovate or replace these assets can therefor be expected. Such assets must be replaced in order to maintain functionality. Typically, investments in these assets are optimized in terms of economic efficiency and fit the 'predict and control' paradigm in terms of hierarchical narrow focus governance and power delivery of massive centralized infrastructure elements by single sources of design (Pahl-Wostl, 2007). Funding of such project is often earmarked for 'transportation purposes', not addressing the myriad of uses and values linked to these waters.
Since the 1970s the concept of integrated water resource management (IWRM) emerged as a concept to manage and develop water-bodies in general. This concept is widely adopted and advocated and promotes the inclusion of the variety of uses, aspects and values in managing water resources. In the practice of waterway management this leads to the following problematic issue:

- Based on the life expectancy of assets in inland waterway transport systems, and the reliance of the transport sector on these systems, a new wave of waterway infrastructure investments can be expected.
- Literature is unclear on how these major and long lasting investments are to be implemented taking into consideration the principles of IWRM. A viable strategy is needed.

Illustrative examples of these assets for navigation purposes are navigation locks, weirs or artificial bank protection like steel sheetpile lining. The modification of these structures, if circumstances change or if they need to

serve other functions than foreseen during design, is generally very expensive if not technically impossible (Pahl-Wostl, Jeffrey, Isendahl, & Brugnach, 2010). If issues of ageing are not adequately addressed, users may experience direct or indirect consequences. Obviously this is true for all types of infrastructure like for instance railways and roads (Rogers, et al., 2012). However, waterway infrastructure has a few distinctive characteristics compared to other transportation systems:

- Assets usually have long lifecycles (sometimes exceeding 100 years);
- Problems are less visible (underwater);
- Assets are capital intensive and strongly linked to the surrounding area due to connections to (other) open water and groundwater;
- The network serves multiple purposes;
- The network is vulnerable to failure due to a lack of alternative routes.

Literature on waterways as a transportation system, and the characteristic issues that come with that, is scarce, certainly considering such a system in the light of IWRM. In this paper we discuss this issue from the perspective of the Dutch practice. As a new wave of investments can be expected, it is important to develop a viable strategy to address the problematic state and challenges of these waterways. At the same time, the push for reinvestment can also be considered an opportunity to boost the meaning and relevance of these waterways for society.

2.2 Theory

In river and watershed management, a widely advocated paradigm for management and development of rivers is IWRM (Jønch-Clausen, 2004; Mount & Bielak, 2011; UN Water and Global Water Partnership, 2007; United Nations, 2010; World Bank, 2009, 2010). However, in literature IWRM has been criticized for the lack of translation of theory to action on the ground (Biswas, 2004; Brugge van der & Rotmans, 2007; Butterworth, Warner, Moriarty, & Batchelor, 2010; Jeffrey & Gearey, 2006).

The definition of IWRM has seen various formulations, the definition used by the United Nations –Water and the Global Water Partnership is formulated as follows (UN Water and Global Water Partnership, 2007):

'A process which promotes the co-ordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.'

In this definition, maximizing the resultant economic and social welfare is mentioned. This general resultant is in fact a summation of many effects on a myriad or stakeholders related to the area concerned. The distribution of value among stakeholders determines whether these parties are interested in cooperating, co-investing, or competing. It therefore greatly influences stakeholder behaviour (Lax, 1986; Raiffa, 1982; Susskind, 1999). So in striving for maximization of the resultant economic and social welfare, it is key to keep a keen eye on the distribution of value in order to avoid resistance or obstruction in the implementation process.

2.3 Method

The emphasis on integrated waterway management, as well as on value, calls for attention to the rich and complex context of waterways. The Dutch situation is taken to illustrate this for two reasons; as it is a densely populated country balancing stakeholder issues is nearly always apparent, and secondly; it is part of a much wider waterway system, the north-western European system, which has been developed in similar pace, and therefor faces similar ageing problems.

The paper is based on a series of interviews with officers responsible for waterway development projects, review of a database of institutional and physical characteristics of waterway projects (i.e. the Rijkswaterstaat database) and gives an overview of the development and issues from this perspective. Then this information is condensed into a constructed case that is written as a story to illustrate how a focus on value, taking onto account a multitude of stakeholders and interlinkages of issues could work. Stories are typically suited to such a purpose and can convey information in a compact form (Denning, 2005; Gargiulo, 2006). This method allowed the authors to visualize the problematic state of our waterways in an articulate way, and detail the dilemma of how to proceed with ageing waterways. This example illustrates how value creation, making transactions, capturing and sharing value can drive an implementation

strategy that fits contemporary waterway management concepts such as IWRM. The elements used in the case have been selected according to recurring characteristics in the Rijkswaterstaat database. A four-step approach is used to construct the case:

Step 1– From an operational list of Rijkswaterstaat waterway projects in planning or implementation phase, projects were identified in which pursuing value of some sort played a significant role. The criterion of significance was that the project had to include uses other than navigation itself. Table 2-1 shows the projects, which have been used. In a desk study, the data were organized according to policy coordination, investment strategies for the projects themselves, the context of the project and ageing of the assets involved.

Table 2-1: List of projects where other uses or values than navigation only played a significant role

Project	Included value(s) other than navigation
Maaswerken Project	Nature development, flood protection, mining of gravel and sand. Water supply through the Julianakanaal, recreation.
Twentekanaal enlargement	Improving Ecological quality of the embankments
New Lock at Eefde	Improved water management for both drainage and supply
Omlegging Den Bosch, 9 km of new canal	Wetlands, recreational values, aesthetics
Replacement of 7 locks at the Zuid-Willemsvaart	Water drainage, ecological quality
Third navigation lock Beatrixsluizen	Recreational and heritage values
Renovation and deepening of the Beatrixcanal	Improving ecological quality, recreation (slow-lane cycling paths)
Self Supporting River Systems (IJssel)	Biomass production at floodplains to recover costs of river management
Room for the River	Housing, aesthetics, ecology, flood protection and recreation.

Step 2 – In-depth interviews were then conducted with the project managers, contract managers and stakeholder issue coordinators of these projects to explore the value opportunities that had been identified and the difficulties in capitalizing on these opportunities. The interviewees were selected on the basis of discussions with practitioners in the field. If value creation amongst stakeholders had been successful or seemed possible, the responsible officer

was interviewed. In this round 10 officers were interviewed (appendix A) using a semi structured interview format (appendix B).

Step 3 – The ideas and data obtained in steps 1 and 2 were based on the experience of the Rijkswaterstaat organization. International valorization of these ideas and data took place in discussions with practitioners from the PIANC working group on values of waterways. PIANC, the Permanent International Association of Navigational Congresses, is a global organization providing guidance for sustainable waterborne transport infrastructure for ports and waterways. The waterway agencies of seven countries are represented in the PIANC working group: the Netherlands, USA, Egypt, France, Belgium, the United Kingdom and Germany. A series of eight meetings took place beginning in Sept 2010, up to September 2013. During these sessions, six to eight workshop participants from different countries were asked about policy coordination, investments, context and the use of value in waterway projects with which they were familiar.

Step 4 – In the last step the illustrative case was created – a fictional story – which was based on the projects and the data and ideas gathered in the previous steps. As explained above, the elements were selected for the story according to generic characteristics from the database.

Step 1, 2 and 3 are reflected in 'Waterways management in the Netherlands' (section 4), step 4 is shown in 'The Hoven Canal – Value as a driving implementation strategy' (section 5). In section 6 the results are discussed and section 7 shows the conclusions.

2.4 Waterway management in the Netherlands

The Netherlands has a system of around 6500 km of waterways used for navigation. The smaller waterways are mostly used by recreational crafts, the main arteries by commercial vessels. Rijkswaterstaat is the agency responsible for these main arteries. These include the rivers Waal and Meuse, and several major canals. For navigation purposes a multitude of assets have been built in these waterways. Rijkswaterstaat is responsible management of these assets. Amongst these assets are for instance 10 weirs and around 120 lock chambers. Figure 2-1 shows the prognoses of the end of lifetime of waterway structures

for the Netherlands. The chart shows waterway-related assets that are the responsibility of the national government (Ministry of Infrastructure and the Environment, 2012). The figure shows that there will be a steep increase in the number of assets that will need replacing in the period from 2020 to 2040, given their design lifetime. Considering the significant preparation and implementation time required for these projects, timely planning is key. Preparations are currently being made for this in the form of national water strategies under the national Delta Programme and management strategies devised by Rijkswaterstaat (Ministry of Infrastructure and the Environment, 2012).

Replacing navigation assets takes place in a different context from the one in which most waterway assets were originally created. There were traditionally only limited dealings with stakeholders when canals were being developed or rivers altered to serve the transportation industry. Furthermore,

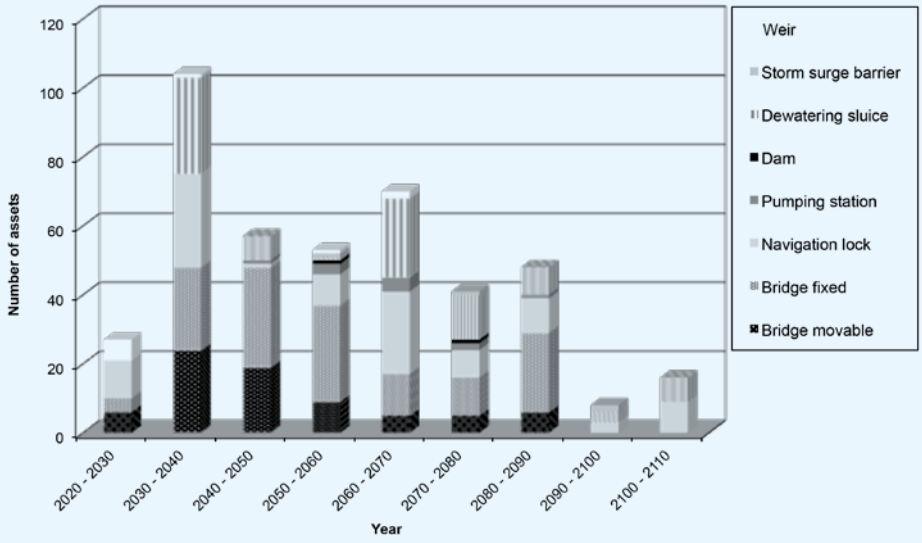

Figure 2-1: Projected replacement times for waterway-related assets of the Dutch national government. Replacement times are based on year of commissioning and technical lifetime of the assets (Ministry of Infrastructure and the Environment, 2012)

the environmental or social effects that needed to be taken into consideration were relatively limited. Contemporary projects, however, need to take into account a multitude of stakeholders and effects.

As water has always played an important role in the development of societies, the interests and effects that need to be taken into account are often as numerous as they are diverse. Table 2-2 lists functions typically related to waterways. It is based on the international experiences of the members of the PIANC working group on values of waterways and was used as a guideline for group discussions (step 3 in the methodology section). The discussion revealed that the list is not exhaustive and it is difficult to attribute a clear outline to the selection. In this paper this list is used to give an impression of the complex relationship waterways can have with the surrounding area, institutions and stakeholders.

Table 2-2: Functions and values of waterways (non-exhaustive). Source; PIANC working group 139, 2010

Functions and values of waterways			
Cargo transport	Irrigation	Flood protection	Ecology
Hydropower	Cooling water	Drinking water	Industrial process water
Ecosystem services	Water storage	Administrative border	Water drainage
Historical/heritage	Social coherence	Cultural identity	Religious values
Recreation at embankments	Passenger traffic	Water recreation	Military purposes
Landscape/aesthetics	Housing at or on the water	Fishing	

With this list in mind, and considering the interconnectedness of different functions and values, it can be argued that waterways have certainly become complex systems that cover social, environmental and economic areas. Complex systems are sensitive to such interconnectedness (Holling, 2001). Adapting these waterways to face the challenges of modern society is therefore more complex than finding a straightforward solution to a single issue (Axelrod, 2011). Since the waterway networks were completed, there have been dramatic social, technological and environmental changes (Filarski, 2013). In the era of the transport revolution and network development (19th century) the major part of the system came in place. In the 1930s a major investment surge adapted and improved the system. A second interesting reference point is the period from 1950 to 1970, when large scale improvements and modifications were made

Table 2-3: Historic and expected investment surges in waterway networks. Selection of relevant characteristics at the historic moments of investment in the Netherlands by Filarski and Mom (2008) and Filarski (2014). Characteristics at projected investment wave is based on the work by van Dorsser and Wolters (Dorsser & Wolters, 2012) and author's own insights.

Sector and society characteristics in early 19th century up to investment wave in the 1930s in Netherlands.	Sector and society characteristics in last major waterway investment period in the Netherlands (1950s to 1970s)	Sector and society characteristics in expected investment wave due to end of lifetime of many assets (present - to around 2040).
Navigation Transport by towing ships, diligence stage coaches, sailboats, horse and carriages Fine-mesh waterway network No open water dredging capability Rivers mostly in natural condition River and open water navigation unreliable due to weather conditions Canals provide reliability for transport Long-distance passenger travel mostly by water Shallow draft ships Emergence of steamships Society and waterways Widespread poverty Economy based on agriculture and crafts Industrialization Limited influence of cost-benefit analysis in government decisions Mature railway networks Emerging influence of global competition Urbanization Growing competition from railway	Navigation Deteriorated condition of waterway network Technological capability to dredge rivers and open water Emergence of push convoys of up to six units Decline in number of commercial inland vessels Economies of scale in inland transportation Fully motorized fleet Disappearance of towing convoys Introduction of on-board IT equipment Improved manoeuvring capability of ships Containerization of general cargo Improvement of productivity and safety Society and waterways Fast growing economy European seaport competition Railroad cargo transport no longer competitive with waterway transport Cost-benefit analysis for projects standard Small waterways obsolete for commercial use Emergence and growth of recreational navigation Importance of environmental issues Cultural heritage of waterways	Navigation Focus on multimodal or synchromodal transport Further growth of containerisation. Focus on fuel efficiency and emissions. Increased climate extremes Improved track, trace and travel planning. Further increase in recreational navigation Growth of average ship size as new vessels are mostly large, decommissioned vessels are mostly small. Society and waterways Climate change and adaptive measures to be taken around waterways. Sustainability, recycling, and closing the material loop as a key concept in construction. Decarbonisation of transport. Integrated view on waterways by the general public and growing participation of public and/or stakeholders. Strict ecologic legislation to take into account in waterway development.

in order to align the characteristics of the waterways with the requirements of the time (Filarski & Mom, 2008). This entails not taking into account the vast majority of developments that have occurred since the 1970s and affected the major assets of the networks. It also means that the local situation determines whether developments dating back further are taken into account. Table 2-3 lists a selection of developments that were relevant to waterways using these time frames. A third column is added referring to a next investment surge due to required replacement of ageing assets.

It is not possible to capture all relevant changes in society and the economy in a single table. However, the main question that arises is what this list actually means for the current situation and the desired future situation. Exploring an example situation in depth would illustrate the trade-offs in more detail.

2.5 Story of the 'Hoven Canal' - value as a driving implementation strategy

This example helps identify a new infrastructure investment strategy that might bring substantial benefits to a wider range of stakeholders because it employs a more integrated approach towards waterway redevelopment. The story begins by discussing typical generic attributes of a Dutch waterway before continuing by demonstrating the difference between two emblematic management strategies: a more traditional specialized approach and a value-oriented approach to waterway management.

2.5.1 History of the canal

About a century ago, the town of Hoven faced several problems. Industry in the region was under severe pressure because the neighbouring town of Veld with its superior riverside location represented lower transportation costs. In addition, during periods of high rainfall, the farmland around Hoven was poorly drained, whereas in the summertime there was frequently a lack of sufficient irrigation water. Local politicians, in conjunction with industrial and agricultural leaders, launched a plan to improve the situation in Hoven. The key feature of their plan was to connect the region to the river with a new man-made, 40-kilometre-long canal (Fig. 2-2). The canal would serve as a transportation

corridor, a drainage canal in wet periods and an irrigation canal in times of drought. Construction started in the 1930s, creating work at a time of crisis and mass unemployment. The canal is suitable for CEMT class IV shipping, these are ships of 85m in length, 9.5m in width and have a maximum draught of 2.5 m (Rijkswaterstaat, 2011). The width of the canal at water surface level was around 50m. The project included two sets of navigation locks, sluices (to allow the discharge of water into the river as needed) and pumping stations (to pump water from the river to the town of Hoven in times of water scarcity). One set was situated at the entrance to the river and the other halfway along the canal. The embankments of the canal were stabilized using rock. The canal served the region well without any significant physical changes for the eighty years that followed. Over the years cargo transportation has grown to an annual level of 15.000 ship passages, 6 million tons of cargo incl. 70.000 containers. These ships served a variety of industry, amongst these the farming community (fertilizer, agro products), a chemical plant (salt products and specialized chemicals), and a container terminal.

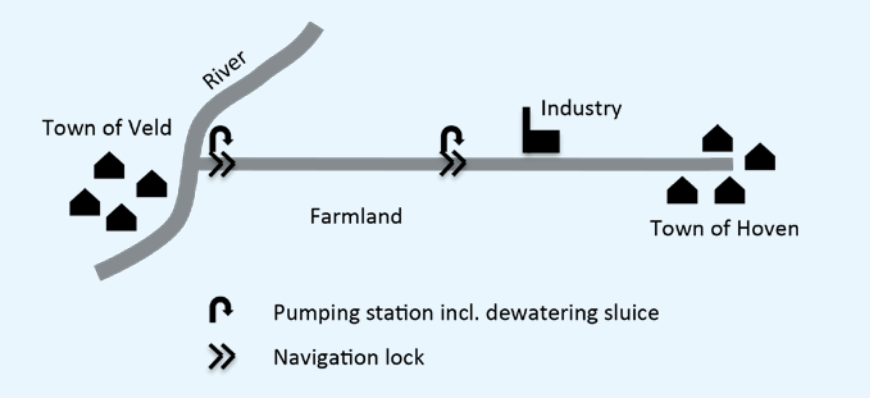

Figure 2-2: The Hoven Canal.

2.5.2 The end-of-lifetime dilemma – a traditional approach to artificial waterways

Around 2010, it became clear that the canal had reached the end of its technical and functional lifetime. The two navigation locks were no longer able to serve an increasing part of the country's commercial fleet as general ship

dimensions kept growing. Typically in the Netherlands, many traditional local waterways have been dimensioned to CEMT class II (ship dimensions length, width, draught: 65m x 6.60m x 2.5m) or CEMT class IV ships (ship dimensions length, width, draught: 85m x 9.50m x 2.5m). Modern ships and nearly all of ships currently being build, however, are all of CEMT class V or larger (ship dimensions of length, width, draught: 110m x11.4m x 3.0m). Costs per tonne in inland navigation range from around € 5,- to € 20 euro depending no the ship size and distance of the trip. Container transport costs between € 170 and € 200 per TEU (Policy Research, 2006), again depending on ships size and distance. Critical ship dimensions are usually length and width as ship captains can choose to sail with limited cargo to allow them to sail shallow waterways. In the case of the Hoven canal, reliability of operations decreased to such a point that industry was no longer willing to use the canal. Furthermore, climatological change meant that the pumping capacity no longer met demand in times of severe drought. A study showed that the most beneficial scenario would involve rebuilding the navigation locks, sluices and pumping stations. This would not only bring the system up to current standards, but would also take into account new requirements for serving the modern fleet and changed rainfall patterns. The cost was estimated at €100 million: €40 million for each of the two locks and €10 million for each combination of pumping station and dewatering sluice. It was estimated that the new system would serve the community for 100 years. The result of a cost-benefit analysis was positive, and a careful Environmental Impact Assessment was undertaken. The cost of the proposed project included mitigation and compensating measures of various kinds such as replanting of trees, reduction of noise, vibrations and dust during construction. Generally these costs are very limited in the case of navigation lock renewal as the impact is very local and similar to the old situation (if this would have been a greenfield development the impact is generally much broader). Approval seemed a formality.

2.5.3
Questions destabilizing the traditional approach

The community raised critical questions. The calculations, it seems, were based on 30-year forecasts, but the new investment was supposed to cover a 100-year lifespan. How could that be? Some people wanted to know whether farming would still be important to the region in two or three decades' time. Others asked whether the industry that required increasingly large ships would still exist in 50 years, especially given the uncertainty caused by the

economic crisis. Perhaps a focus on leisure, nature or cultural heritage would be a more appealing perspective for the region. The decision-makers were unable to answer these and related questions with any certainty. How could they know whether the new canal would aid or prevent future opportunities that might yield a far more favourable cost-benefit ratio for the region? And, from an economic standpoint, the long-term development plan placed hardly any weight on radically different, but not unreasonable, assumptions about regional developments.

2 . 5 . 4
The alternative approach – a value-driven one

An alternative approach was consequently taken. Reducing the requirement of 2,5m draught for shipping to 2,0m created the possibility of a system with only one navigation lock instead of two. Vessels that are less heavily loaded but sail more frequently now serve the industry. Economies of scale in transportation reduce shipping cost per tonne, but are not necessarily optimal for the entire supply chain. Large shipments reduce some transportation cost per unit, but storage cost (dead capital) and the capital cost of unloading equipment rises as the size of the average load increases. However, the possibility of receiving large shipments can improve the negotiation power of the receiving firm.

There were also concerns about the reliability of the corridor. When storage is reduced, reliability of the supply becomes a concern. Industry therefore valued this aspect of the system. In order to enable this, the lock complex halfway along the canal was renewed, while the lock complex at the entrance to the river was removed in 2011. This was possible because the vessels' reduced draft meant that only a lock halfway along the canal was required and the one at the entrance of the canal could be removed. The reliability of the entire system doubled due to the removal of the one lock and renewal of the other. The operating and maintenance costs for the canal authority are now much lower than they used to be. Reduced economies of scale have been disadvantageous for transportation interests, but by reducing local port dues industry has been compensated.

In times of drought, water security for farmers is now more broadly framed. The issue of water supply was framed in the past as a farming issue. Over the last century, however, canal operations have become increasingly more important to

a much wider group of users, whose concerns include household water, process water and cooling water. The water-dependent ecology also became a protected 'user' of the water. Given these developments, the demand for water over time is less straightforward. Restored wetlands connecting to the canal have increased the water storage capacity of the overall river system. For the canal authority it was important to align its ecosystem values with its efforts to increase water storage capacity and enhance the robustness of the water system. For the town of Hoven it was important to make the region a more attractive place in which to live or spend leisure time.

The pumping capacity was reduced because the system is far more capable of damping the extremes. This, in turn, lowered investment and maintenance costs while improving reliability (due to increased storage capability). 'Smart' irrigation methods have continued to reduce the demand for irrigation water.

In order to be able to implement all these changes, industry and farmers had to be convinced. Initially, the increased transportation costs made it hard to gain backing from industry. Furthermore, farmers were opposed due to the extra cost of investing in smart irrigation systems (to lower their demand for water). Both of these stakeholder groups initially preferred to keep their costs down by encouraging the canal authority to invest in the renewal of the 'old' infrastructure. But quick calculations revealed that the benefit would increase in the long term and the cost reductions would be far greater for everyone in the region. It was only those two groups who were facing short-term drawbacks. The question was therefore how to tap the long-term benefits to the region in such a way that they could be used to compensate those who would have to pay a significant price in the short-term. Table 2-4 summarizes the differences between the traditional and the alternative approach

2.6 Discussion

A question inherent to the case is whether the value-oriented management approach to the Hoven Canal produced a better outcome than the straightforward renewal of the old system would have done. Although such a question is difficult to answer entirely, the development of a more flexible approach to infrastructure investment and development does raise important issues. Decisions that respond to a broad spectrum of values are likely to have

Table 2-4: Summary of cost and benefits of the traditional approach and alternative approach the Hoven canal.

	Traditional approach		Alternative approach	
	Cost	**Benefit**	**Cost**	**Benefit**
Waterway authority	2 navigation locks (2 x €40 million), 2 combined pumping stations/ dewatering sluices (2 x €10 million). Total €100 million.	None monetary. Addressing a policy goal, strengthening support for the agency.	1 navigation lock (€40 million) and 1 combined pumping station/dewatering sluice (€8 million). Total €48 million.	Reduction of operating and maintenance cost. Addressing a policy goal, strengthening support for the agency. Hydropower revenues. Reduced pumping cost due to smart irrigation by farmers. Reduced investment in pumping/dewatering station due to measures by municipality and farmers.
Industry	none	Economies of scale	Extra cost for transportation (less draught).	Reduced cost for handling and storage. Compensation by waterway authority for reduced available depth in canal. Increased reliability of transportation system
Farmers	none	none	Investment in smart irrigation equipment	Support by waterway authority from pumping cost savings. Less vulnerability at droughts.
Municipality	none	none	Development of wetlands	Support by the waterway authority due to reduced flood protection measures. Increased attractiveness of the region. Increased tax revenues through growing tourism and increased house prices.

greater political legitimacy. The overall cost is lower, meaning that there will probably be less political opposition than otherwise.

The interviewees confirmed that, as in the story, for many waterways the ageing of the assets and the need for their replacement is what drives investment. The new assets need to meet two conditions: the multitude of stakeholder issues has to be addressed in some way, and the requirements have changed compared with the original ones.

In the new scenario devised for the Hoven Canal, a major break was made with the traditional approach by seeking value from issue linking. Whereas a single party can only optimize within its own boundaries, multiple actors can connect issues in terms of space, time or functions and employ, create or capture value by doing so (Evers & Susskind, 2009; Kabat, van Vierssen, Veraart, Vellinga, & Aerts, 2005; Susskind, 1999; Woltjer & Al, 2007). Multiple actors with either conflicting or parallel interests can seek mutual gain through their differences in utility, capability, expectations and forecasts or endowments (Lax, 1986). As the case shows, the alternative approach includes several transactions to harvest gains. A fundamental hindrance to employing these mutual gains is transaction costs (Coase, 1937; Williamson, 1998). Actors have to reach an agreement of some sort, which implies valuable, and for some actors very scarce, resources being deployed without any guarantee of reaching the agreement they would like.

With the Hoven Canal, by linking the problem of water quantity control to farmers and landowners for instance, more space was made available for a solution and the actors in the system did not act counterproductively because the incentives guided all actors in the same direction. This prevents one actor, the waterway authority in this case, being forced to make tremendous investments, which are, on an overall scale, far from efficient. Therefore, instead of basing investment on uncertain and unrestricted long-term demand forecasts (unrestricted because water users have no incentive to save water), investment on the both supply and demand sides needed to be optimized as a whole by linking the networks (Borgers & Van der Heijden, 2011).

A way then had to be found to compensate parties who were suffering loss. By making these links between systems, the overall reduction in the cost of improving the canal was around €50 million, and this was followed by permanent reductions in maintenance and operating costs. As the farmers and industry were facing, respectively, extra investment and higher transportation costs, part of the gain made by the Canal Authority was needed to compensate these stakeholders.

New functions of the system also contributed to the solution. Couplings in the case story include the enhanced aesthetic qualities resulting from the new embankments as well as the addition of wetlands (Thorp et al., 2010). Improved reliability is another factor that has been shown to increase the value of the

system. The importance of this aspect of waterways has been recognized in the Netherlands, and a nationwide programme on 'reliability of the waterways' (Ministerie van Verkeer en Waterstaat, 2005) followed, which aims to improve this characteristic for the benefit of the users of the system. The interviewees stressed the importance of this aspect.

Different actors reaching an agreement achieved all the above-mentioned solutions. The interviewed project officers acknowledge that such an agreement could only be reached after considerable amounts of time, energy and money had been spent on the details, and yet the agreement involves different uncertainties than the actors have been used to cope with. These difficulties, referred to in economic literature as transaction costs, are key in the optimization process. Transaction-cost theory has opened up an entire economic field of exploring and analysing optimization strategies for all sorts of organizations and has proven to be a fundamental element in organizations realizing mutual gains (Coase, 1937; Williamson, 1979, 1998). Transaction-cost analysis has found its way to other fields as well, including the interactions between public and private entities in the field of spatial planning (Alexander, 1992, 2001). The explanatory power of transaction cost theory when it comes to creating value could therefore be of great help in addressing the problematic state of our waterways with their need for high investment demand and multi-actor context.

2.7 Conclusions

The title of the article refers to whether we need to rethink our waterways. The answer is a clear 'yes' for countries where the ageing of assets entails a need for reinvestment and in which the socioeconomic environment has changed. These conditions apply to many Western countries that rely on a properly functioning waterway system. The end of the functional or technical lifetime of many of the capital-intensive assets in waterways, such as navigation locks, weirs and artificial embankments, consequently creates a push for such a rethink.

The Hoven canal makes clear that not all incentives to rethink the waterways arise from re-establishing the traditional function according to modern standards. Opportunities to enhance the significance of waterways for society

are an important factor as well. As many waterways were traditionally developed with a narrow focus on navigation, there are opportunities to employ new values that are related to this system.

Current management practice falls short when it comes to developing these waterways to their full potential. Increasing awareness of this situation amongst practitioners could help move towards a more viable and efficient redevelopment path. The review of projects in this paper has shown that investment strategies for current waterway projects assume a broader consideration of both the physical and institutional context in which these projects operate. In particular, linkages (or couplings) between waterway values and other land-use values are imperative. A further assessment of the role of the transaction costs involved in integrating these values would be useful. Transaction-cost theory could be instrumental in revealing management strategies that are productive in employing value and generating alternative funding sources.

Finding value in cooperative strategies is a promising way forward for waterway authorities to find support and funding for those waterways that are in need of development or redevelopment. Applying a transaction-cost framework to the waterway sector could help gain an understanding of the possibilities and limitations of a value-driven strategy.

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CHAPTER

3

Troubled waters: an institutional analysis of ageing Dutch and American waterway infrastructure

ABSTRACT

Waterways are one of the oldest systems for the transportation of cargo and continue to play a vital role in the economies of some countries. Due to societal change, climate change and the ageing of assets, the conditions influencing the effective functioning of these systems seem to be changing. These changing conditions require measures to renew, adapt or renovate these waterway systems. However, measures with the sole aim of improving navigation conditions have encountered resistance, as the general public, and stakeholders in particular, value these waters in many more ways than navigation alone. Therefore, a more inclusive, integrated approach is required, rather than a sectoral one. Addressing these contemporary challenges requires a shift in the traditional waterway authorities' regimes. The aim of this study is to identify elements in the institutional setting where obstacles and opportunities for a more inclusive approach can be found. Two major waterway systems, the American and the Dutch, have been analyzed using the Institutional Analysis and Development framework to reveal those obstacles and opportunities. The results show that horizontal coordination and a low pay-off for an inclusive approach is particularly problematic. The American case also reveals a promising aspect – mandatory local co-funding for federal navigation projects acts as a stimulus for broad stakeholder involvement. Improving horizontal coordination and seizing opportunities for multifunctional development can open pathways to optimize the value of waterway systems for society.

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3.1 Introduction

Waterways were one of the first infrastructural systems to transport people and goods. A waterway system usually consists of linked rivers, canals and lakes. Many of these systems have been expanded, altered and improved to serve the needs of transportation, and although transportation over water has lost its prominence in some countries, it remains a vital part of society in many others (Central Intelligence Agency, 2011).

Currently, the institutions responsible for waterway systems face a threefold challenge. In societies where these systems were developed a long time ago, crucial elements of these systems, such as navigation locks, dams and weirs, are ageing (Heijer et al., 2010; Hijdra et al., 2014). Secondly, climate change is altering operational conditions (Beuthe et al., 2014; Jonkeren et al., 2011; PIANC, 2009), and thirdly, society sees the role of these waters differently to how it did in the early years of their development (Mount & Bielak, 2011; Pahl-Wostl et al., 2010; UN Water and Global Water Partnership, 2007). The ageing of assets and climate change have together created a need for action: a changed perspective on these networks brings with it the challenge to 'fit' the waterway systems to the contemporary needs of society and build on the systems' value.

The significance of these waterway systems for society and the need to address contemporary challenges would be of no concern if adaptation to this new context were without effort. However, these systems and their related institutions have often had long histories of sectoral optimization and are still aligned to this. Examples of such sectoral optimizations are the construction of dams and locks to ensure navigation depth, the dredging of navigation channels, and the construction of artificial river and canal embankments. Waterways, and more in general infrastructure systems, can be described as large socio-technological systems. Due to their physical attributes and related institutions such systems typically show signs of inertia (Geels & Schot, 2007).

The situation described above is true for countries such as Germany, France, Austria, the Netherlands and the United States. All have inland waterway networks of significant importance, ageing assets and strong central agencies governing these networks. The ageing of assets, climate change and changing societal requirements are driving these agencies to consider measures to renew,

adapt or renovate these waterway systems. However, measures with the sole aim of improving navigation conditions have encountered resistance, as the general public, and stakeholders in particular, value these waters in many more ways than navigation alone (Pahl-Wostl, 2007). Beyond reducing resistance, society can be served in a broader way (Hijdra et al 2014). Interconnecting issues and broadening the scope of optimization can reduce inefficiencies and provide new opportunities. Examples are that attractive waters and waterfronts influence real estate value in a positive way, or, economies of scale in shipping affects natural river dynamics, flooding patterns and ecological balances in a negative way. Perhaps a very straightforward example of optimization beyond national agencies mandate is in contracting. Contracting of dredging of national waters could be combined with dredging of local waters delivering economies of scale. The examples show inclusiveness can take many forms and benefits. Therefore, a more inclusive, integrated approach is required, rather than a sectoral one.

An international group of waterway experts from the Permanent International Association for Navigational Congresses (PIANC) reviewed which elements could be taken into account in such an inclusive approach (PIANC, 2013). The committee was explicit that waterways today are valued for many more reasons than in the age when they were developed. Table 3-1 shows a wide variety of functions and values related to waterways. Typically, these functions and values do not relate to a single authority but to a wide variety of institutions and

Table 3-1: Wide array of waterway uses and functions, non-exhaustive inventory by PIANC working group on 'Values of Waterways' (PIANC, 2013).

Waterway as a logistical corridor	**Waterway as a socio-geographic element**	**Waterway as a water resources system**	**Waterway as an ecological system**
Recreational boating	Recreation at embankments	Drinking water	Nature
Cargo transportation	Administrative border	Cooling water	Ecosystem services
Passenger traffic	Social coherence	Industrial process water	
	Religious values	Irrigation	
	Housing	Water management	
	Historical values	Hydropower	
	Landscape/aesthetics	Water storage	
	Cultural identity	Fisheries	
	Military purposes		

action arenas. The elements in table 1 have been categorized into four groups representing four major views in literature. However, as many of the elements in the table do have aspects that relate to more than one category, the table should be considered as a help to provide some overview, rather than the exact categorized division.

A more inclusive approach inevitably relates to the mentioned wide variety of institutions and action arenas. The aim of this study is to identify elements in the institutional setting where obstacles and opportunities for a more inclusive approach can be found. Two illustrative cases have been analysed, the USA and the Netherlands, to identify such obstacles and opportunities. Both systems are of great socioeconomic importance and both systems are highly optimized for cargo transportation. For the analysis the Institutional Analysis and Development (IAD) Framework has been applied. This framework is particularly useful for the analysis of these kinds of situations, as it was developed to understand decision-making by institutions, their rules and actors. Fresh empirical data could contribute to the debate in this area, as waterway systems as a means for transportation have received little attention to date.

3.2 Theory

Waterway systems can cover large areas of land, cross administrative borders of various kinds and link to many economic, social or environmental aspects of society. As a consequence, a myriad of institutions could be involved in these networks' development issues. These institutions could be national, regional or local. Understanding how these institutions form decisions for waterway development is therefore crucial to finding opportunities and obstacles to an inclusive approach.

A variety of theoretical frameworks can be used to gain understanding in decision making when a broad group of actors is involved. Stakeholder identification and analysis techniques, as for instance described by Bryson (2004), can be very helpful in this. Policy network analysis, perhaps the most common framework, can be used to study how formal institutional and informal linkages between governmental and other actors determine policy outcomes (Rhodes, 2008; Risse-Kappen, 1996). Multi-level governance analysis typically recognizes that governance occurs across scales and involves both

public and private actors in a variety of settings. The multi-level refers to the interdependence of governmental bodies operating at different territorial levels, and the governance part reflects the interdependence between governmental and non-governmental actors (Bache & Flinders, 2004). An incrementalist's view, muddling through or positional analysis have a less broad reach, but can be helpful in multi-actor cases where comprehensive policy development and implementation is lacking (Marsden, Ferreira, Bache, & Flinders, 2014). The IAD framework, provided by Ostrom (Ostrom, 2005; 2010), is a useful framework for analysis of multi-actor settings with a somewhat different perspective. What differentiates the IAD framework from other forms of organizational analysis is the focus on rules associated with action arenas. It is this type of analysis that has been selected for this study, as it is expected that the in-depth analysis of rules around a specific action arena could reveal the specific opportunities and obstacles for an inclusive approach.

By following the steps in the IAD framework and taking the action arenas as the unit of analysis, the analysis will systematically follow the path of decision making for a project. This path can be followed from policy level to implementation. When these action arenas and associated rules are shown against the background of stages for project development, the results can provide useful pointers for practitioners on where and when to act in order to improve the broad societal value of projects. Classic stages of projects which can be distinguished are: agenda setting, programming, planning, and implementation (Boal & Bryson, 1987; Bryson & Delbecq, 1979).

Within the IAD framework, institutions are defined as a set of prescriptions and constraints that humans use to organize all forms of repetitive and structured interactions. Institutions are important as they are the underlying determinant of economic performance by forming a society's incentive structures (North, 1993). The IAD framework offers researchers a way of understanding the process of policymaking and collective decision making by outlining a systematic approach for analyzing the institutions that govern action and outcomes within collective action arrangements (Ostrom, 2005; 2010). The IAD framework is particularly suitable for the analysis of waterway development, as related institutions can be considered as a range of action arenas with a multitude of actors and rules. The IAD framework defines the action arena as the relevant unit of analysis for understanding a system. Figure 3-1 shows the structure of the action arena.

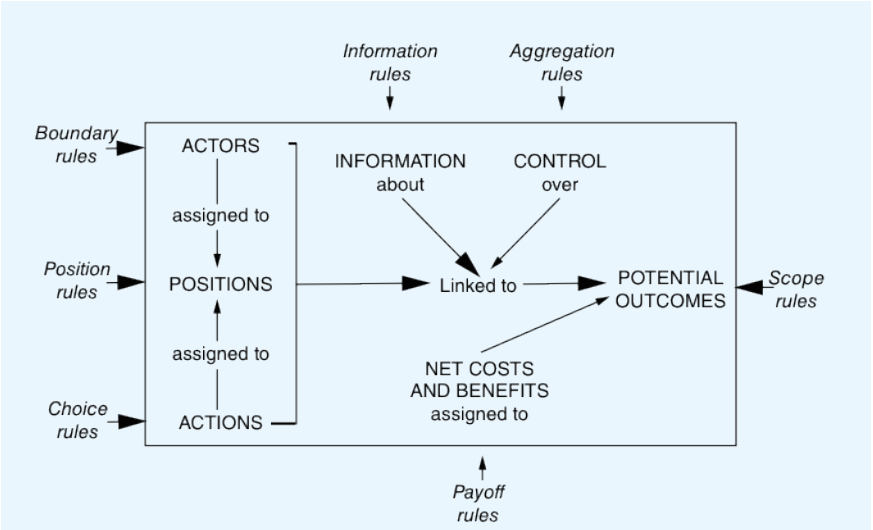

Figure 3-1: Structure of an action arena and its rules affecting the action elements (Ostrom, 2010)

The action elements are not elements in isolation but are affected by a set of rules. Many rules can often be distinguished, but seven types can be distinguished in a more generalized sense:

(i) Boundary rules that specify how actors were to be chosen to enter or leave these positions;

(ii) Position rules that specify a set of positions and how many actors hold each one;

(iii) Choice rules that specify which actions are assigned to an each actor in a position;

(iv) Information rules that specify channels of communication among actors and what information must, may, or must not be shared;

(v) Scope rules that specify the outcomes that could be affected;

(vi) Aggregation rules (such as majority or unanimity rules) that specify how the decisions of actors at a node were to be mapped to intermediate or final outcomes; and

(vii) Payoff rules that specify how benefits and costs were to be distributed to actors in positions. (Crawford & Ostrom, 2005).

This framework was used to identify obstacles in the Dutch and American systems which create entrapment in the current state and which impede effective response to changing conditions and requirements.

Literature provides little insight into specific waterway infrastructure arrangements. For infrastructure planning in general, coordination in multi-objective settings, and institutional arrangements have been studied, but there seems to be no convergence to best practices (Mishra, Khasnabis, & Swain, 2013; Short & Kopp, 2005). For water management the performance of institutional arrangements is identified through the broad watershed studies of Saleth and Dinar (2004) and Pahl-Wostl et al. (2012). Saleth and Dinar concluded that the strength of institutional links determines water institution performance and affects water sector performance. They found that links and effective coordination of polycentric governance structures are key to achieving efficient and integrated results for watershed planning. By applying the IAD framework to such governance structures, more detailed insight can be gained about the working of these links and coordination activities.

3.3 Materials and Method

Many countries have waterway systems of some sort, but quite often such systems are either very limited in extent or limited in use. Some of these systems consist mainly of natural rivers. Institutional inertia or inefficiency related to the management of the navigation infrastructure is not a pressing issue in these countries: efficient freight transportation does not rely on government infrastructure provision.

This is different for countries where inland waterway transport is an important mode of transport and where the management of waterways and related navigation infrastructure is an important factor in safe and reliable transport. Both the Netherlands and the United States fit this principle. These two countries have been chosen as areas for study as both offer a rich and relevant context for investigating the limitations and opportunities for more inclusive approaches. Both have a long history in waterway use and development, and even today these waterways are intensively used for freight transportation. The waterway systems are of significant national economic importance, and both systems have been heavily altered to function properly for navigation. In both

Table 3-2: General characteristics of the American and Dutch freight transportation systems*

Item	USA	Netherlands
Length of infrastructure (km) Highway / railroad / waterway	423.976 km/ 358.667 km/ 34.547 km	6675 km/ 3032 km/ 4346 km
Relative length of infrastructure Highway / railroad / waterway	52% / 44% / 4%	47% / 22% / 31%
Modal split (freight mass) Road/rail/water/pipeline/others or unknown	73% / 11% / 5% / 9% / 2%	62% / 3% / 24% / 10% / 0%
Modal split (ton kms)** Road/rail/water	43% / 50% / 7%	56% / 5% / 39%
Waterway length, federally operated	19200 km	1686 km
Federally operated lock sites / lock chambers	191 / 237	83 / 139
Dominant use Highways / railroad / waterways	Passenger cars / freight trains / freight pushing convoys	Passenger cars / passenger trains / self propelled freight ships
Commodities transported over inland waterways***		
Solid fuels	23%	8%
Petroleum products	28%	19%
Sand gravel and stone	10%	29%
Food and farm products	9%	9%
Chemical products	8%	13%
Iron ore and scrap	6%	7%
Others****	16%	15%
Total	100%	100%

* Data sources: Freight Facts and Figures 2013. Federal Highway Administration and Bureau of Transportation statistics. Bureau of transportation statistics - Centraal Bureau voor Statistiek.

** Pipeline transport not available in tonkm

*** Data sources: US -Transportation Facts and information. Navigation and Civil Works Decision Support Center. The US Army Corps of Engineers, November 2012. NL – Bureau Voorlichting Binnenvaart, 2009.

**** For the Netherlands this is mainly containerised transport, in the USA containerised transport by barge is almost negligible.

countries a significant portion of the waterway assets is reaching the end of its technical lifetime, therefore ageing of assets has become a pressing problem. Both systems are also exposed to climate change issues. Therefore, in both countries, there is a sense of urgency to react to these developments, which provides, in theory, a window of opportunity for breaking the existing lock-in situation.

Both countries have a single central agency responsible for these systems' main arteries and both systems have an extensive system of locks and weirs to maintain navigable conditions. The institutions responsible for the waterways are strong and resourceful organizations, and have a long history of managing and developing these waterways (Lonquest et al, 2014). Ageing of assets and climate change effects play a role in both systems. The general characteristics of the national transportation systems in the USA and the Netherlands are shown in Table 3-2. In table 3-3 an overview is provided of different issues at play with regard to ageing for highway, railroad and waterway systems.

A variety of sources have been used to gather data for the analysis. For general information on opportunities in waterways development and more inclusive approaches, use has been made of the proceedings of the international PIANC working group, studying the variety of functions of waterways in a series of 14 sessions from 2010 up to 2014. Officials from waterway authorities from 6 countries attended these sessions, amongst these countries were the

Table 3-3: General characteristics of ageing issues in highway, railroad and waterway systems

Typical maintenance	Highways Railroads Waterways	wear and tear dependent on use and deterioration through weathering wear and tear dependent on use dredging dependent on sedimentation patterns
Typical capital assets	Highways Railroads Waterways	Bridges, tunnels Bridges, tunnels, yards Locks, dams, quays
Typical motivations for reinvestment	Highways Railroads Waterways	End of technical lifetime of assets, Traffic bottlenecks End of technical lifetime of assets End of technical lifetime of assets Shipping traffic bottlenecks Changing hydrological conditions.

Netherlands and the USA. For a general understanding of the systems in both Dutch and American situation use has been made of observations and documentation of a variety of projects and site visits in both countries, which have been visited during the period from 2011 to 2014.
For in depth analysis of the decision making process and the actual action arenas, a series of projects in both countries has been analysed. These projects were the New Orleans Inner harbour Navigation canal expansion, the Napa river flood projects, and the Miami River restoration, the Beatrixlocks and Lek-canal expansion, the new canal around the city of Den Bosch, and the New lock complex at Eefde. Twenty-two project managers, waterway specialists and contract managers (12 American, 10 Dutch) were interviewed in semi-structured interviews. Furthermore use has also been made of publically available documents and reports, website postings and data from conversations with officials and stakeholders in waterway projects.

On the basis of all gathered data, the action arenas in both countries have been mapped out. The data was structured along the steps of project development phases as both arenas and actors are aligned like this (appendix VIa). Vice versa, results can therefore be related to these steps so these are readily for use for practitioners. The data from the semi structured interviews, documents, reports and website postings was used to identify the opportunities and hindrances related to the arenas and associated rules of the IAD framework.

3 . 4

Results

American Waterways

Documentation, projects visits and interviews all underlined the central position of the US Corps of engineers in the waterway operation, maintenance and development activities. The US Army Corps of Engineers, established in 1802, is responsible for the vast majority of the waterway network in the US, and all major stretches fall under their responsibility (US Army Corps of Engineers, 2009). The Corps is in essence a military organization which includes a civil branch within which waterway management and development is located (US Army Corps of Engineers, n.d.). Its mission is defined as: ‘Deliver vital public and military engineering services; partnering in peace and war to strengthen our Nation’s security, energize the economy and reduce risks from disasters’ (US Army Corps of Engineers, 2014). The Army Secretary Assistant for Civil Works

Figure 3-2: Main waterway network of the US (figure courtesy of US Corps of Engineers)

(ASACW) oversees the activities and determines policies for the navigation works of the US Corps of Engineers (United States Army, 2014). The Secretary of Defense (SoD) is the highest official under the President of the US overseeing the nation's entire armed forces, including the US Corps of Engineers. The network under the responsibility of the Corps is around 19,200 km in length (Figure 3-2). By law, a local partner must be found to carry the burden of part of the expense of any waterway project to secure federal support. These expenses can be monetary or in kind.

The federal funding comes from the federal budget along with funds raised from the waterway trust fund. These funds come from fuel taxes paid by waterway users. The Inland Waterways Users Board (IWUB) is an advisory board monitoring the trust fund and advising the Army Corps of Engineers and Congress on priorities for spending from the Inland Waterway trust fund. Although the IWUB has an advisory role in the process, congress and the US Corps of engineers rely heavily on the opinion of the Board as was made clear by officials in the PIANC working group meetings.

In the planning and implementation process a wider group of actors comes into view. Local property owners, special interest groups, contractors and local governmental representatives are involved in the planning and implementation phase. The interviewees provided rich data on the wide variety of interactions in these phases. In appendix VIb the variety of arenas, which determine the development of waterway projects, are shown.

Dutch Waterways

In the Dutch situation, documentation, website postings and interview data pointed towards Rijkswaterstaat as the main and dominant agency for waterway operation, maintenance and development. This public agency is responsible for all the main arteries of the waterway system (Rijkswaterstaat, 2011). It was established in 1798. The Agency falls under the remit of the Ministry of Infrastructure and the Environment. The Ministry is responsible for initiating, budgeting and preparing information on prioritization of navigation projects. *Rijkswaterstaat* is assigned to advise, prepare and implement these projects. Funding for projects comes from the treasurer and usually covers the entire cost of a project. In 1815 at the Conference of Vienna, it was decided that major waterways in the countries along the Rhine river had to be free of toll and obstacles. This agreement still stands and implies that users of waterways should not be charged for use of the system in any sense. The network that falls under the responsibility of *Rijkswaterstaat* is a mix of adapted rivers and artificial canals (Figure 3-3).

Documentation provided a clear overview of the responsibilities of Rijkswaterstaat under the umbrella of the Ministry of Infrastructure and the environment. The Ministry has a broad array of responsibilities and each has its own internal line of decision making and funding. Transport policy and projects are evaluated and prioritized within the Directorate General of Mobility and Transport. User groups, which can also exert influence over representatives in Parliament, are consulted in this process.

A project's scope is agreed in cooperation between the local offices of *Rijkswaterstaat*, a central advisory unit from *Rijkswaterstaat* (*Dienst Water Verkeer en Leefomgeving*) and responsible officials at the Ministry. Local stakeholders are consulted early in the process. The actual project design results from an interactive process involving market parties (Lenferink, Tillema & Arts, 2013). As funding is earmarked for transportation purposes, there is only

Figure 3-3: Main waterway network of the Netherlands (figure courtesy of Rijkswaterstaat)

limited opportunity to provide for other requirements if these are costly. The legal project planning process includes informing and facilitating stakeholders in expressing their objections. Overall, waterway projects are agreed at a variety of arenas at national, regional and local levels. In appendix VIc an overview is provided of the main arenas and the rules determining the focus and value of waterway projects.

3.5 Analysis and discussion

The development of the waterway systems in two case studies, the USA and the Netherlands, has been studied through the lens of the IAD framework. The results will be discussed following the classical planning phases, from the 'agenda setting/policy level' to the local 'implementation level'.

3.5.1 Agenda setting/policy making

For both countries the rules of the action arena in this phase of planning appeared to be of a general nature. The arenas are the national parliaments where policy and investment plans are discussed, prioritized and allocated. The scope rules showed that the networks are considered a national issue, which seems logical as both watersheds and inland waterway transport cross many regional or local borders. To a large extent these rules determine what trade-offs can be debated, defended or decided on. The scope rules also showed significant differences for both countries. A difference revealed by the data is that American plans cover waterway and port issues while Dutch plans cover national transportation and spatial development issues. A special '*sneller en beter*' (faster and better) programme has been implemented in the Netherlands to include stakeholder interests earlier in the process. Also in the Netherlands, a general policy has been adopted to stimulate public private partnerships, which provides opportunities for horizontal cooperation in the implementation phase.

In the Dutch situation the scope rules of the matters at stake include multiple modalities at the same time. Therefore trade-offs, interrelated and correlated issues can be part of the debate. In terms of pay-off rules the members of parliament can feel a priority for certain issues or modalities depending on their political preferences. For the USA this is quite different. Waterway issues are part of the US Army civil works plans, which is generally restricted to flood protection and navigation works. Other modalities like rail and highways are not part of it. The general policy for waterway investment, however, implies that local co-funding for each project is to be provided in the USA. This offers opportunities for inclusive approaches in the planning and implementation phase.

The pay-off rules are much more regionally oriented in the USA compared to the Dutch situation, as politicians have geographical confined constituents (boundary rules). Based on the scope rules one could expect, as the opportunity is there, an active integrated freight policy in the Netherlands in contrast to the American policy. However, the political preference in the Dutch situation has been a market oriented one; the policies do not favour any of the modalities above another. In addition, the nature of the networks does restrict such policies in some extend as the railroad network in the Netherlands is dominated by passenger traffic, whereas the waterways are mostly a freight system (table 2). In the US both systems are freight oriented, but decision-making takes place in different arenas.

3.5.2 Programming

In the Dutch situation the action arena for programming is the political decision making in parliament based on the plans as presented by the minister. In the American situation it is a double action arena. The data showed that the Inland Waterway Users Board plays a pivotal role in the US. The IWUB is a specialized stakeholder group of commercial waterway users. If the elected members of the IWUB reach unanimity (aggregation rules) on there advice to congress, congress will follow in most cases, otherwise congress would be action arena at play.

While Dutch plans cover a range of modalities including public transportation, American programming is much more narrowly restricted to the topic of waterways. In terms of pay-off the regional distribution plays a large role in American decision-making, while Dutch decision-making also includes distribution across (transportation) sectors and modalities. It was observed that wrapping multiple projects into programmes was regarded in the Netherlands as a method for optimizing beyond the individual projects; it widens the scope rules. Such an approach bridges the gap between programming and planning. In terms of the rules at play the boundary rules allow a much larger influence of the users of waterways in the American situation compared to the Dutch situation. Altogether the American arena for programming is very much aligned for sectoral optimization, while the Dutch arena offers ample opportunities for inclusive approaches.

3.5.3
Planning

It is in this phase that a variety of deals have to be made with local stakeholders, regulatory bodies, municipalities and other independent democratic entities. As expected, many ties to institutions, stakeholders and other organisations were found in both countries. The results showed for both that two main decisions determine the results at this phase of waterway development: a 'regional agreement' and an 'approval by regulating authorities'. The regional agreement in the Dutch case was referred to as a '*bestuursovereenkomst*'. This *bestuursovereenkomst* is often a convenant among regional and local government bodies determining a project's scope, mandate, funding and some regulatory issues. The approval by regulating authorities is called the '*planbesluit*' and is a formal planning consent decision on the basis of the legal and environmental requirements for the project. In the US, similar roles were found for the Record of Decision (regional agreement) and the Environmental Impact Statement, including the mandatory documents and approvals from relevant government bodies. In both countries, the national authorities for waterways, *Rijkswaterstaat* and the US Army Corps of Engineers take the lead and possess the resources to negotiate the necessary deals, prepare plans and ensure approval is obtained in the permitting process. However, the American system is more dependent on local support as local co-funding is mandatory for federal approval. This is to ensure that regional stakeholders actually value the investment. In some situations this led to more inclusiveness, but it was also observed it led to a push for local contracting to serve the local businesses.

In general the data uncovered varying degrees of inclusiveness of function and value in projects in the two countries. The pay-off rules in both cases showed limited rewarding for an inclusive approach for both *Rijkswaterstaat* and the US Army Corps of Engineers. The strictly enforced remit of the US Army Corps of Engineers was often mentioned as restrictive. *Rijkswaterstaat* had a more relaxed attitude towards its remit. Despite this more relaxed attitude, the low pay-offs acted were considered as hurdles for further inclusiveness. In terms of obstacles and opportunities the data point to the problematic combination of these agencies' strict focus on navigation and the low pay-off for broader optimization.

3.5.4
Project preparation and implementation

The preparation and implementation phase involves a lot of local work to prepare a project, negotiate a variety of issues with local stakeholders, prepare the bidding process, contract a construction company and manage construction. The negotiations with local stakeholders and the contractual arrangement selected for project development can result in the yielding of greater or lesser value for the region. Project managers play both in the Netherlands and the US a pivotal role in decision-making. He or she is informed and advised, but the aggregation rules point out that this officer has a final say in many of the issues at stake. The pay-off rules, however, hardly reward this officer for action in order to increase the value of the project. On the contrary, the pay-off rules reward the project manager and his team to run a smooth and focussed project, avoiding complications where possible. This was found in both countries.

Also, a difference in approach came forward. It was found that *Rijkswaterstaat* typically passes design responsibilities on to the contracted parties while the US Corps of Engineers retains tighter control over these activities. Design responsibility for the contractor in the Netherlands was frequently mentioned as an opportunity for broader optimization. Reflecting this to the rules of the action arenas, it meant that the scope rules and aggregation rules provided less decision room for the Rijkswaterstaat project team to define the exact outcome of the project. Or, vice versa, the aggregation rules and scope rules provided the contractor and associated engineering team plenty of room to optimize to the project according to their insights. Nevertheless, little evidence was found of broader optimization beyond the scope of the assignment defined by Rijkswaterstaat. Optimization was often found in streamlining construction logistics and not so much in capturing related development opportunities. The data suggest that for the contractor and his design team the same reasoning is valid as for the client's team. Pay-offs steer in the direction of running a tight and efficient operation, not so much in the direction of exploring and capturing opportunities. Opportunities for wider optimization also need to be prepared in earlier phases of project development, phases where the contractor and his team played no role in.

3.6 Conclusions

In an era of rapid technological developments, waterway systems as transportation infrastructure receive little attention in literature. Nonetheless, a smart path towards redevelopment would be of value as many of these infrastructure assets are due for renewal. The high level of interconnection between water and a wide spectrum of societal values requires broader optimization to maximize the social and economic benefit. As North (1990) stated: if institutions existed in a zero-transaction-cost world, the system would instantaneously react to changed preferences. However, when maximizing social and economic benefits, hurdles can be expected. This paper analyzes the relevant institutions for waterway development in the Netherlands and the US to understand where resistance is limiting value for society and where opportunities can be found for further optimization.

The IAD framework was selected as a tool to analyze the situation of waterways in development. The breakdown of the process into action arenas and the rules associated with these arenas proved to be helpful in understanding the decision making process. The American and Dutch systems were described on the basis of this framework. The arenas and associated rules are set out along the planning phases in infrastructure development: agenda setting/policy making, programming, and planning and implementation. In such way practitioners can easily translate the results into action for improvements.

The US and Dutch situations were found to be alike in many aspects, which is remarkable given the different planning traditions in these countries: the Anglo-Saxon and the Rhineland traditions. Both have a centralized system for managing and developing waterways, which is also found in many other Western countries where waterways are of significant societal importance like for instance France, Germany and Austria. In the policy/agenda setting phase, decisions are taken about the outline of the waterway development. Project and investment priorities are determined in the programming phase, a phase that offers few opportunities for increasing inclusiveness. In both cases these two phases and the associated arenas are closely focused on efficient transportation solutions. Similarities were also identified further down the line, as the national waterway authorities, US Corps of Engineers and *Rijkswaterstaat* both play a dominant role at the planning and implementation level. These

agencies negotiate with a variety of local and regional government bodies to determine the detailed scope and impact of waterway development. For both national authorities the scope rules were found to be restrictive in terms of broader optimization. Pay-off rules also seemed unhelpful, as there appeared to be no incentive for these agencies to work towards such broader optimization.

Aside from all similarities, also some fundamental differences between both countries were observed. In Dutch practice the policy-making and agenda setting is coordinated by a single ministry, which includes the entire transportation and water sector. Policy documents and decision making in parliament is therefore often framed in a broad way. However, as the current policy for transportation is market oriented, parliament is reluctant to intervene in market dynamics. Therefore, hardly any interconnected, integrated or active modal shift policies are pushed for. In other words: the Dutch context does offer greater opportunity for inclusive approaches at this level compared to the American situation, but it is reluctant to actually push for those approaches.

A second fundamental difference is the role of the waterway users, the transportation companies. In the American situation these acquired a formal role in programming through the IWUB. In the Dutch situation the role of the users is much more informal. Nonetheless, programming of waterway projects in the USA means prioritising of a list of many urgent waterway projects in the context of a relatively restricted budget. One way or another, programming remains within the scope of waterway projects and the IWUB will assure the most urgent waterway transportation project will be prioritized. In the Dutch situation, programming encompasses the entire national infrastructure and spatial developments at once, and a less formal role of the user. Therefore much more flexibility trade-offs can be, and occasionally are, made.

A third difference was found in the mandatory local co-funding for the American situation, which was not encountered in such form in the Netherlands. This appeared to be a forceful incentive to engage local governmental bodies in the planning process. Valuable resources are at stake and results, which are appealing for their constituents, are desired. In some situations this led to more inclusiveness and capturing opportunities, in other cases a push for local contracting was observed to satisfy the local community. A fourth significant difference is found in the implementation phase. In the Dutch context design responsibility is transferred to the contractor, the waterway authority contracts

parties on the basis of functional requirements. In the USA the designs are made by the US Corps of Engineers themselves. Although potentially transferred design responsibilities could bring more opportunities for inclusiveness and broad optimization, the rules of the action arenas were not aligned to support the capturing of these opportunities.

In both cases the data showed well-developed and institutionalized vertical coordination structures and activities, clear examples are the hierarchic structures from ministries to the operational waterway agencies like the US Army Corps of engineers in the USA and Rijkswaterstaat in the Netherlands. Opportunities and incentives for horizontal coordination were found in both countries; however, the rules of the action arenas do not seem to be aligned in such way that opportunities are easily captured. Specifically in the planning and implementation phase, the lack of alignment of scope rules, aggregation rules and pay-off rules to support broader optimization is found to be a hindrance. Room for improvement is found in aligning these. The first signs of recognition of the narrow scope as a hindrance is observed in the Netherlands, programming now includes spatial projects in addition to infrastructure projects.

In the light of this study's findings, waterways offer ample opportunities for broad optimization, serving society in many ways. Given the variety of policy statements underlining the importance of inclusive and integrated approaches, this is well recognized. Broad optimization, however, means acting beyond the vertically organized silos for transportation projects. It is important to recognize that the dynamics in these processes, where interests across scales and from different stakeholders come together, can be considered as multi-level governance. Acting beyond the vertically organized silos requires horizontal coordination with entities outside the hierarchical influence of the national bodies responsible for waterway development. This can be, for instance, municipalities, provinces or private sector entities. For countries with waterway systems in need for reinvestment, application of mandatory co-funding, as found in the USA, could be a helpful tool in stimulating such horizontal coordination.

This study shows that countries with an ambition to realign their ageing waterway systems to current society should pay particular attention to the planning and implementation phase. It is in these phases where intentions are turned into solid results. The rules of the action arenas should be aligned with these intentions to be effective. Special emphasis should be laid on

strengthening horizontal coordination and local pay-off approaches. Further analysis of the incentives and frictions in horizontal coordination, specifically at the planning and implementation level would therefore be helpful to shed more light on the hindrances and opportunities for maximizing social and economic value in waterway development.

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CHAPTER

4

Value creation in capital waterway projects; application of a transaction cost and transaction benefit framework for the Miami river and the New Orleans inner harbor navigation canal

ABSTRACT

Waterways have many more ties with society than as a medium for the transportation of goods alone. Waterway systems offer society many kinds of socio-economic value. Waterway authorities responsible for management and (re)development need to optimize the public benefits for the investments made. However, due to the many trade-offs in the system these agencies have multiple options for achieving this goal. Because they can invest resources in a great many different ways, they need a way to calculate the efficiency of the decisions they make. Transaction cost theory, and the analysis that goes with it, has emerged as an important means of justifying efficiency decisions in the economic arena. To improve our understanding of the value-creating and coordination problems for waterway authorities, such a framework is applied to this sector. This paper describes the findings for two cases, which reflect two common multi trade-off situations for waterway (re) development. Our first case study focuses on the Miami River, an urban revitalized waterway. The second case describes the Inner Harbor Navigation canal in New Orleans, a canal and lock in an industrialized zone, in need of an upgrade to keep pace with market developments. The transaction cost framework appears to be useful in exposing a wide variety of value-creating opportunities and the resistances that come with it. These insights can offer infrastructure managers guidance on how to seize these opportunities.

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4.1 Introduction

Infrastructure (re)development by public agencies seems headed for trouble. A great many public assets are aging and funds to replace or redevelop them are limited. Nevertheless, because highways, railways waterways and the like play a vital role in urban and regional economies, a way must be found to maintain or upgrade these assets. For waterways like canals and heavily modified rivers, one of the earliest forms of infrastructure, this is most certainly the case (ASCE, 2006; Heijer et al, 2010; Hijdra, 2013; Pointon & Grier, 2004; US Army Corps of Engineers, 2009). In maintaining, rebuilding or revising infrastructure projects, a wide variety of pathways to implementation is possible. Variations are possible in time, space and the actors involved. Because maintenance and improvement of these assets can have enormous social and environmental consequences, many trade-offs must be made. These trade-offs should reflect concerns about efficiency, that is, maximize the ratio between the services provided to the public and the resources used. This is a common definition of value.

Interestingly enough, a focus on value does not come naturally for public entities, although a movement in that direction is noticeable (Stoker, 2006). Many governmental infrastructure projects are developed in a siloed approach with a restricted view on related issues, which are valued by other stakeholders (Bateman, 2009). Auxiliary values are covered by the obliged compensatory and mitigative measures. This raises a few questions. First of all it is not clear why agencies are not actively pursuing solutions, which are considered to be more valuable for a broader group of stakeholders, perhaps including the agency itself. In other words; opportunities to be more efficient are not seized. Secondly, in the cases where additional gains beyond a singular goal were employed and captured, the question can be posed: what circumstances led to this behaviour leading to more efficient outcomes?

These questions address the problem of infrastructure development, which often leads to highly specialized structures but with a wide range of externalities, which are not traded off in a multi-stakeholder setting. Public agencies are often bound to deliver projects within the legal context, achieving a pre-agreed level of service for the minimum cost. This leads to the paradox that the agency, as a public body, is striving for delivering a specific service

in order to reduce inefficiencies for society, but at the same time this specific service obstructs the process of achieving efficiency in a broader sense. The above-mentioned situation could be characterized as a classical economic problem. The opportunities for public agencies to create value are not that different from options available to the private sector. Firms tend to pursue the best value proposition they can, minimizing the cost relative to the products sold or services delivered. Transaction costs are at the heart of this calculation (Coase, 1937; Williamson, 1979, 1981, 1998). Transaction costs are defined as costs, which result from a transaction itself and describe the sacrifices for a party in relation to the transaction activities. Or in other words, transactions cost focuses on the resistances and frictions necessary for a transaction to take place. Through this lens in- or outsource dilemma's can be analysed. Expanding the framework with transaction benefits broadens the analytical value towards cooperative strategies (Blomqvist 2002).

This paper focuses on the realization of value for infrastructure projects, seen through the lens of transaction cost and transaction benefits. However, further insight and clarification, and subsequent operationalization of such a framework for the infrastructure sector could help to analyse smart strategies to address the challenges that lie ahead. Evidently, the design of the physical product should find its proper place in this framework, as it is the physical object, and its use, that delivers value and externalities. The transaction cost and transaction benefit framework is applied on two case studies to explore the explanatory character when applied to waterway redevelopment. In the following section the methodology will be described in further detail. Section 4.3 will describe the theoretical background. In section 4.4 the application of the framework in two case studies is shown and the results are described in section 4.5. Discussion and conclusions follow in section 4.6.

4 . 2

Material and Methods

Transaction cost theory assumes the presence of markets and free choice. The domain of public policy delivery is different, requiring the approach to be tailored to this sector and to keep a keen eye on the limitations (Alexander, 1992). On the basis of theory on value creation for firms, using a transaction cost and transaction benefit framework, the relevant elements for developing infrastructure in a multi-party setting are used to set up a tailor-made

framework for this sector. This framework is then analysed from the perspective of the derived characteristics of public agencies compared to firms to identify the validity and limitations of the application of such a framework in the sector of infrastructure development. This leads to a framework similar to the framework of firm behaviour in creating value through its governance structure and product development related to that, but with the addition of the role of the design of the infrastructure in delivering value, and with the restrictions of free choice for the involved public entities.

The above-mentioned framework is tested by applying it to two empirical case studies in the sector of waterway development. Amongst the different infrastructure sectors, waterways are particularly illustrative here for three reasons: First, water is a medium, which relates to many societal values, functions and interests. The potential for value creation by making smart combinations, functionally and institutionally, is therefore relatively large compared to other infrastructure settings. Second, in many countries institutions governing water have a narrowly defined assignment, which creates a tension between this assignment and the potential societal economic value of the water. Efforts to employ the diversity of values by applying an Integrated Water Resources Management approach remain troublesome (Biswas, 2004). And third, waterways are widely regarded as a common good which indeed should be managed taking the 'greater good' into account, meaning socio-economic value creation should be a goal (Global Water Partnership, 2005; UN Water and Global Water Partnership, 2007; Ward, 2009).

Selection of the case studies was based on four criteria:

1. Maturity of the projects. Both projects selected have gone through the entire approval process and are being implemented, or are approved for implementation. This condition was set to make the distinction between ideas and plans which are very successful in creating value on paper but which somehow never made it to implementation, and the projects, which can be considered the 'proof of the pudding'.
2. The project had to be located in areas with intensive multiple land use, having significant potential for cooperation and value creation. Settings in which multiple parties have multiple interests meet this condition. This condition was set in order to be able to analyse the value creating capabilities of the organizations involved.

3. The projects had to be of a size that ensures significant attention by stakeholders. Otherwise a project could be implemented as a 'routine' operation without much thought about alternatives. Projects above a $100 million have been selected to avoid any concerns about this condition.
4. The projects had to be in the field of navigation. Such projects typically serve economic purposes, creating an opening for bringing other beneficial interests into the decision making process. The tradition of a siloed approach by waterway authorities provided situations where there is room for broad optimization.

Based on these criteria, two case studies were selected which represent two distinct situations common in Western countries where redevelopment of waterways play a role: an urban waterway and an industrial waterway respectively, represented by the Miami River and the New Orleans Inner Harbor Navigation Canal. The Miami River restoration project, about to reach completion, addressed interests like navigation, ecology, recreation, waterfront development, stormwater improvement, cultural heritage and more. Total investment exceeds $ 200 million and come from multiple sources. The waterway is an important link for the seagoing vessels serving the many islands in the region. For the New Orleans Inner Harbor Navigation Canal, a project for enlargement of the canal and its navigation lock is planned. The project has been approved and is under preparation. The total project costs are estimated at around $ 1.2 billion. The project combines two purposes of two organizations; inland navigation for the US corps of engineers and deep draft shipping for the port authority. Due to its location within the flood prone area of New Orleans, it correlates to many other issues. The first case, the Miami river, shows a highly integrated approach, both in governance and in the product. The second one, the Inner Harbor Navigation Canal in New Orleans, shows a specialized approach, with a limited institutional interaction. The case studies have been based on documents, website postings, local observations by the authors themselves, and through semi-structured interviews with several members of the project teams responsible for planning these projects. The interview questions were structured according to the framework of analysis (see appendix B). Per project, 5 to 8 officials were interviewed (appendix 1). The interview transcripts have been screened on remarks matching the theoretical framework elements. Documents, website postings and local observations have been used to cross check statements and remarks where possible. Generalized conclusions have been drawn on the basis of the results for each element of the framework.

4.3 Theory

4.3.1 A transaction costs and benefits perspective on optimization of governance structures

The roots of transaction cost theory lie in the domain of markets and free choice. Before discussing the relevance of this theory for optimization of governance structures in the domain of infrastructure development, we will consider the significance in its classic domain: the private domain. Ronald Coase asked himself the question why do firms exist (Coase, 1937)? This is a fundamental question as one could assume that if markets were the most efficient way of organization, there would be no use in founding a firm. Value could be created by the sole existence of transactions. However, firms are ubiquitous, and transactions costs are assumed to be the cause of this. Depending on multiple variables, within a firm a decision is made based on whether it is more valuable to include an activity within the firm's own boundaries, a hierarchy, or to get this delivered by the market. In this sense, firms economize on the set of internal cost, transaction cost, and cost coming from market purchases.

Williamson extended this framework by including types of organization which are neither firms nor markets (Williamson, 1979, 1981). These can be joint ventures, alliances, co-operations, third party arbitraged contracted relations etc. Again, in choosing the most beneficial form of organization, the transaction costs seem to be a determining factor. These intermediate forms in the spectrum ranging between markets and hierarchies can be beneficial for different kinds of reasons, but share the common value that these cooperative arrangements are perceived as beneficial for both parties as otherwise there would be no rationale for continuing them. In other words: increasing the value proposition from the organizational perspective can be achieved by choosing the most efficient form in the spectrum between markets and hierarchical organizations. However, a focus on minimizing transaction costs alone might be deceiving if one pursues maximizing the value proposition. As Zajac and Olsen argued:

> *'...when the pursuit of transactional value necessitates higher transaction costs, and expected joint gains outweigh transaction cost considerations (both criteria, it is argued here, are commonly met for arrangements such as joint ventures), inter organizational strategies having greater joint value will typically require the use of less efficient (from a transaction cost perspective) governance structures.' (Zajac & Olsen, 1993).*

Zajac and Olsen argued that for revealing value, one should not only focus on minimizing the transaction cost for a single firm, but rather take into account the maximization of co-operative joint gains of the transaction as well. The general argument is that transaction cost theory takes a single-firm perspective on minimizing transaction cost in deciding between the market or hierarchy. If this would lead to vertical integration of one firm incorporating the activities of a second firm, the transaction cost of the second firm would not be considered. Following similar reasoning the second firm could just as well incorporate the activities of the first firm when trying to minimize its own transaction cost. If both firms would decide to cooperate by creating a joint venture, transaction costs could be reduced as well, however, it would become quite problematic how a transaction cost minimization approach of such a case would have to be performed. Would this be the transaction cost of the first firm, the second one or a combination of both? On the latter case this would be a fundamentally different way of treating these costs compared to hierarchy or market decisions. In short, one could state that a focus on efficient operations could lead to the neglect of more valuable propositions for which a certain degree of inefficiency needs to be tolerated.

The above means the crucial transactional issue for an inter-organizational strategy is more than just the single firm's transaction cost optimization process; it has to include the benefits of the cooperation as well (Blomqvist, 2002; Zajac & Olsen, 1993). This might lead to a situation where certain arrangements are preferable due to high pay- offs to both parties in terms of benefits, while transaction costs are not necessarily at a minimum for either party. Nevertheless, in a rational valuation, each individual firm will join the cooperation only on the condition that the surplus of benefits flowing back will outweigh the extra transaction costs of the proposed cooperative strategy. The analysis of multiple organizations cooperating should therefore include the creating and claiming of value in the relationship between those partners.

4.3.2
Application of the transaction cost and transaction value model to infrastructure development

If we take a closer look at public agencies responsible for infrastructure, we find that delivery of these physical assets is one of their primary tasks. The performance of the agency is in fact closely related to, and to a large extent determined by, these assets. In its most straightforward form, the agency has a highly specialized focus, the project organization resembles a hierarchy, and costs are covered by a single funding source. However, in contemporary planning of new, or renewal of, infrastructure, many different models for development can be chosen from to fulfil the agencies' task. It may seem advantageous to find a public or private partner for a project, to outsource design activities, to in-source others, or to contract out multiple stages of the project. These choices greatly influence the outline of the physical product to be delivered. For example; a hierarchical type of organization by the agency itself will almost inevitably lead to a specialization within the limits of the agencies' assignment. A navigation authority tasked with renovating the embankments of a canal would be driven towards least-cost solutions serving the purpose of safe and efficient shipping only, for instance new sheet-piling. If the same agency were in a partnership, this could for instance lead to ecologically optimized embankments, development of recreational opportunities or waterfront developments by real estate developers.

Ultimately, Pareto efficiency can only be achieved if the broad set of stakeholder issues is included in the process. For infrastructure development, this would logically lead to a diversified cost recovery scheme, as generally no single source of funding would be willing to pay for benefits enjoyed by each and all of the individual stakeholders. In other words; a higher degree of project integration can lead to a multitude of beneficiaries willing to compensate others. Considering the significance of the physical assets themselves in many of the tradeoffs between stakeholders, it is argued here that the design of these cannot be left out of the analysis of value creation. On the contrary, the value creation in the design and development of infrastructure has received considerable attention in the engineering disciplines since value engineering was introduced in the 1960s (Miles, 1961). Other concepts followed, such as probabilistic approaches, scenario planning, adaptive management, and real

options strategies (Scholtes and Neufville, 2011). Taking into account the significance of the assets itself, a simplified model for development could be described as follows:

An organization develops a product and delivers it to the public.

This model has three distinct elements: (1) the organization, (2) the development of a product, and (3) capturing or claiming the value of this product. It is in fact a closed loop in which value is created and, directly or indirectly, flows back into the organization. It takes an organization to develop a product, and the product is the focal point of value creation and the vehicle to convey value to society. In return, society will fund the organization, either directly or indirectly. In order to economically optimize, all three elements should be taken into account. Deployment of resources should be kept to a minimum while the maximum of returns should be achieved. Considering the fact that value can come from smart design strategies and smart intra-organizational strategies, and appreciation of value comes from the ability to capture it, all three should be thought of when maximizing value. In fact, the relationships between these are determining factors. In figure 4-1, a schematization of infrastructure development is given through a singular organization with a specialized focus, and through a joint

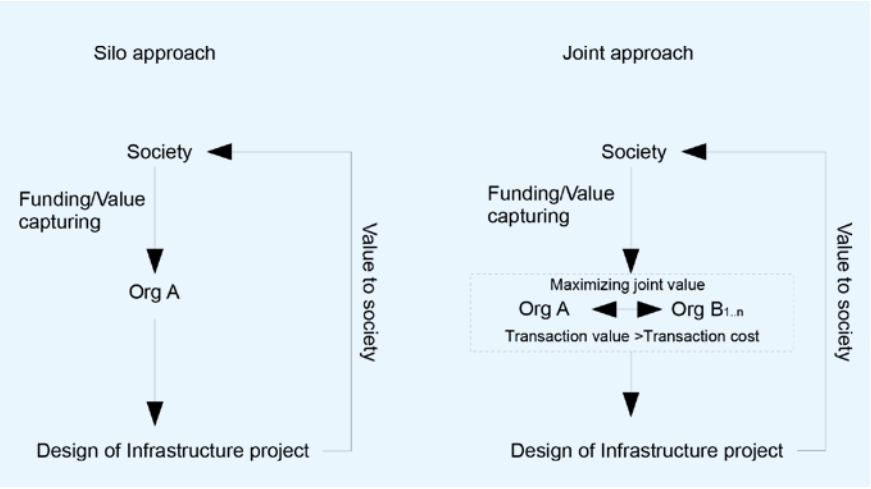

Figure 4-1: Value realization in siloed and joint approach

organizational structure. The joint form can only be realized if both, or even multiple parties, will all benefit (Axelrod & Hamilton, 1981). The attractiveness of this co-operation is determined by the transaction costs and transaction benefits. Both are influenced by, and themselves influence, the design and valued aspects of the product, the infrastructure project. The product itself and the relation between the parties determine the way value is captured for each individual organization. Below, the three steps of the model are described in more detail.

Step 1: Organization

The inter-organizational links between Org. A and B can take several forms depending on the governance structure chosen. In principle the forms could range from a straight market purchase, to full integration of both; a hierarchy (Alexander, 2001; Williamson, 1999). In the practise of development of infrastructure, projects are not bought from the shelves, neither are these projects developed without contracting or collaboration of some sort. The unique nature of the projects and the long term relationship required for development often lead to 'in between' variants of governance; hybrids. One step deeper, these hybrids can be described by the degree of inter-organizational integration. The integration can be based on sharing of capacities, data, facilities, financing or risks, or a combination of these. This integration could either be formal or informal. The organizations taking part in this cooperation can be either public or private.

Organization A may have the ability to do the project on its own, according to its assignment, and making use of legislation empowering it to do so, but a cooperative strategy may seem appealing. However, if this cooperation requests the spending of valuable internal resources, or if it means increased risk or uncertainty, the organization may shy away. So, organization A will make a trade-off between the aspects of the cooperation, which it deems favourable, and the aspects, which could be unfavourable to its position. Insight into the unfavourable aspects, i.e. transaction costs, in the field of land planning has been offered by Alexander (2001) reflecting on the three dimensional nature of transaction costs; interdependency, uncertainty and timing. Various publications of further operationalization have come forward on this basis (Buitelaar, 2004; Paavola, Adger, 2005; Widmark et al, 2013). In the field of project development related to capital projects the costs can be broken down into the following elements:

Transaction costs

- Exploring and evaluation cooperative options
- Preparing, crafting, negotiating an agreement
- Inter-agency coordination: local representation, preparing and attending meetings, communicating
- Intra-agency coordination: communicating, administrating, and addressing partnership issues internally
- Education and training related to the cooperation
- Monitoring interagency issues
- Transaction enforcement (e.g. dispute resolution, litigation, financial hostage)
- Activities to build trust

The above-mentioned elements all refer to actual costs, but there might be 'resistances' which do not translate to costs but certainly add to the balance. This might be the case when collaboration leads to the perception of higher risks, uncertainty or complexity without having any tools to counter these effects.

Inversely, the transaction benefits could be drawn from the field of negotiation theory (Lax, 1986; Raiffa, 1982). These can be considered to be very general, but no framework including transaction value has been applied to the specifics of the infrastructure sector yet in literature. Tailored definitions are therefore lacking. However, for the communication industry, where products and cooperation are equally important, Blomqvist (2002) described applicable elements which create benefits in transactions, and which can be used here.

Transaction Benefits

- Joint assets value surplus. This is the case when the joint use of (complementary) assets generate more value than when used separately.
- Joint surplus of complementary skills, routines and capabilities. Joint surplus comes from the melting of these instead of isolated deployment.
- Cooperative use of asset x increasing pay-off generated through asset y.
- Economies of scope. This is based on cost advantages which come forward through the integration of various elements or subsequent steps of a project and stimulates tighter vertical integration.

- Economies of scale. When cost advantages or learning effects can be found through scale effects this would drive horizontal integration.
- Level of trust. Mutual trust eliminates the fear for opportunistic behaviour, the source of transaction cost. Therefor trust paves the way to capture the above-mentioned benefits and reduces the costs related to cooperation.

The elements mentioned above can be used as the basis for an analytical framework for the infrastructure sector to analyze value creation in (re) development projects.

Step 2: Product design

The second step in the process model is the development of a product. Although the model defines the organization as a body which creates a product, in reality these two will interact. This interaction can affect the effectiveness of solutions, the spectrum of functionalities included, or the perceived value of the product. Product development can take place within the organization itself, or can be (partly) outsourced, altering the governance structure. Here, the fundamental difference between a public agency and a firm is that, once again, the agency can only direct its resources to the functionalities, which fall within its – often narrowly-defined assignment. Making arrangements for future alternative uses, or making use of the wide range of societal functions and related interests of waterways, will not be beneficial for the agency unless some of the value can be claimed through an agreement with another party. Outsourcing design, construction and operation, and perhaps even funding, could ease this limitation and open up new opportunities to create value. PPP projects are an example of such efforts. Such arrangements influence the physical and functional design of the project. The projected Seine-Escout canal, a PPP project of 70 km new canal from Paris to the Belgium Border, includes the development of industrial zones along the canal. Such an activity is beyond the tasks of the national waterway authority, but for the private consortium responsible for development, these zones are important elements to focus on. For waterways in general, functionalities can be very diverse; in addition to navigation one might think of flood protection, hydropower, irrigation, drainage, recreation and ecological services.
The earlier mentioned perceived value of the product is also often referred to as ‘esteem value’ (Miles, 1961). The aesthetics of infrastructure is a way to increase

this type of value. Architecture and attractive landscaping can add to this, just as well as camouflaging, or making assets invisible (tunnels, underground assets) can improve the value by reducing its downsides. Assets can also carry symbolic value. This could add to the value of the asset itself, or to other entities in which the asset is embedded. The famously elegant and high Millau bridge in France certainly carries more value than its functionality alone. The enlargement of the Panama Canal puts Panama on the map for investments in a broad sense and is often seen as a symbol of progress of the nation.

Apart from the functionality and physical or spatial aspects of the design, the dimension of time is a second determining factor. The design determines the distribution of costs and benefits in time through the stages of construction, operation and demolition. Large-scale construction works are not easy to adapt later on, and the upfront capital cost for construction often far outweighs the operational cost expressed in terms of nett present value. In the design phase, most of the other costs down the road will be determined, so this is a critical phase when it comes to creating value for a project. Accurate predictions of future developments allow for sharp optimization of the design, increasing the efficiency of the solution. High sunken costs in inflexible designs are, however, vulnerable for changes in circumstances. If uncertainty of future developments plays a significant role, incorporating flexibility into the design could enable the parties to reduce risks and capture upward potential if possible (Scholtes, 2010). But if uncertainty of future developments becomes considerable, it might even be more effective to invest as little as possible, and address the urgent needs only. In this way the risk for ineffectiveness of a chosen design is reduced (Pahl-Wostl, 2006). Specifically for infrastructure development these considerations play a significant role. The technical lifetime of assets often exceeds 50 years, and choice of locations or alignments create a web of linked interests, which can make it almost impossible to ever change this. Examples are alignments of railroads and highways or the location of weirs and dams. Selecting one option automatically implies that many future options are excluded.

Step 3: Claiming and capturing value

The creation of value, either by smart governance structures or by design methodologies or choices, is only of use for a contributing organization if this value can be claimed or captured. In some ways this might be very indirect, as an agency might receive funding to develop a certain piece of infrastructure, which was mandated through a political process. Such a project might even be

considered as non-beneficial in itself, as is often the case with public projects. However, improving the value of such a project should deliver benefits to its initiator, as otherwise there would be no incentive to do so.

From the organizational point of view, ultimately, three basic categories can be defined in which value can be captured to the benefit of this same organisation. This is either through reduced spending, increased returns, or an improved strategic position. A further division can be made on the basis of the elements in step 1 and 2, providing the following breakdown;

(a) reduced cost/risk
(b) cost/risk sharing
(c) increased return flows
(d) additional return flows
(e) strategic benefits (reputation, skills, knowledge, access to new opportunities)

Claiming or capturing can come 'naturally' by the effects of the infrastructure itself, or results from the arrangement between the participating organizations. In the silo approach the value could e.g. be captured by general taxes, special taxes (ship fuel tax), tolls, shadow tolls, leases etc. In a joint approach, the value might come from society, or equally likely from the partnering organization. If, e.g, renewal of canal embankments can be combined with a waterfront development project envisaged by one of the towns along the canal, the opportunity of cost sharing may arise. And if another town were interested in having the embankments renewed for a side canal under their own authority, it may be interested in joining the project and hence generate economies of scale. But in the end, the agency intending to renew the canal embankments will have to be convinced that the benefits of such a transaction outweigh the increased complexity of the contract, the extra internal resources required, additional risks etc. To illustrate the potential complexity in this example; issues which are commonly linked to navigable waterways, which can therefore be used in the context of value creation, are flood protection, hydropower, ecosystem services, water storage, drainage, recreation, aesthetic/landscape values, cooling water, irrigation, sand and gravel mining, defence purposes, social cohesion, cultural heritage and others. Capturing value related to recreation or aesthetic values will be much easier for a municipality than for a navigation authority.

4.3.3 Differences and limitations of a transaction cost and transaction benefits optimization when public agencies are part of the structure

In many aspects, governments and their institutions can be considered different from private sector organizations and institutions. If we consider public agencies responsible for developing infrastructure in Western countries, most of these fit the contemporary paradigm of New Public Management. Typically, these organizations can be characterized as agencies focussing on the efficient delivery of services and products to the public. Kelly and Muers (Kelly & Muers, 2002) described the characteristics of these agencies as shown in table 4-1.

Although some characteristics are typical of governments, many organizational features have become similar to market structures. These agencies strive to maximize their output deploying a minimum amount of resources. This is very similar to the way companies behave. Essentially, both types of organizations strive for maximizing their value proposition.

The scope of an organization is determined differently for public organizations than for private ones. A private organization has fewer restrictions in changing

Table 4-1: Characteristics of New Public Management (Kelly & Muers, 2002)

Key objectives	Managing inputs and outputs in a way that ensures economy and responsiveness to consumers
Role of managers	To help define and meet agreed performance targets
Definition of public interest	Aggregation of individual preferences, captured in practice by senior politicians or managers supported by evidence about consumer choice
Approach to public service ethos	Sceptical of public sector ethos (leads to inefficiency and empire building); favours customer service.
Preferred system of delivery	Private sector or tightly defined arms-length public agency
Contribution to the democratic process	Delivers objectives: Limited to setting objectives and checking performance, leaving managers to determine the means.

Table 4-2: Operationalization characteristics of value creation for infrastructure.

	Organization A *Market type*	*Organization B,* *Governmental agency type*
Institutional setting		
Description of interests	The formal interest of A for which the partnership is supposed to be beneficial. Interests can be e.g.: profit, continuity, visibility, strategic.	The formal interest of B for which the partnership is supposed to be beneficial. Interests can be e.g.: fulfilling assignment, continuity, strategic, political or power gain.
Description of form of governance.	The inter-organizational structure with regard to the project undertaken. This could be formal or informal.	
Interlinkages addressed	The interlinkages between the partners reflecting the degree of inter-organizational integration. The integration can be based on sharing of capacities, data, facilities, financing and risks or a combination of these. A myriad of combinations is found in practice and literature.	
Step 1: The organization		
Transaction Costs relate to: (a) *Exploring cooperative options* (b) *Preparing agreement* (c) *Inter-agency coordination* (d) *Intra-agency coordination* (e) *Education and Training* (f) *Monitoring interagency delivery/efforts* (g) *Transaction enforcement* (h) *Activities to build trust*	The investments A has to make, or drawbacks it has to accept specifically correlated to the transactions with others. Examples of costs; human resources to prepare bid-documents, local office/ representation, hiring legal support, bank guaranties.	The investments B has to make, or drawbacks it has to accept specifically correlated to the transaction with others. Examples of costs: manhours to manage complex contracting, administrative activities for payments, verification of progress and quality in the works.
Transaction Benefits relate to: *(a) joint assets value surplus,* *(b) complementary skills, routines, capabilities,* *(c) payoff x increased by y,* *(d) economies of scope,* *(e) economies of scale,* *(f) level of trust*	The benefits A expects to get in return by teaming up with others. Examples are: delivering expertise (b), sharing mobilization cost of equipment with nearby projects (e), build track record for major clients (f), improved revenues on real estate development.	The benefits B expects to get in return by teaming up with others. Examples are; linking networks (a), high expertise and efficiency in works by experienced or specialized partner (b), increased tax revenues (c), combine projects with earth shortage and earth excess (d).
Step 2: The design of infrastructure		
Value creation through design relates to; (a) *functional effectiveness of the design* (b) *spectrum of functions included* (c) *esteem value: design aesthetics* (d) *esteem value: symbolic value* (e) *value in time: life cycle cost optimization* (f) *value in time: build-in flexibility (preparing for uncertainties)* (g) *value in time: adaptive, step by step, approach*	The way value is employed or increased through its physical, functional and esteem value aspects and the choices made to optimize value during the lifetime of the works. Examples are an integrated design, asset management, embedding possibilities for adaptation, monitoring efforts to adjust plans.	

Value to society	General value which is created by the joint effort	
Value capturing relates to; (a) *reduced cost/risk* (b) *cost/risk sharing* (c) *increased return flows* (d) *additional return flows* (e) *strategic benefits (reputation, skills, access to new opportunities)*	Elements of the created value which are directly beneficial for A, tangible or intangible. Capturing can take place through new cost reduction opportunities through partner choice, shifting cost to the partner, increased or new income streams, or a better (market) position of the organization in general	Elements of the created value which are directly beneficial for B, tangible or intangible. Capturing can take place through new cost reduction opportunities through partner choice, shifting cost to the partner, increased tax/toll revenue, new income streams, or a better (political/power) position of the organization in general.
Verification of beneficial character of cooperation: TB > TC ?		
BATNA (no cooperation between any of the parties)	The Best Alternative To a Negotiated Agreement is the verification of value creation in the partnership. The transaction benefits should outweigh the transaction costs in order to create value on top of the general profits in case the project (or a part of it) was done without others.	The Best Alternative To a Negotiated Agreement is the verification of value creation in the partnership. The transaction benefits should outweigh the transaction costs in order to create value on top of the general profits in case the project (or a part of it) was done without others.

its scope than public organizations do. Within a firm, management can decide to change, expand or narrow its scope to increase the creation of value. Public organizations, however, have an obligation to provide certain services, and are limited in changing, expanding or narrowing its scope. This does not mean public organizations do not have any flexibility at all to seize opportunities related to their own objectives. For many objectives cooperation with other organizations is to be sought. These partners can be either public or private parties. The joint scope of these organizations can be used to capture value, which is otherwise not within reach. The metrics for optimizing could be different for a public agency compared to a firm, as would its set of parameters expressing success. But fundamentally, there appears to be no reason why a public agency should not be economizing using its possibilities while still respecting its limitations.

In the context of this study the question is how this would play out for a public agency in infrastructure development. If the perspective of such an agency would be the creation of maximum value for the public in general, a less efficient governance structure could be regarded as acceptable, from a transaction cost perspective. But if the agency would focus solely on limiting its internal costs, for instance due to political pressure, value maximization through partnerships would be less attractive.

The theoretical considerations above need further operationalization in order to be able to gather information and analyse case studies. The steps of a waterway authority seeking a value-creating strategy for (re)developing a waterway may be seen as described in section 4.3.2. The organization can seek an arrangement with other stakeholders, develop the product and try to capture the value of it. The steps taken in this process should give each partner a perspective of increased gains compared to their Best Alternative To Negotiated Agreement (BATNA). Table 4-2 shows the operationalization of such a framework.

In the following section the framework as described is used for the analysis of two case studies; the Miami River and the New Orleans Inner Harbor Navigation Canal. These cases happen to be dominated by public entities, the 'market type' organizations as described in the framework are therefore not reflected in these cases.

4.4 Case Studies

4.4.1 Case study Miami River

The Miami River runs through the highly urbanized area of Miami, Florida. The stretch of the river of interest to this case study is its first 5.5 miles, which are navigable for seagoing ships. This stretch can be described as a canalized river, straightened and with artificial embankments (figure 4-2). The river's discharge is very low, to zero. The inflow of water comes from the Everglades, and eventually the river flows into Biscayne Bay. This bay is located between the Miami Beach peninsula and mainland Miami and has an open connection to the Atlantic Ocean. The bay is also part of the Intracoastal Waterway route. The Miami River has several port facilities along its embankments. The main port business is dedicated to trade with Caribbean islands and super yacht maintenance. In the 80s and 90s of the 20th century, the river was neglected. It was polluted, navigation depth was reduced by sedimentation, it gathered derelict vessels and the neighbourhoods along the river were deprived. During the 1990s the river's condition became part of the public debate, primarily due to pollution and the loss of functionality for commercial shipping. Around 32

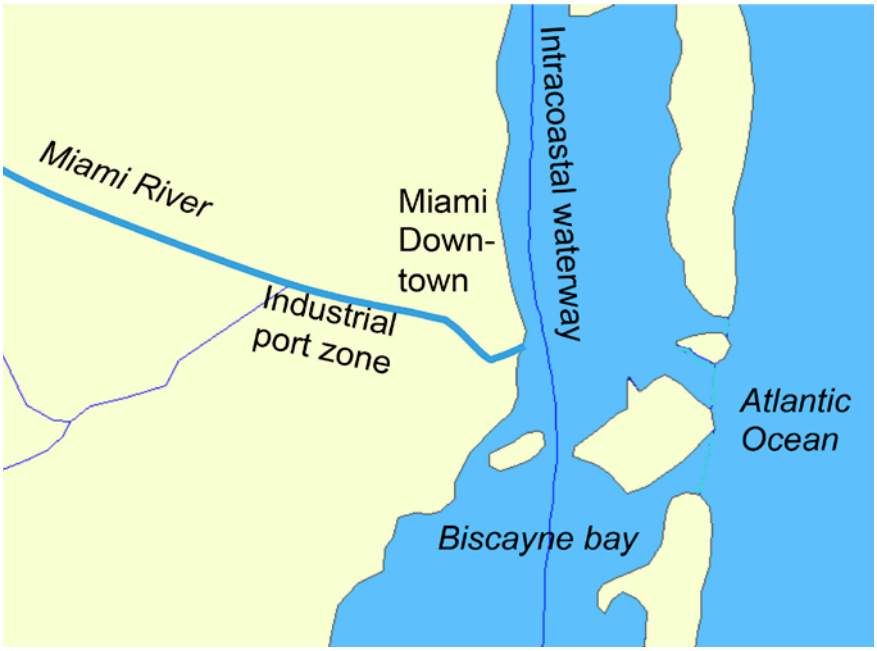

Figure 4-2: Miami River

agencies had some kind of authority over one or more aspects of the river, which made the situation institutionally highly complicated. The most pressing and costly question was the one of dredging the river. The City of Miami was, in fact, the authority for the Miami river port and had a direct interest. However, the river was just one of many urban issues the city had to deal with. The Florida Inland Water District, closely cooperating with the US Corps of Engineers was responsible for maintaining the intracoastal waterway in the Biscayne Bay, and these organizations were confronted with fast inclining dredging costs as sediments in the Bay became contaminated by the Miami River outflow. Eliminating the source of pollution was considered far more efficient than continually coping with the dispersed contamination throughout the bay. The public increased the pressure to act on the situation as Biscayne Bay, unlike the Miami River, is considered one of the region's most valuable assets. The State of Florida added extra pressure, being of the opinion that a river should add to the attractiveness of a city and a region, as is the case in many cities around the world. Yet the complexity was not easily resolved.

Proposals for a port authority were introduced in 1996 and 1997 in the Florida legislative sessions. However, these proposals met substantial resistance from local interest groups, businesses, residents and the City of Miami Commission. The controversy concerned the lack of local representation. To address these issues the State Legislature took initiative by creating the Miami River Coordination Commission (MRCC) through Specific Appropriation 1196. This committee facilitated the debate by conducting a study based on input from all affected parties. The MRCC concluded that river related issues would not be advanced by an authority, however, it did recommend that a study should be conducted to the appropriate type of entity required to address the wide array of issues related to the river. A 14-member study commission (MRSC) was appointed in 1997, its members represented public and private sector interest groups. In 1998 the MRSC presented its conclusions and recommendations; the problems can be solved, the payoffs can be enormous, but absolute commitment and cooperation is required. Furthermore they proposed to establish a permanent Miami River Commission (MRC). In 1998 the State creates the MRC, which became the official coordinating platform responsible for the redevelopment of the Miami River. The MRC is the official coordinating clearinghouse for all public policy and projects related to the Miami River and it acts as the principal advocate and watchdog to ensure that river projects are funded and implemented in a proper and timely manner. The commission may seek and receive funding to further its coordinating functions regarding river improvement projects of the commission. Regulatory authority and responsibility remained as it exists with city, county, state and federal government. The MRC will use powers of persuasion to achieve its objectives through the process of building a consensus work plan. After 12 years of acting on this basis, the MRC is widely acknowledged for its accomplishments. The river has been dredged, pollution is tremendously reduced, a river walk along the water has been partly established, and the river has become a recreational destination and a place attracting commercial and residential investments.

Table 4-3 shows the results of applying the previously described value model to the three most influential cooperation partners. The partnership included several other parties, which played a less significant role.

Table 4-3: value creation in the Miami River Project

	Downtown Development Authority (agency of City of Miami)	*Florida Inland Navigation District*	*City of Miami*
Institutional setting			
Description of interests	Improve local economy, create jobs, increase tax base, improve 'liveability', traffic circulation all related to highly urbanized area at the river mouth.	Act as a "local sponsor" of the Atlantic Intracoastal Waterway project.	Improve local economy, create jobs, increase tax base, improve 'liveability', traffic circulation with a focus on the mixed urban industrial and industrial zone.
Description of form of governance	The MRC is the linkage between all river related interest groups. It has to unite all governmental agencies, businesses, and residents in the area to speak with one voice on river issues. The commission may seek and receive funding to support its coordinating functions regarding river improvement projects of the commission. Regulatory authority and responsibility will remain as it exists with city, county, state and federal government. The Miami River Commission will use powers of persuasion to achieve its objectives through the process of building a consensus work plan. The MRC does have a three-tiered structure: (1) a policy committee consisting of elected officials, stakeholders and citizens as listed below, (2) a Managing Director who has the responsibility to implement plans and programs, and (3) a working group consisting of all governmental agencies that have jurisdiction in the river area, as well as representatives from business and civic associations.		
Interlinkages addressed	The interlinkages are concentrated around sharing financing, data, risks and capacities.		
Step 1: The organization			
Transaction Cost relate to: (a) *Exploring cooperative options* (b) *Preparing agreement* (c) *Inter-agency coordination* (d) *Intra-agency coordination* (e) *Monitoring interagency delivery/efforts* (f) *Transaction enforcement* (g) *Activities to build trust*	Bring DDA objectives into the agreement (b) Attending meetings of the MRC (c). Dispute resolution with partners about access to waterfront and bridge-opening disrupting downtown traffic (f). Joint boat trips on the river (g).	Evaluating whether it is more profitable to join the river collaborative than to focus on its primary task: the intracoastal canal (a), attending meetings of the MRC (c), Monitoring effects for the intracoastal canal (e). Joint boat trips on the river (g).	Evaluating why a focus on the river in a collaboration is a better option than other city development possibilities (a). The efforts of the Miami River Study group (a). Dispute resolution and litigation with partners about magnitude of marine activities in the total balance of the project (f). Joint boat trips on the river (g).
Transaction Benefits Relate to: *(a) joint assets value surplus,* *(b) complementary skills, routines, capabilities,* *(c) payoff x increased by y,* *(d) economies of scope* *(e) economies of scale,* *(f) level of trust*	Progress on several goals where no resources were available for (=e). Dredging and water-quality issues are specialties of other participants (=b) Cooperating with other representatives on long term on a regular basis improved mutual trust (=f)	Improving the navigability of the river improves the quality of the navigation system as a whole (a) Co-operating on dredging the river would be far more effective in reducing contamination of sediments in Intracoastal waterways than dredging this waterway itself (c) Cooperating with other representatives on long term on a regular basis improved mutual trust (=f)	Progress on several goals where no resources were available for (=e). Dredging and water-quality issues are specialties of other participants (=b) Cooperating with other representatives on long term on a regular basis improved mutual trust (=f)

Step 2: The design of infrastructure			
Value creation through design (a) *functional effectiveness of the design* (b) *spectrum of functions included* (c) *esteem value: design aesthetics* (d) *esteem value: symbolic value* (e) *value in time: life cycle cost optimization.* (f) *value in time: build-in flexibility (preparing for uncertainties)* (g) *value in time: adaptive, step by step, approach*	Broad participatory design approach. Urban Infill plan as main design product. Relevant elements, emergence of a river walk (c), revealing and showing historic areas and elements along the river. Pinpointing origin of the city of Miami alng the riverbanks (d), recreational opportunities (b), small business development like restaurant along the river (b), public space design (c), stormwater management (a). Urban orientation towards the river (c). Some plots along the river were deliberately left open for future development (g). To remove contamination dredging from upstream to downstream was required, for navigation dredging from downstream to upstream is most profitable. The first prevailed delivering lowest overall cost, but delaying increased (navigation) revenues. An unanticipated delay of several years occurred as funds were redirected for emergency relief in the Katrina hit region. This delayed navigation revenues even further.		
Step 3: Value capturing			
Value to society	Aesthetics, jobs, health, improved recreational opportunities, safety, preserved cultural identity, ecological improvements, preserving trade hub function of the river port to islands.		
Value capturing relates to; (a) *reduced cost/risk* (b) *cost/risk sharing* (c) *increased return flows* (d) *additional return flows* (e) *strategic benefits (reputation, skills, access to new opportunities)*	Tangible: Increase in tax base (c), Intangible: Appreciation by the public, consolidating position as an authority (e)	Tangible: Cost reduction of dredging program intra-coastal canal by eliminating contamination source (a), (b).	Tangible: improve local economy, create jobs, improve attractiveness of the city for residents and businesses resulting in enlarging the tax base (c), (e).
Verification of beneficial character of cooperation			
BATNA (no cooperation between any of the parties)	*Initiate some minor improvements related to accessibility of the river and some aesthetic improvements.*	*Maintain status quo. Face the extra costs of continued inflow of polluted sediments in the ICW. Accept reduced use of the ICW due to shallow Miami river. Focus on other navigation projects.*	*Gradually lose port activities. Project elements outside the water can be performed on own authority, but with reduced payoff.*

4.4.2
Case Study of the Inner Harbor Navigation Canal in New Orleans

The Inner Harbor Navigation Canal (IHNC) is the official name of the 9 km canal connecting the Mississippi river to Lake Ponchartrain (see figure 4-3). The canal is often referred to as the Industrial Canal, and indeed serves the industry along its embankments. The Intracoastal Waterway bisects the canal and connects it to Lake Borgne. At the canal's south entrance, the Industrial Canal Lock provides a connection with the Mississippi River. The lock dates back to the 1920s and has become a bottleneck in the system both in terms of capacity and size. The pushing convoys sailing the Mississippi need to break down their convoys to get through. A larger lock could also serve a larger part of the world's ocean- going fleet in terms of size. This is particularly interesting, as the industry along the canal has direct access to a class I railway, a unique feature in the area. A class I railway connection allows competition between railway firms on those tracks which is a highly favourable situation for the industry along the canal. Most other ports in the region, which are connected to the railway system, either lack a deep draft facility, or lack competition on the railways for hinterland transport.

The deal between the Corps and the Port is based on the concept that the Corps needs to improve the shallow draft shipping route, and the Port needs the deep draft ships to get access to the port zone. The agreement states that the Corps pays 50% of the costs for a shallow draft navigation lock, the other 50% will be supplied by the Inland Navigation Trust Fund, which is funded by a tax on barge fuel. The additional cost for upgrading the facility for deep draft vessels has to be paid for by the Port of New Orleans. So, the facility in fact combines two types of transport: inland navigation and deep see shipping, funded by multiple sources. Table 4-4 shows the results of applying the value creation framework for the New Orleans Inner Harbor Navigation project.

Table 4-4: value creation in the Inner Harbor Navigation Canal project.

	US Corps or Engineers	*Port of New Orleans*
Institutional setting		
Description of formal interests	Providing quality navigation routes for shallow draft shipping traffic	Having a reliable, large scale, non-congested access to the deep draft industrial zone creating greater more revenues and more opportunity for local economic development.
Description of form of governance	The project was authorized by an act in 1956[1], cost sharing with the Port of New Orleans was arranged in the WRDA of 1986[2]. In 1991, the US House of Representatives, committee on Appropriations enacted the Energy and Water Appropriations Bill which directed the US Army Corps of Engineers, in conjunction with the local sponsor to develop a community impact mitigation plan to ensure that the communities adjacent to the project remain complete, liveable neighbourhoods during and after construction. The agreement was therefor based on cost sharing of the civil works, and a joint responsibility of the impact mitigation.	
Interlinkages addressed	The interlinkages concern sharing of financing and capacities.	
Step 1: The organization		
Transaction Cost *Relate to:* (a) *Exploring cooperative options* (b) *Preparing agreement* (c) *Inter-agency coordination* (d) *Intra-agency coordination* (e) *Monitoring interagency delivery/efforts* (f) *Dispute resolution, litigation* (g) *Activities to build trust*	The partnership was natural; no other options were to be evaluated. Large cost and many linkages to the area were involved which required careful crafting of the agreement (b).	The partnership was natural; no other options were to be evaluated. Large cost and many linkages to the area were involved which required careful crafting of the agreement (b).
Transaction Benefits *Relate to:* *(a) joint assets value surplus,* *(b) complementary skills, routines, capabilities,* *(c) payoff x increased by y,* *(d) economies of scope* *(e) economies of scale,* *(f) level of trust*	Support and funding by the Port is mandatory for the Corps to proceed (b).	The linkage of deep draft facilities to a class I railway system is enforced (a), the corps knows about locks (b), the port does only have to pay for the additional cost for a deep draft lock (d) there is a long standing and mutual beneficial cooperation through many projects (f).

Step 2: The design of infrastructure		
Value creation through design (a) *functional effectiveness of the design* (b) *spectrum of functions included* (c) *esteem value: design aesthetics* (d) *esteem value: symbolic value* (e) *value in time: life cycle cost optimization.* (f) *value in time: build-in flexibility (preparing for uncertainties)* (g) *value in time: adaptive, step by step, approach*	The design options are mainly focusing on finding methods of construction, which have the least adverse impacts on the local communities (a). Off site construction is considered to avoid hindrance to shipping and neighbourhood. In addition a very rich compensatory program is set up to help local neighbourhoods still struggling with the aftermath of hurricane Katrina (b). A low-cost solution is an important goal (a). The symbolic (marketing) and functional value of having the deepest draft facilities of the Gulf coast with direct access to a class I railway system is an important value for the Port (a) and (d).	
Step 3: Value capturing		
Value to society	Cost savings shallow draft shipping, cost savings deep draft shipping, increased reliability. Local job creation, economic growth.	
Value capturing; (a) *reduced cost/risk* (b) *cost/risk sharing* (c) *increased return flows* (d) *additional return flows* (e) *strategic benefits (reputation, skills, access to new opportunities)*	Funding for the Corps comes from federal funds. No additional capturing in terms of cost or revenues takes place. However, involvement in such a big project on the core competence of the corps is important for its reputation (e)	Increased revenues from leases (c). The city is represented in the board of commissioners of the port and has a stake at increased tax base during construction for the city (c), an increased tax base for the city due to job creation (c). The costs for the project are being shared with the corps due to the duo function as a shallow and deep draft lock (b).
Verification of beneficial character of cooperation		
BATNA (no cooperation between any of the parties)	Status quo without new lock. Weak link continues to hinder performance of regional waterway network.	Status quo without new lock. Optimization of commercial interests will take place based on current lock dimensions.

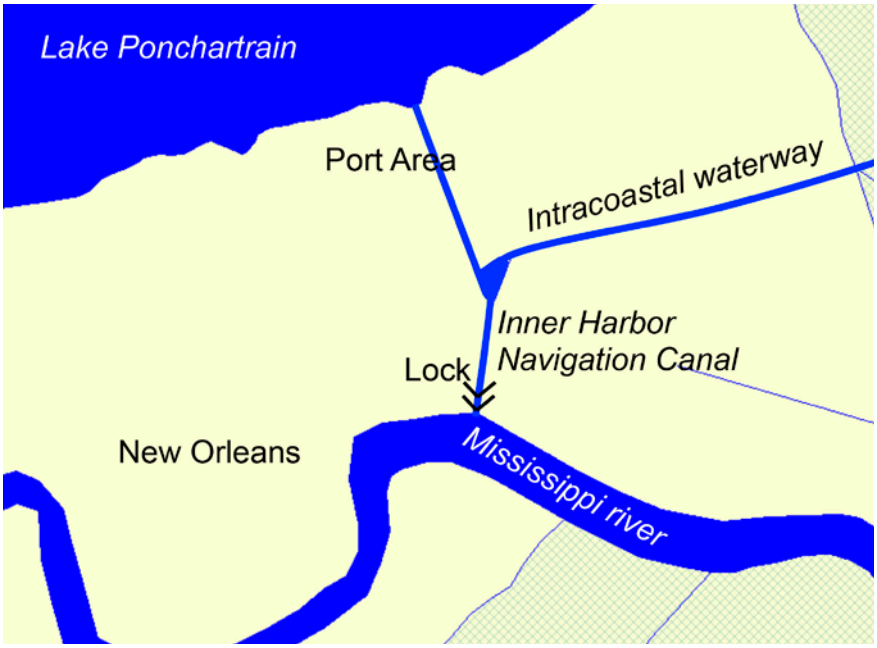

Figure 4-3: Inner Harbor Navigation Canal in New Orleans

4.5 Results

The two case studies described reflect two common situations for waterway (re)development: a problematic waterway in an urbanized setting and a waterway in an industrialized setting where economies of scale dictate performance. The results of the cases will be described according to the elements of the framework.

The formal interests of the individual parties are clear and easy to capture in the framework. A distinction is found between special interest organizations (US Corps of Engineers, Florida Inland Navigation District, Port of New Orleans) and the organizations focused on broad interests in a constrained area (Downtown Development Agency, City of Miami). For the latter type, the choices for optimization are much more flexible.

The form of governance in the Miami river case can be described as a public-public partnership. Coordination, funding and monitoring is a joint effort under the MRC umbrella, authorization, contracting and construction remained at the individual partners. From the MRC perspective the chosen form was described by one of the interviewees: *'I think people would say it would have been better we had regulatory authority, but then we would not have been there as there would have been too much resistance against that. That was not the reality. It is better they created the MRC without authority than not having the MRC at all. They would have to do it by intergovernmental coordination and you would assume they would communicate a lot, but they don't, they are busy with their own things, in their own offices.'*

In the New Orleans case the partnership was initially based on cost-sharing for the civil works needed to improve navigation, but in a later stage this was expanded by joint responsibility of the mitigation measures. However, contracting, construction and monitoring remained at the Corps of engineers. This type of cooperation can be described as an intergovernmental agreement.

A commonly encountered obstacle for getting to a transaction was the assignment and commitment of man-hours related to a form of collaboration. This played a role for all entities. Especially in the smaller organizations with limited staff, like the DDA and FIND, the deployment of man-hours was carefully considered. A striking difference between the two cases, in terms of transaction cost, is found in the efforts to come to a form of cooperation. In the Miami case the accent was on exploring the options for a collaborative approach, while in the New Orleans case the partners could find each other almost blindfolded. However, due to the complex situation in the neighbourhoods around the New Orleans lock project, the crafting and negotiating of the agreement asked considerable attention there. A second interesting difference is the fact that the Miami agreement brought parties together for a single unique event, whilst in New Orleans cooperation was a modus operandi for successive projects undertaken jointly by both parties. The evidence revealed a high level of trust amongst the parties in New Orleans, in Miami this had to be built. It seemed that the Miami River Commission played an important role in bringing the parties together and building trust. The commission played a significant role in dispute resolution as well. All together both cases revealed to include a mechanism to keep transaction costs at low levels, for Miami the commission played this role, for New Orleans it was the trust build in the recurrence of joint projects in the region.

The transaction benefits are much less homogeneous. All elements of the framework are present in the studied cases. In the Miami case, parties seem to have found and valued each other through a variety of ways, and for a variety of reasons. Or in other words as stated by one of the interviewees: *'Both sides* [environmental and navigation] *have been able to view the benefits of the other side and be proud that one project can produce multiple benefits.'*

In the New Orleans case, the situation is more straightforward. The institutional set-up, funding resources and the local situation tie both parties together like a forced marriage. However, benefits of this collaboration are felt and valued by both parties. The long-term cooperation on a variety of projects has established a basis of trust between the two parties making it easier to use each other's qualities.

The infrastructure design had many aspects in the Miami Case; the New Orleans case was much more straightforward. In Miami, there was an overall design master plan, which was broken up into many elements. Some elements were designed by individual project developers and architects, others came from engineering firms focusing on the waterway itself, and in some cases areas were left undeveloped to allow for future developments. The overall design could therefore be described as a mixed process, involving various stakeholders and taking into account some degree of adaptation. This method allowed many stakeholders to influence the value capturing opportunities of the design to some degree. The brochures and communications to the public showed that the river project represented a symbolic value as well. It is represented as the origin of the city and bringing back liveliness to the area and strengthening the community. Contextual, the New Orleans project can be considered very similar. Both are large waterway projects, bringing the infrastructure up to date, in a deprived urban/industrial environment. Nevertheless, the New Orleans case showed an entirely different way of translating value into the design. Two factors played a major role in the New Orleans approach. One was the enormous up-front cost and the desire to find a design minimizing these costs, the other was gaining support from local neighbourhoods and their representative institutions. Therefore, the design had to be optimized in such a way that the burden for the surrounding neighbourhoods was minimal, significant parts of the work could be carried out by local companies, and a broad set of compensatory elements was included. Adaptation or flexibility did not seem to play a role, minimizing construction cost was key.

In the Miami case, value was expected to be captured in a variety of ways, spread over a long period. This value was mostly expected to be captured indirectly. Value capturing was very obvious in the New Orleans case. Integrating two projects, a deep draft shipping solution and a shallow draft shipping solution, allowed for construction cost sharing. This made value capturing direct and tangible. For the Port of New Orleans, the project increased the value of their leases and generated second order effects for the community. These effects were important due to the city's stake in the port.

The verification of the beneficial character of the cooperation should logically indicate that cooperation in the two cases was indeed beneficial, as otherwise the cooperation would not have been logical. In the Miami River project, the cooperation seems to have created a valuable relationship for all three organizations. The design allowed them to capture values for their individual interests. The question arising from this case is the nature of the role of the Miami River Commission. It could be regarded as an additional party, but through the lens of this framework the commission presents itself as a broker searching for value in the relations. Perhaps even more importantly, the commission takes the lead in organizing monthly meetings during which the most pressing issues are discussed amongst the participating partners. The evidence indicates this is considered a low-threshold way for participants to stay involved and make sure their individual interests are served. So, the commission in fact appears to be a force in reducing transaction costs, making it attractive for partners to participate and make trade-offs happen.

For the New Orleans Inner Harbor Navigation Canal project, the development appears to be based on one functionality only: navigation. But when regarding the case in more detail, a significant distinction between shallow draft and deep draft navigation can be made. Although funded by different systems, cooperation appears to have a very high pay-off for the Port Authority. The benefits of such a transaction for the Corps of Engineers are less obvious, however, ignoring the interests of the port and focussing on shallow draft only would certainly lead to high-level repercussions and damage to the Corps' reputation. No decision maker would be interested in taking that position and taking the burden. The design incorporates interests of both parties in a fully integrated and seamless way.

The similarities between these two cases lie in the fact that cooperation pays off, and trying to move forward on an individual basis is hard to imagine. In other words, the BATNAs have very low value. Transaction costs could cause thresholds for seeking cooperation or hold back the process. In Miami, the broker function of the MRC lowered these thresholds; in the New Orleans case cooperation between the port and the Corps has traditionally been beneficial due to the value capturing capabilities of both parties. The federal government raises funds from the shipping community through the Inland Navigation Trust Fund. These funds flow directly to the US Corps of Engineers for their navigation projects. Therefore it is highly beneficial for the port to cooperate with the Corps. Vice versa, the Corps needs to receive local co-funding to get approval for their projects. The long-standing relationship between both parties also lowered the thresholds for cooperation.

4.6 Conclusions and discussion

Waterways relate to many societal and economic functions and interests. Therefore, waterway projects offer opportunities for the creation of value by finding synergetic combinations of functions and cooperative strategies. Waterway authorities, however, often have a narrowly defined assignment, which may lead to a focus on specialization. This seems particularly true in the planning of major waterway projects. Revealing, employing and creating value in these projects could solve stakeholder conflicts and ease funding problems. Such a focus on value in cooperative strategies and developing projects is a common strategy in market-like environments and is often analysed using a transaction cost and transaction benefits framework.

Transferring a transaction cost and transaction benefit framework to the sector of waterway development mean applying a well-known framework to a sector distinctively different from the private sector. The participating organizations are public, or are a mixture of public and private parties, the product has significant spatial implications, affects many stakeholders, and value capturing may be indirect and non-monetary. Nevertheless, the application of a transaction cost and transaction benefit framework appears to be a tool, which can improve insight in the complex system of value creation in waterway projects.

The framework has been applied to two case studies, which represent two distinct but common situations in waterway (re)development in Western countries; a neglected waterway in an urban setting, and a waterway in an industrial setting where economies of scale call for investments. The case studies conducted were the Miami River project, and the New Orleans Inner Harbor Navigation Canal project. The case studies showed that value can be created but transaction costs related to cooperation have to be overcome. This obstacle was overcome by the fact that BATNAs represented less value, transaction benefits were substantial, and transaction costs were kept low. The Miami River case study showed the usefulness of an agent, the Miami River Commission, whose assignment implicitly focuses on decreasing transaction cost in a complex cooperative development. In the New Orleans case the cooperation was focussed on a more narrow set of goals. The benefits of cooperation were high in terms of cost-sharing and economies of scope, transaction costs for cooperation were low due to a high level of trust, and he BATNAs represented a non-appealing outcome for both parties. The arrangements of both cases therefor represented high benefits, low transaction costs, and negative BATNA's. Or in other words: both represent fertile grounds for joint value creation.

The application of a transaction cost and transaction benefit framework in the public sector has some limitations. The framework relies on voluntary partnerships based on the beneficial elements for each. This is not always the case in the public sector as certain partnerships can be mandated for other reasons. However, if this is the case, it can be argued the involved parties will still strive for getting the most benefits against the least costs for themselves. So although the partnerships are not a result of free choice, the mechanisms can be expected to work similarly.

Keeping in mind its limitations, the framework sheds light on infrastructural projects from a perspective that differs from engineering perspectives or macro-economic perspectives. It could therefore aid learning about ways to strengthen such projects, making them more efficient and enabling these investments to cope with changing circumstances. And although this is only a first step in the application of this framework to the infrastructure sector, it seems to be fit well for the analysis of cooperative strategies to create value in infrastructure projects in general, and waterway projects in particular. For practitioners it could help in supporting decision making for these projects or selecting partners

for project planning and development. Through more detailed empirical evidence (Hijdra, forthcoming), further validation and elaboration of the transaction cost and transaction benefit framework can be achieved.

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CHAPTER

5

Dutch and American waterway development: identification and classification of tools for value creation

ABSTRACT

Waterways can serve society in a variety of ways. However, authorities responsible for maintenance and development of waterways often have a sectoral focus. They strive for cost efficient solutions within their restricted scope; broader development of socio-economic value receives little attention. This can be seen in e.g. the Netherlands and the USA. Both countries have strong national authorities responsible for the navigation function of waterways. The societal call for broader optimization is recognized, but a systemized response to this call is lacking. Nevertheless both authorities make attempts towards increasing the socio-economic value of their capital waterway projects by deploying tools for broader optimization. Six recent cases, in which such attempts were made, are studied with the aim of identifying and classifying the tools deployed. Identification and classification is needed to evaluate where gaps and opportunities lie for more systemized responses. From these cases a total of 15 tools are identified which stimulated broad optimization. These tools are classified by identifying the transaction characteristics associated with these tools. These characteristics can relate to cost, benefits or value capturing and can be of informative, coordinative or legislative nature. The results show overlaps and voids in the domains these tools address. For practitioners the results can be helpful to navigate through the planning and implementation phase of waterway projects. More broadly the study shows that in the waterway sector, a sector in need for adaptation and renewal, the application of a variety of mixes of governance is an emerging issue.

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5.1 Introduction

Waterways have been used as systems for transportation for many ages. Although other modalities emerged, in some countries the waterway system still plays a vital role for transportation. Besides the transportation function of waterways, many other aspects are valued by society. One can think of recreation, nature, water supply, aesthetics, hydropower and so on. Whether all of these values actually come to development can be highly dependent on the authority responsible for these waters. If such an authority has a restricted scope for operating, maintaining and developing these waters, a focus on efficient solutions within this scope can be expected (Pahl-Wostl et al., 2010; Raadgever et al., 2008). However, such sectoral solutions may well offer restricted public value.

Amongst Western countries, both the USA and the Netherlands have an extensive waterway network and large volumes of cargo are transported over these waterways by ships and barges. These two countries can be considered as illustrative cases in a rich context. The Dutch and the American waterway authorities, respectively Rijkswaterstaat and the US Army corps of Engineers, are also examples of agencies with a focus on efficient solutions within a restricted scope (Lonquest et al., 2014). This does, however, not mean the opportunities for value creation in a broader sense are not recognized by these agencies. Both organizations make attempts to increase the broad socio-economic value of their capital waterway projects by deploying tools for broader optimization (Brink van den, 2009; Hijdra et al, 2014a). By investigating their latest projects, the tools used for this purpose have been identified. In this paper, a total of six projects, three in the Netherlands and three in the USA are analyzed.

The aim of the paper is to identify and classify tools aiming at creating societal value in waterway projects. Waterway management and planning typically involves rational processes of project development, budgeting and coordination. Identification and classification is therefore framed from the perspective of an inclusive approach and the transaction costs and benefits that come with that. By applying such a dedicated framework a more systemized and fundamental understanding of practical approaches is provided. This framework helps to unravel the often-implicit drawbacks and incentives experienced by

the waterway authorities when deploying value tools. A more fundamental understanding of the practical approaches can therefore contribute to the scarce literature in the field of value analysis of public projects, and it could help practitioners in selecting effective methods to optimize their projects. Also the research aims to contribute to literature of waterway planning in an international context.

5 . 2 Methodology and materials

To obtain insight in tools for value creation in waterway development, two countries have been selected where inland waterway transport plays a significant role, and where waterway authorities have actively been improving these systems in recent years. Most illustrative in this respect are the Netherlands and the United States. The agencies responsible for operation and development of these systems are highly vertically optimized, i.e. through hierarchically organized various levels of government, but do recognize the potential of improving horizontal coordination with other policy sectors. Amongst the many Western countries relying on their waterway system, the Netherlands and the United States can be considered exemplary for sectoral optimization within a rich context (Brink van den, 2009; Hijdra et al., 2015). The context can be considered as rich as in both countries many possibilities are recognized to include multiple functions and values in the process of altering waterways.

The Netherlands is often considered to be the 'main port' of Europe with ports like Rotterdam and Amsterdam (Ministerie van Infrastructuur en Milieu, 2012). Furthermore it has one of the most fine-mazed waterway networks in the world, and the highest modal split for inland waterway transport in Europe (Bureau Voorlichting Binnenvaart, 2010; Central Intelligence Agency, 2011). Therefore, waterways as a means for transportation, is certainly an important asset for the economy of the Netherlands. The responsible agency for these waterways is Rijkswaterstaat. Rijkswaterstaat operates, maintains and develops these waterways with the purpose of water management and navigation.

The United States shows similar highlights. It has the largest waterway system in the Western world, it is intensively used and it is of vital importance for the energy sector (coal), agriculture (fertilizer, agro-products), and the oil industry

(oil-products) (US Army Corps of Engineers, 2009a). Similar to the Netherlands the USA has a strong centrally guided agency responsible for these waterways: the US Army Corps of Engineers. This agency has a clear mandate to maintain operate and develop these waterways with the purpose of water management and navigation.

To investigate the application of tools for value utilization case studies are presented here. For both countries recent cases of waterway development with involvement of the national agencies have been selected to investigate the way these centrally guided agencies include functions outside their own objective. From the entire set of projects with involvement of these agencies, selection of cases took place around three major themes in waterway development. These themes are: ageing and replacement of assets, waterway improvement, and flood protection.

Ageing of assets and replacing these is an issue strongly on the rise as many assets in waterways have been constructed in the 1930s. These projects often require high investments, and can become rather urgent if safety or functionality is compromised. Waterway improvement, the second theme, often takes place in zones where the traditional role and design of the waterway is under pressure. This could mean more functionality is required and/or economies of scale ask for accommodating larger ships. The third theme, flood protection, has a driver from outside the transportation sector but can seriously affect waterways. Due to increased flood protection levels and/or changing climatological and hydrological conditions waterways need to be adapted to protect the surrounding areas from flooding.

A total of six projects have been selected, a pair for each theme. For the first theme, ageing of assets, two navigation lock projects are studied; the Beatrix lock project in the Netherlands (Rijkswaterstaat, 2014)and the Inner Harbor Navigation Canal lock expansion in New Orleans, USA (Walsh, 2009). Both take place in a mixed urban and industrialized zone, both need to solve a major transportation problem. For the second theme, waterway improvement, two recent projects of the national agencies have been selected which cover a stretch of a waterway to be (re)developed; the Zuidwillemsvaart in the Netherlands (Rijkswaterstaat, 2011) and the Miami river in the USA (MRSC, 1998). These projects take place in an urban environment in a context where broader societal functions are hard to ignore. A third pair of cases was selected

around the theme of improving flood-protection in a navigable waterway; Room for the River Waal, part of the Room for the River program (Room for the River, 2012), in the Netherlands and the Napa river in the USA (US Army Corps of Egineers, 1998). Both take place in an urbanized zone, which is not surprising as these are the zones where flooding is troublesome. In table 5-1 an overview of the selected cases is shown.

Table 5-1: capital waterway projects selected as case studies

Waterway investment theme	*focus on asset replacement*	*focus on waterway improvement*	*focus on flood protection*
Netherlands	Beatrixsluis. Planning of a third lock in the inland shipping route between Amsterdam and Rotterdam.	Zuid-Willemsvaart around den Bosch. A new canal of around 9 km is being constructed to replace the old canal through the inner city of Den Bosch.	Room for the river Waal project, Nijmegen. The river Waal is adapted to be prepared for an increase of discharges.
United States	IHNC lock expansion. Planning of a second lock next to an existing old lock in the Inner Harbor Navigation Canal. The lock provides access to sheltered port terminals and the intracoastal canal.	Miami River. A stretch of 8 km of the Miami river, it highly resembles a canal, has been redeveloped since the 90s. Various elements of the redevelopment are still ongoing.	Napa river. One of the most flooded cities of the USA, Napa, is protected against recurrent flooding by the Napa river.

Data collection for the case studies took place through semi-structured interviews with project officials, document analysis, field visits and website postings. Four of the cases were visited once (Napa, New Orleans, Miami, Waal), two cases were visited multiple times (Zuid Willemsvaart, Beatrixlocks). The interviews were conducted with 21 officials related to the investigated projects (appendix 1). The interviews took 1 to 2 hours each, depending on the time available by the interviewee. Some of the interviews had multiple interviewees simultaneously (Napa, New Orleans, Miami). One interview was done by conference call (Miami). The data from the interviews, document analysis, field visits and website postings were analyzed using a value classification system. This value classification system was developed on the basis of transaction cost theory (table 5-2). Within this framework all single elements of transaction cost, transaction benefits and value capturing elements are defined. In section 5-3 this is described in more detail.

5.3 Theoretical framework

Infrastructure projects in general have many stakeholders, as the works have many logistical, environmental, physical, financial and other effects. Involving a wide variety of stakeholders in the process of infrastructure development seems like a logical choice to address these issues. These stakeholders can be individuals, groups, firms, governmental bodies or non-governmental organizations. To capture mutual gains, or simply avoid opposition, agreements have to be made between the developer and the stakeholders related to the development; a transaction.

Transactions are not without cost and effort; these require information, interaction, coordination and so forth. If transactions would be without such costs and efforts, land use value would maximize instantaneously (Coase, 1960). To properly address the variety of elements involved in transactions (institutionalized) tools are used. The transactions have to lead to reasonable value for each individual party. And generally, these transaction benefits need to exceed the transaction cost in order to add value.

Insight into transaction costs in the field of land use planning has been offered by (Alexander, 1992, 2001, 2010, 2012). Alexander emphasizes the three dimensional nature of transaction costs: interdependency, uncertainty and timing. Various publications of further operationalization have come forward on this basis (Buitelaar, 2004; Paavola, Adger, 2005; Widmark et al, 2013).

Inversely, the transaction benefits could be drawn from the field of negotiation theory (Lax, 1986; Raiffa, 1982). The benefits described are of generic nature, but Blomqvist (2002) described these benefits in more detail, which can be used for infrastructure development. On these elements, a framework including transaction value and tailored definitions has been developed for the specifics of the infrastructure sector by Hijdra (Hijdra et al, 2014b).

The creation of value is only of use for an agency if this value can be claimed or captured (Huxley, 2009). It is important to note here, that claiming and capturing value can require substantial efforts itself, and can therefore add to the transaction costs as described above. From the organizational point of view, ultimately, five basic categories can be defined in which value can be

Table 5-2: Classification system of the value elements.

Transaction costs*	Transaction Benefits**	Claiming and capturing value
- Exploring and evaluation cooperative options. - Preparing, crafting, negotiating an agreement - Inter-agency coordination: local representation, preparing and attending meetings, communicating. - Intra-agency coordination: communicating, administrating, and addressing partnership issues internally. - Education and training related to the cooperation - Monitoring interagency issues. - Transaction enforcement (e.g. dispute resolution, litigation, financial hostage) - Activities to build trust	- Joint assets value surplus. This is the case when the joint use of (complementary) assets generate more value than when used separately. - Joint surplus of complementary skills, routines and capabilities. Joint surplus comes from the melting of these instead of isolated deployment. - Cooperative use of asset x increasing pay-off generated through asset y. - Economies of scope. This is based on cost advantages, which come forward through the integration of various elements or subsequent steps of a project, and stimulates tighter vertical integration. - Economies of scale. When cost advantages or learning effects can be found through scale effects this would drive horizontal integration.	- Reduction cost/risk. Cooperating might lead to lower cost or risk for either one or both of the parties. - Cost/risk sharing. This usually involves an agreement on the specifics of sharing. - Increased return flows, builds on return flows already happening. - Additional return flows. This usually requires operationalization of new cash flows. - Strategic benefits. This could be reputation, skills, knowledge or access to new opportunities.

* The elements all refer to actual costs, but there might be 'resistances' which do not translateto costs but certainly add to the balance. This might be the case when collaboration leads to the perception of higher risks, uncertainty or complexity without having any tools to counter these effects (Hijdra, Woltjer, et al., 2014a).

** These elements are derived by Blomqvist et al (2002) and described in more detail for infrastructure projects by Hijdra et al (2014b)

captured to the benefit of this same organisation. These categories relate to costs, benefits and strategic advantages. The cost elements can be split into cost reductions, and cost sharing. The benefits can be split up in a similar way; increased benefits, and additional return flows. A fifth category captures the strategic advantages, which cannot be monetized directly. In other words, claiming or capturing can come 'naturally' through the effects of the infrastructure itself, or results from the arrangement between the participating organizations. In the sectoral approach the value could e.g. be captured by general taxes, special taxes (ship fuel tax), tolls, shadow tolls, leases etc. In a joint approach, the value might come from society, or equally likely from the

partnering organization (Heeres et al., 2015; Hijdra et al., 2014a). The elements of transaction costs and transaction benefits, and the ways of claiming or capturing value are shown in table 2.

5.4 Results

The results for each of the six case studies are briefly described in the following paragraphs. Each description starts with some general background of the case followed by information about the tools used to increase socio-economic value of the project. The tools described are the tools that were considered by the interviewees and actively used in stimulating the socio-economic value of the project. For each tool a code-name is introduced (between brackets) for further reference.

5.4.1 Beatrixsluis, the Netherlands

The Beatrixsluis in the Netherlands is a navigation lock complex with two chambers. It is located in the Lekkanaal, a short canal of 4km. This canal connects the Amsterdam-Rijnkanaal with the Nederrijn-Lek. It is an intensively used shipping route. The lock complex was built in the 1930s. Policy documents indicate its capacity is viewed as insufficient to handle the busy shipping traffic, therefore the construction of a third lock has been announced. The incentive to start the project was therefore rather technical, or as one of the interviewees phrased it: *'Thinking in terms of ambitions was not really done when we started the project'*. Tendering and contracting this project is in preparation since 2014. Together with this third lock the canal has to be adapted to allow pushing convoys to align properly for this new lock (Rijkswaterstaat, 2014). Widening of the approaches runs into a variety of interactions with other, current, uses of the land adjacent to the canal. These uses include agricultural land projected to be converted into an industrial zone, and military bunkers part of a large historic defence system (Nieuwe Hollandse Waterlinie). Stakeholders included farmers, the municipality and the National Heritage agency. One of the interviewees mentioned about this: '*I noticed at the Beatrix lock project that when you start doing things together, then you achieve results which may not be earth-shattering, but in the end it leads to better overall results.'* Project officials

mentioned they deployed a variety of tools. The most prominent tools mentioned in the interviews were stakeholder group involvement *(Bea – Stakeholder)*, and the application of a contract form in which the contractor is responsible for design, construct, finance and maintenance of the new lock *(Bea – DBFM contract)*.

5.4.2 New Orleans Inner Harbor Navigation Canal Lock (IHNC), USA

The IHNC lock is a deep draft single lock built in 1923. It is located in the IHNC, a 9km long canal connecting the two most intensively used waterway systems of the USA, the Mississippi and the Gulf Intracoastal Waterway. It is located in industrial and residential areas (lower 9th ward) of New Orleans. Policy documents indicate that the current lock is considered too small to accommodate modern generations of oceangoing vessels. Another problematic issue coming forward from these documents is that inland pushing convoys need to be disassembled to pass through. One of the interviewees summarized the situation as follows: *'The lock severely limits the size of ocean going vessels that can go through it. It also severely limits the size of barge traffic that can go through it. So it is extremely inefficient for all purposes because of how old it is.'* For this reason a larger, deeper lock to replace this old lock is proposed (US Army Corps of Engineers, 2009b; Walsh, 2009). According to the plans, the canal and bridges have to be adjusted as well. Due to budgetary and legal problems the tendering process is delayed several times. In 2015 the scope of the project is being reconsidered as the court decided that the effects of the construction plans are insufficiently addressed. Project officials stated that two tools played a prominent role in the process with regard to their stakeholders: a co-financing agreement with the Port of New Orleans *(IHNC – cofunding)*, and a design and tendering process with a focus on local mitigation elements and local revenue generation *(IHNC – tendering)*.

5.4.3 Zuidwillemsvaart, the Netherlands

The Zuidwillemsvaart project embodies digging 9 km of new canal around the city of Den Bosch. The old canal ran straight through the historic city. The project documentation describes this old situation as narrow, lacking upgrading possibilities, and shipping traffic causes congestion in the inner city

due to many bridge openings. Policy documents mention that a new stretch of canal is required to facilitate and stimulate transport of goods over water (Rijkswaterstaat, 2011). By-passing the city by such a new stretch of canal had long been anticipated for and was considered as a project with a large impact, both positive and negative. Two different quotes from interviewees describe this paradox: *'You're going to rearrange the area there anyway, why don't you make it in such a way that the entire region of Rosmalen and Den Bosch gets a new beautiful area?'* and *'The local people, they didn't ask for the project, it is imposed on them, forced, and they are affected in their own environment...'.*

After a planning period of decades, which was halted and reinitiated several times, the contract was awarded in 2010. Construction of the new canal is completed and it has been officially opened in February 2015. The new stretch has been named 'Maxima canal'. Project documentation showed the project had considerable implications for a wide variety of current and future infrastructure plans of the city Den Bosch. Through an intergovernmental agreement, cooperation, co-development and co-financing were arranged *(ZWV – intergovernm)*. The construction works itself were tendered to construction companies. The contract for construction was a design-build contract. Such a contract allows the contractor to optimize the design of the works and the associated construction processes as long as the functional requirements of the design and build contract are met *(ZWV – DB contract)*.

5.4.4
Miami River, USA

The city of Miami was founded at the riverbanks of the Miami River. In the 19th century the riverbanks became an industrialized and port zone. In the 1980s and 1990s the canal-like-river and adjacent zones became deprived zones. The river was polluted, sedimentation and derelict vessels hindered port activities. Project officials mentioned that in the 1990s a growing awareness was felt by city officials and state officials that something had to be done. Or as one of the interviewees phrased it: *'At some point it didn't take a lot of brains to conclude it is not good to have a sewer through this city.'*

It was felt that cities worldwide embraced and redeveloped their waterfronts, while Miami ignored its river. The Miami River project was born. The project had the purpose of re-development of the river. Policy documents showed this

re-development had the purpose of improving navigation conditions for short sea cargo ships, clean up the river, and upgrade the entire area around the river (Florida Atlantic University, 2008; Miami Downtown Development Authority, 2009).

The interviewees mentioned a variety of tools had been deployed to stimulate the redevelopment process. The Miami River Commission was raised in 1998 and acted like a trading house, boosting horizontal coordination (*MIA – MRC trading*). Or in other words, as posted on the MRC website: *'Our mission: To act as the official coordinating clearinghouse for all public policy and projects related to the Miami River.'*

Permits for real estate development included conditions to provide public access and development of continuous walkways along the river (*MIA – permitting*). The use of federal funds to clean up the river and improve navigation had the pre-condition of matching co-funding (*MIA – cofunding*). Furthermore the development process itself was based on a step-by-step approach with separate contracts for each step (MIA – step-by-step).

5.4.5
Room for the River Waal, the Netherlands

The Room for the River Waal project refers to a problematic narrow curved zone of the River Waal exactly where the city of Nijmegen is located. To prevent future flooding, the river had to be made capable discharging up to 18.000 m^3/s (Room for the River, 2012). The project documentation showed that Rijkswaterstaat, the national agency responsible for navigation and flood management of the river, calculated and designed a cost efficient solution by deepening and widening the river where possible. Where other institutions had additional ambitions for the zone, these institutions were invited to present alternative local plans, including their own ideas and ambitions. The original cost efficient design was taken as a reference for comparison. When alternative plans required no increase in national financial contribution, and showed to be equally effective, these could be awarded. Awarding such plans was called an '*omwisselbesluit*', or translated: 'a swap decision' (*Waal – swap*). This process resulted in an adaptive planning approach and led to the execution of an

alternative plan where riverfront development, recreation, housing and flood protection go hand in hand. Instead of Rijkswaterstaat, the city of Nijmegen took the lead (*Waal – auth. by munic.*). Their ambition for the project was phrased by one of the interviewees as: *'Most important is that a high quality public space for the city of Nijmegen is developed.'* Furthermore, project officials stated that private developers could get involved by presenting plans adding to the broad project goals in return for real-estate development opportunities (Waal – real estate)(Wolff & Spaans, 2010). The project is at its final stage and is expected to be completed in 2015.

5.4.6 Napa Valley, USA

Napa valley is located in California in the proximity of the San Francisco bay area. The valley is named after the Napa river. The city of Napa emerged at the riverbanks of the river in the early 19th century, as this was the furthest inland place to be reached by a cargo vessel. The city of Napa is nowadays often referred to as the most flooded city of the USA. In 1986 the US corps of engineers initiated a flood protection project to prevent further floodings. The plan comprised straightening and widening of the river, and protecting the riverbanks with artificial constructions. Inhabitants of the valley rejected this plan. As one interviewee stated *'In the past there have been attempts to channelize the Napa river like they did in LA. [...] It's ugly, it's against nature, and all they do is move the problem downstream. [...] So the people said let's look at something else'.* From documentation, interviewed city officials, project officials and stakeholders came forward that a group of volunteers continuously negotiated with a variety of stakeholders (Napa – volunteers). A more broadly defined plan, including nature restoration, riverfront developments and landscaping was embraced (US Army Corps of Egineers, 1998). Additional funding had to be found, which was done by raising local taxes, based on a 2/3rd majority vote in 1998 (*Napa – tax hike*). The contracting was done is such a way that most of the spending was directed to local and regional contractors. The project has been implemented in phases and was completed in 2013.

In the above paragraphs the individual projects have been described briefly, and the tools deployed have been highlighted. In table 5-3 the tools have been classified on the basis of the elements of the value elements classification system in table 5-2.

Table 5-3: classification of tools – classified from the perspective of the waterway authority

		Bea- stakeholder	Bea – DBFM contract	IHNC – co-funding	IHNC - tendering	ZWV – Intergovernm.	ZWV – DB contract	MIA – MRC trading	MIA - permitting	MIA – co-funding	MIA – step-by-step*	Waal - swap	Waal – real estate	Waal – auth. by munic.	Napa – volunteers**	Napa – local tax hike**
Transaction cost	Exploring	x				x		x			x	x		x		x
	Preparing	x	x	x	x	x	x	x	x	x		x	x	x		x
	Interagency coordination	x	x	x	x	x	x		x	x		x	x	x		x
	Intra-agency coordination	x	x	x	x	x	x	x	x	x		x	x	x		
	Education and training		x				x								x	x
	Monitoring		x		x		x		x			x	x	x		
	Enforcing		x		x		x		x			x		x		
	Build trust	x						x							x	
Transaction benefits	Joint assets			x		x		x	x	x						
	Complementary skills	x	x		x		x	x				x	x		x	
	Cooperative use of assets					x		x				x	x			
	Economies of scope		x			x	x					x		x	x	
	Economies of scale		x		x	x	x			x						
Value capturing	Reduced cost/risk	x	x		x		x			x		x		x		
	Shared cost/risk			x				x		x			x			
	Increased return flows							x	x							x
	Additional return flows															
	Strategic value			x	x	x		x	x	x		x		x	x	

most encountered least encountered

* The MIA - step-by-step approach anticipates on future opportunities. Interaction with partners will take place in the future, therefore no specifics, other than exploration of the opportunities can be given yet.

** From municipality of Napa perspective.

5.5 Analysis

The variety of tools as presented in this paper will be analysed here on the basis of the findings for transactions costs, transactions benefits, and the ways of capturing value (see table 5-3). This will be followed by a description of the differences and similarities in Dutch and American application of tools.

5.5.1 Transaction costs

In terms of transaction costs, all tools investigated included multiple elements of such costs except for the Miami-step-by-step appraoch. Most common are the cost elements of making preparations for an agreement, interagency and intra-agency coordination (see table 3). Therefore, the theoretical notion by Coase (1960), that land use value would maximize instantaneously if there were no transaction cost, seems indeed to be theoretical here. The step-by-step approach in Miami can be considered a logical exception, as future opportunities for value are not clear yet. It does not mean there will be no transaction costs involved in such an approach, but these did not occur yet.

The findings also showed that not all parties addressed by a certain tool will experience the same type of transaction costs. For instance, the MRC trading tool, is quite intensive in terms of preparation and intra-agency coordination for the MRC itself, but for some of the involved stakeholders it just means they have to show up in a meeting and express their opinions. In fact this is exemplary of this kind of tool, it focuses on reducing transaction costs for other agencies. This is similar to the principles of the Napa volunteer group, and to a lesser extend to the ‘Waal - real estate’ initiative and the ‘Waal - swap’ decisions. All these focus on a facility to allow synergetic transactions without having the individual agencies having to pioneer a deal themselves. In other words; these tools smoothen the path for mutual gains.

5.5.2
Transaction benefits

In terms of transaction benefits, the tools show a large degree of variation. This means the tools address different elements of benefits that come with cooperation. The beneficial element of 'complementary skills' is found most often in the tools investigated. And as transaction benefits are the driver to seek transactions, the capabilities of partnering organizations seem to be a main driver amongst the benefits. The benefit of cooperative use of assets was least often addressed, and therefore a much less prominent driver to engage in transactions. Some of the tools relate to a single benefit only like Bea-stakeholder, IHNC co-funding and Waal-authority by municipality. The Napa-special tax hike to fund the Napa-River project is a bit of an a-typical tool in the set. It is a tool with an aim to capture value. It does not focus on some sort of transaction with stakeholders, and therefore it is without a specific benefit in terms of cooperation. It could be argued that it does not belong in this set of tools, but as it was an important element in making the Napa project to a success, it has been included here nevertheless. Some of the tools addressed multiple transaction benefits. The tendering and contracting tools (Bea-DBFM, IHNC-Tendering, ZWV–Design Build), but also the trading facilities (MRC-trading house, Waal – swap) are examples of these. In table 3 it is shown that all these tools address 'complimentary skills' together with one or more other benefits.

5.5.3
Value capturing

The data showed two remarkable results for the value capturing and claiming group of elements. First of all, strategic value is often mentioned or referred to by the interviewees. Building and maintaining the relationship with regional partners was often mentioned in this context. Secondly, no additional return flows have been mentioned or found for all of these tools. No direct explanation for this is provided through the empirical evidence. A logical reason behind this might be that this type of value capturing required much more coordination than the other types. Furthermore, a reduction of risk/cost comes forward as an important mechanism to capture value for many of the tools. The MRC trading facility is the single tool that combines both a cost and return element.

5.5.4
Comparison Netherlands-USA

If we compare the results for the tools as applied in the Dutch and the American situation a few specifics arise. In the American situation the use of local co-funding is mandatory for federal navigation projects. This actually played an important role in the IHNC case and the Miami river case. For the Napa case co-funding was applied, but as the federal objective was flood protection, it was not mandatory. Secondly, volunteer groups with impact and active long-term involvement, as seen in the Napa case, could be related to the American culture and tradition of volunteering. However, it does not rule out it could take place in other countries as well. Furthermore, the Dutch have been exploring the path of contract forms in which contractors are responsible for design, and sometimes finance, and maintenance as well. This is not witnessed in the American cases, nor has any reference to this kind of contracting been found there. Reference to contracting forms by US Corps of Engineers interviewees revealed that the design responsibility is in generally held close to the Corps itself, and not transferred to contracted parties. More generally there appears to be more attention for alternative contract forms in the Netherlands in comparison to the USA.

A striking difference in the results was the lack of addressing return flows in the Dutch tools, while this appeared several times in the American cases. This needs a bit of nuance though; increasing return flows only appeared to be viable in case a local authority could influence the project significantly. Or as one of the interviewees for the Miami case phrased it; *'90% of the river is controlled by the city. Taxes go to the city, and the state, but mostly the city. Now condos go for a million a piece. The city had no political will before the MRC was in place. But once they learned the value was there, the money was there, people would go there, tax base was there, they understood you would have to do something there.'* There seems to be no specific hurdle for stakeholders in the Dutch context to act in a similar way. This means Dutch local authorities could try to influence the plans to optimize for increasing local tax revenues similar to the way this was actively done by local permitting in the Miami river case.

5.5.5
Three waterway themes

As described in section 5.2, the cases are selected from three mayor categories of waterway investments; replacement of assets (Bea, IHNC), waterway improvement (ZWV, MIA) and flood protection (Waal, Napa). In deployment of tools, three notable differences are observed. First of all, in replacement of assets the benefit element of 'cooperative use of assets' is not addressed at all. In these cases this means that these assets are considered to be of single purpose. The second observation is that economies of scale are not addressed in the flood protection cases. This benefit is closely related to contracting forms, which is not a dominant tool in the flood protection cases. The third observation lies in the fact that tools deployed in the replacement of assets category do not address increased return flows at all. This is in contrast to both other categories. Again, an explanation could be that the focus lies in developing a cost efficient single purpose solution, and not so much in stimulating broader value.

The tools identified have been verified on the fact whether these include the mentioned elements of transaction cost, benefits, or value capturing mechanisms. From the observations it came forward that the way these elements are addressed can take several forms of governance. Taking these mechanisms encountered in consideration, basically five forms of governance were observed. Below these five forms are ranked from closed to more open types of governance (Martens, 2007):

- Permitting – with a purpose to optimize benefits (MIA- permitting, Waal real estate)
- Financial instruments – with a purpose to capture value through taxes or co-funding (IHNC – co-funding, MIA - co-funding, Napa – local tax hike)
- Contracting – with a purpose to optimize benefits or with a purpose to redirect expenses to regional returns (Bea – DBFM, ZWV – DB contract, IHNC – tendering)
- Cooperative instruments – with a purpose to reduce transaction costs (Bea-Stakeholder, ZWV – Interngovernm, Waal-auth by munic, Napa-Volunteers).
- Trading house – with a purpose to transfer transaction costs from stakeholders to trading unit (MIA – MRC trading, Waal swap).

Special mention has to be made of the MIA step-by-step approach, as this tool seems to be of different nature. This tool was indeed meant to optimize the overall value of the project by enabling the actors to decide on timing of decisions, plans, contracts, designs and so on. As it appears to be a fundamental different type of tool, it is not mentioned in one of these groups. Such a step-by-step, or adaptive, approach can be seen as an overarching tool to optimize the deployment of tools by phasing developments in time.

5.6 Conclusions and discussion

The deployment of tools and instruments to increase value of waterway projects has been analysed. A series of six recent projects, three in the Netherlands and three in the USA have been studied to gain insight in contemporary developments in the waterway sector. Both national waterway authorities, Rijkswaterstaat and the US Army Corps of Engineers, showed recognition of the societal call for broader optimization of waterway projects and made attempts to optimize their projects in such way. As these attempts can be defined as planning practise in progress, it is certainly not evolved yet to a level of fit for purpose, refined and balanced practice.

In the six case studies the use of a variety of tools was observed. Literature on the precise working of these tools in waterway planning appeared to be scarce. By analysing the tools deployed on the basis of a classical transaction cost and transaction benefit framework, deeper insight has been provided on the elements these tools address in the optimization process. Transaction cost theory provides a useful framework as it says that land use value would optimize instantaneously if no transaction costs existed. By finding the way transaction costs are reduced, benefits increased and value capturing mechanisms deployed, we have seen that a structured identification and categorization of the tools can take place.

A total of 15 tools were found, all had a purpose to increase the value of the project in some way. All these tools addressed elements of transaction costs, transaction benefits and value capturing. The variety in transaction-cost-elements addressed and transaction-benefit-elements addressed was large; in value capturing the variation was much lower. Reduced cost/risk was often used as a way to capture value, together with strategic value. An explanation for

this might be that these two types of capturing hardly ask for extra coordinative efforts, the benefits of the transaction 'fall' to the partners almost without extra effort. The strategic value element often referred to maintaining good relationships with other local or regional actors due to the recurrence of transactions beyond the project investigated. None of the tools added a new return flow in the system, and increased return flows were only witnessed in the USA situation. In the Dutch situation contracting tools stood out as a way to increase benefits by transferring (design-) responsibility to the contractor. This was not encountered in the American situation. In the US situation, however, contracting included directing expenses to local firms to increase the local return flow. This was not found in the Netherlands.

The cases were tied to three mayor categories of waterway projects; asset replacement, waterway improvement and flood protection. The tools from the cases in the first category appeared to focus most on developing a cost efficient strictly defined solution. Resolving an urgent specific problem is the key issue here. The tools applied in the projects of the category 'waterway improvement' addressed most transaction benefits and value capturing elements. These kinds of projects appear to have ample opportunities for broad optimization. The 'flood protection' projects seem to take a position in between these two themes. The geographical impact is wide, but the functional need is narrowly defined. Such projects seem to be able to go either way.

At a more abstract level the tools could be categorized into five types of governance based on the purpose related to value elements pursued. These were: (1) permitting instruments, (2) financial instruments, (3) contracting to optimize benefits or stimulate local returns, (4) cooperative instruments, and (5) trading houses. And although the purpose of each instrument might be clear and defendable, the data provided a rather dispersed image on the elements addressed according to transaction cost theory. This means room for further optimization is likely to be found. Ideally all transaction costs are to be minimalized and all benefits and value capturing elements maximized, in practice this appears to be difficult.

Optimizing waterway projects in a broad sense, taking into account many of the linked issues valued by society, can be a complex task. Tools can be helpful in this process. The effects of these tools in the optimization process are, however, rather complex itself. This is due to the wide variety of transaction cost elements

and transaction benefit elements associated with these tools. These effects can also vary due to differences in context; an industrial zone will give different dynamics than a residential zone or a rural zone.

The cases learn that practitioners should keep in mind that inclusiveness comes with transaction benefits and transaction costs. The benefits are often explicit and highlighted by stakeholders, the transaction benefits are much more implicit. The benefits do not only need to be larger than these transaction costs, but have to be captured in an efficient way as well. Attention should be paid to these aspects when selecting a mix of tools to optimize a project.

Practitioners can expand their set of tools by adopting and application of successful tools as seen in other countries. Examples could be application of trading facilities or an obligatory requirement for co-funding in the Netherlands, or trying out alternative contract forms in the USA. Ideally deployment of mixes of tools should be complimentary and synergetic. Systematically considering application of tools in a structured way could be a practical step forward.

More broadly the study shows that current planning process in waterway development seems to be advancing. Both in the Netherlands and the USA a shift is seen from a traditional cost effective sectoral approach towards the application of tools to stimulate inclusiveness. There is a strong incentive to continue on this path as waterways need to be adapted to new circumstances, and at the same time assets are ageing and need to be renewed. Waterway authorities are forced to take action, but need to take into consideration the wide variety of issues related to these waters. Applying new mixes of tools and types of governance can be considered an emerging issue in the waterway sector. These mixes vary greatly in characteristics. Further research into selecting effective mixes of governance, improving tools and instruments and providing guidance for harmonization of deployment of tools could strengthen the advancements in the sector.

5 . 7

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CHAPTER

6 Changing practice in Dutch waterway development

ABSTRACT

Internationally, many waterways are used as arteries for cargo and passenger transport. Where this transport is intensive, the focus on transport alone often becomes a dominant factor for optimization and management of these waterways by its responsible agencies. However, benefits of waterways are wider, and these benefits require coordination, place integration, and are typically an activity in spatial planning. In current practice, this is insufficiently acknowledged. Broad and balanced optimization based on of the wide spectrum of societal benefits associated with waterways can bring additional value to society. This value results from the satisfaction of a wide variety of individual stakeholder needs. This article reviews the extent to which waterway development is acknowledging broader benefits, and assesses the costs associated with current practice of public waterway management. In practice, such an inclusive approach proves to be difficult. The Netherlands, a country with an intensively used and economically important waterway system, is exemplary: the Dutch case reveals that incentives in implementation are not typically aligned with policy ambitions to increase societal value. Coordination costs appear to be an important limiting factor, but the case shows little explicit management attention for these costs. The results also show that management incentives put a reward on limiting interaction to stakeholders that are considered a risk to project progress only; therefore an inclusive, planning-oriented approach needs more attention. The societal value of the networks could be stimulated by alignment of policy ambitions with project practice, increased explicit attention for coordination costs and more structured attention by project teams for value-opportunities.

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6.1 Introduction

Internationally, an increasing awareness of integrated planning, place-making and considering infrastructure in its local context can be witnessed (Heeres et al., 2012; Kidd, 2007; Lloyd & Peel, 2005; Nadin, 2007; Nassauer & Larson, 2004; Vigar, 2009; Woltjer et al., 2015). Specifically for management of rivers and watersheds, such integrated and holistic thinking already emerged in the 1960s and 1970s, forced by the borderless flow of water itself (Bouwer, 2003; Brack et al., 2009; Global Water Partnerschip, 2004; Mitchell, 1990; Pahl-wostl, 2002; White, 1998). Recurrent key elements in this growing awareness are integration of stakeholders' issues, inter-organizational collaboration, building broad support and increasing socio-economic value. This line of reasoning, and stressing these key elements, is supported in a broader context by the emergence of public value management. Public value management aims to improve effectiveness and efficiency of deployment of public resources (Colon & Guerin-Schneider, 2015; Kelly & Mulgan, 2002; Moore, 1997; Stoker, 2006; van der Wal, Nabatchi, & de Graaf, 2013). However, for the water sector, it remains troublesome to bring these ambitions into practice (Biswas, 2004; Brink van den, 2009; Brown & Farrelly, 2009; Butterworth et al., 2010; Jeffrey & Gearey, 2006). This is particularly valid for waterways that are in use for transportation purposes. The economic importance of transport and its required navigation conditions can easily dominate the actions of agencies responsible for such waterways (Hijdra, et al., 2014b; Hijdra et al., 2015). The intensively navigated waterways in the Netherlands can be considered exemplary.

In the Netherlands, a country with major European ports like Rotterdam and Amsterdam, the once natural waters have been altered and adapted to serve the needs for transportation. Many canals have been constructed in addition to the natural waterways, resulting in a dense inland waterway transportation network. In addition to transportation, these waters serve many other societal functions like recreation, ecology, supply of household water, irrigation, flood alleviation, cooling water, and so on (fig 6-1). The managing agency for these inland waters is a national agency called Rijkswaterstaat. This agency is responsible for day-to-day operations, but also finds itself facing major challenges for future waterway development. Climate change will change circumstances for management and development, and secondly, many of the assets in the inland waterway system are ageing and due for renewal. These issues create a push for redevelopment

and forces Rijkswaterstaat to consider pathways for redevelopment. Policy ambitions in the Netherlands prescribe pathways on the basis of inclusiveness, aiming to satisfy individual stakeholders' needs along with redevelopment (Rijkswaterstaat, 2015). These ambitions are not typically Dutch; all over the world agencies are struggling with the issue of acknowledging value related to their services (van der Wal et al., 2013), and developing integrated approaches to build on this value (Pahl-Wostl, Jeffrey, Isendahl, & Brugnach, 2010).

The international trend to focus on integrated planning is also found in the Netherlands (Brink, 2009; Commissie Elverding, 2008; Ministry of Infrastructure and the Environment, 2013; Networking for Urban Vitality, 2013; Schultz van Haegen, 2014). An integrated and inclusive approach for waterway redevelopment would build on the wide range of values associated with these waters. However, an executive agency like Rijkswaterstaat is not ideally suited for such an approach. The organization can be characterized as a 'predict and control' type (Pahl-Wostl et al 2010). Its scope and mandate is narrowly defined, and has a strong focus on cost-effective solutions for one-dimensional problems (Brink, 2009). Nevertheless, the Dutch case shows this central agency to be keen

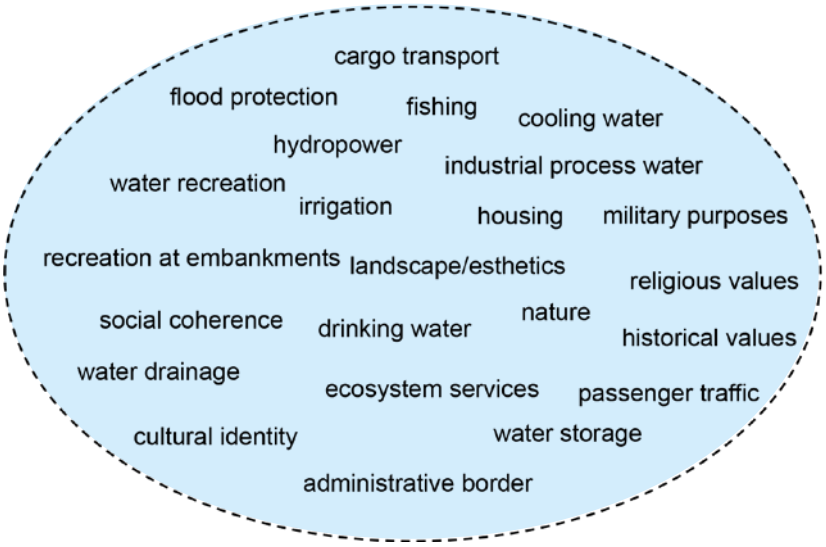

Figure 6-1: Pool of waterway-related elements valued by society (PIANC Working Group 139, 'Values of Inland Waterways', 2013)

on taking steps towards more inclusive approaches. Arguments to explore such approaches come from policy directives (Rijkswaterstaat, 2014, 2015), but are also, again typical for public waterway agencies, driven by finding sources for co-financing and reducing opposition when implementing projects.

To bridge the gap between policy ambitions, aiming at developing value, and project implementation, with a focus on cost-effective solutions, agencies need to integrate stakeholders' issues and inter-organizational collaboration into project management. The aim of this article is to determine where project implementation practice falls short in realizing these ambitions and how this practice can be improved. Locating these problematic issues and areas with room for improvement can be helpful for practitioners at infrastructure agencies in general, particularly if improved socio-economic value is to be achieved.

6.2

Theoretical understanding of value in multi-actor settings

In academics and practice, many definitions of value and approaches to the optimization of value are used. These approaches can relate to fields like philosophy, economics, engineering, economics, humanities, law, and management. In this study, a rational economic perspective is taken based on Pareto optimizations. In this context, value is seen as the summation of satisfaction of all individual stakeholder needs. Within this perspective, transaction cost theory is often used to analyse multi-actor optimization problems. According to this theory, maximized broad societal value is achieved instantaneously if transaction costs would not exist (Coase, 1960; AK Dixit, 1996; Williamson, 1998). Contrasting waterway development practice with transaction cost theory can reveal detailed insight in effectiveness of this practice in terms of realizing value. The basis of the concept is that altering the use of land or water has a myriad of implications for stakeholders with an interest in the area. Therefore, optimizing the area for its users requires cooperation with these stakeholders. Such cooperation comes with transaction costs, which determine whether optimization is likely to take place or not.

Transaction cost theory has widely been used in the private sector to analyse the rationality of cooperation between firms (North, 1990; Williamson, 1979, 1998; Zajac & Olsen, 1993). It has gradually become an instrument to study public organizations as well (Avinash Dixit, 1997, 2002; Ostrom, 2010; Williamson,

1998, 1999). For spatial planning, transaction cost theory appears to be a helpful tool to analyse the multitude of options for collaboration and the associated implications (Alexander, 1992, 2001a, 2001b; Buitelaar, 2004; A. Hijdra et al, 2014a; Whittington, 2012)

The idea behind transaction cost theory is that it makes explicit the costs and benefits for each actor considering a form of collaboration with another actor. This idea is based on the premises of free choice. If the costs associated with

Table 6-2: Transaction benefits and transaction costs determining the susceptibility to capture mutual gains

Transaction benefits	Transaction costs
Joint assets value surplus. In this case the joint use of (complementary) assets generates more value than when used separately. **Skills, routines and capabilities.** Joint surplus results from the melting of skills, routines and capabilities instead of isolated deployment. **Asset X increases pay-off asset Y.** Through cooperative use of asset x, an increased pay-off generated through asset y can be achieved. **Economies of scope.** Cost advantages through the integration of various elements or subsequent steps of a project stimulate tighter vertical integration. **Economies of scale.** Cost advantages or learning effects can be found through scale effects. This would drive horizontal integration. **Level of trust.** Mutual trust eliminates the fear for opportunistic behaviour, the source of transaction cost. Therefore trust paves the way to capturing the above-mentioned benefits and reduces the costs related to cooperation.	**Exploring and evaluation cooperative options.** For larger projects, the options are almost endless and ask for a well-defined approach. **Agreement.** Preparing, crafting, and negotiating an agreement. **Inter-agency coordination.** Local representation, preparing and attending meetings, communicating. **Intra-agency coordination**. Communicating, administrating, and addressing partnership issues internally. **Education and training** related to the cooperation in order to improve mutual understanding of the issues related to the cooperation. **Monitoring interagency issues.** Activities to monitor activities of the counterpart to reduce the chance of opportunistic behaviour. **Transaction enforcement.** This can consist of dispute resolution, litigation, financial hostage and so on. **Activities to build trust.** Activities to build trust require investment of resources in the short term (see also 'Level of trust' in left column)

engaging in such collaboration are expected to outweigh the returns of it, no collaboration will be sought, and vice versa. This means there is a threshold for actors to actually try to seize mutual gains. In other words: transactions have benefits and costs for each actor, which determine the willingness to proceed in such transaction. Typical benefits are cost savings or improved results, while transaction costs include spending of resources associated with coming to an agreement. The notion of 'mutual gains' refers to the situation where two parties are better off by having an agreement instead of not having one. The benefits and costs associated with transactions in the infrastructure sector can be described in more detail as shown in table 6-1 (Blomqvist, 2002; A. Hijdra et al 2014b).

Mutual gains and associated options for collaboration can be found at multiple stages in project development. For example, at the executive level of an agency, collaboration with a knowledge institute can be mutually beneficial, whereas at an operational level, collaboration with a municipality can be fruitful on both sides. Transaction cost considerations will therefore play a role at all stages of project development and levels of management, as shown in in figure 6-2. The figure represents the multiple planning stages (vertical axis), and the restrictions in place for the responsible agents to optimize their projects. The bottom of figure 6-2 shows the pool of value elements as appreciated by Society (figure 1 shows a practical example of such a pool based on the findings of the PIANC waterway practitioners working group with regard to values of inland waterways).

A public entity responsible for policies regarding waterways (a) provides the playing room for public agencies responsible for infrastructure development (b). Such agencies do, however, have a limited mandate for development and are not directly legitimized to build upon this entire pool of values. By partnering with actors not restricted by these limitations, a broader optimization can be pursued. This can be done at the agency level (b), the project level (c) or even by the consortia responsible for construction (d). Such broader optimization should be beneficial for the individual incentives and targets of the agency itself, as otherwise there would be no drivers to engage in such cooperation. This is also valid for the other partnering actor in the cooperation. In other words; with a theoretical assumption of free choice, cooperation will only be realized when mutual gains are expected and transaction benefits exceed transaction cost (TB>TC). By broadening the scope at these multiple levels, more value will be realized (f) than in the case without cooperation (e).

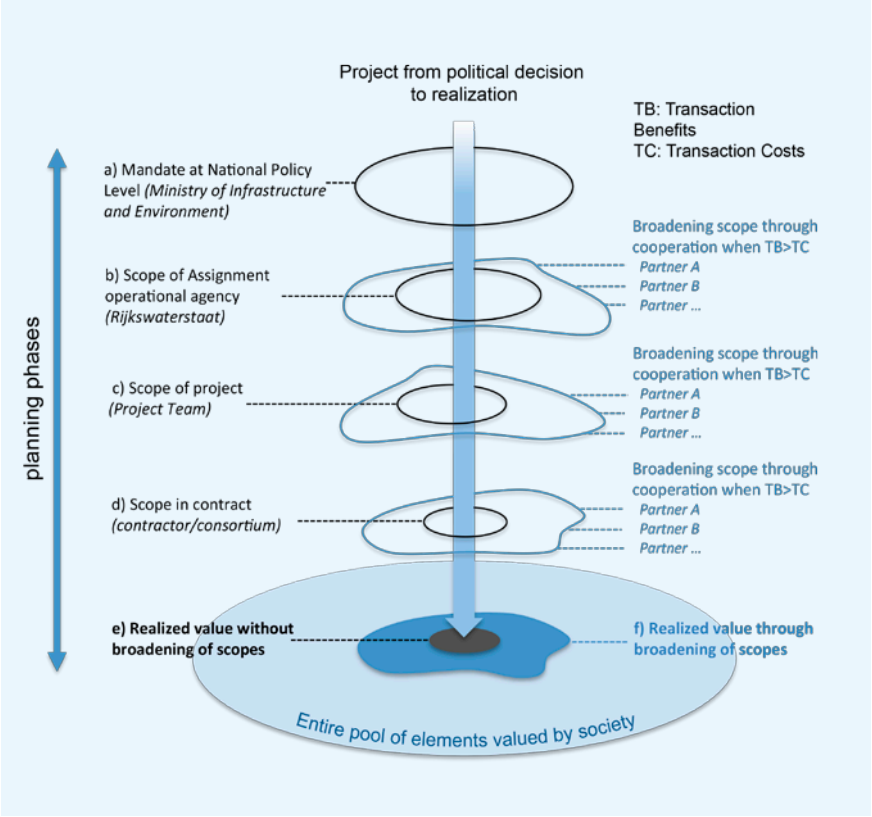

Figure 6-2: Cooperation at a variety of levels influences the societal value of projects.

The above-mentioned process could theoretically be brought into practice for each possible cooperative option. If this would not require any effort whatsoever, infrastructural developments would smoothly lead to maximized benefits, as well as minimized externalities. In practice, however, there are limitations. The coordination efforts (intra- and inter-organizational) will be growing progressively with the number of actors involved (Simon, 1965). After all, limitations in knowledge, combined with the sheer number of options and consequences, will boost several elements at the side of transaction costs. This means that increasing the degree of 'integratedness' will broaden the overall benefits and reduce a project's externalities, but at some point, this will be countered by the extent of the coordination costs, as shown in figure 6-3.

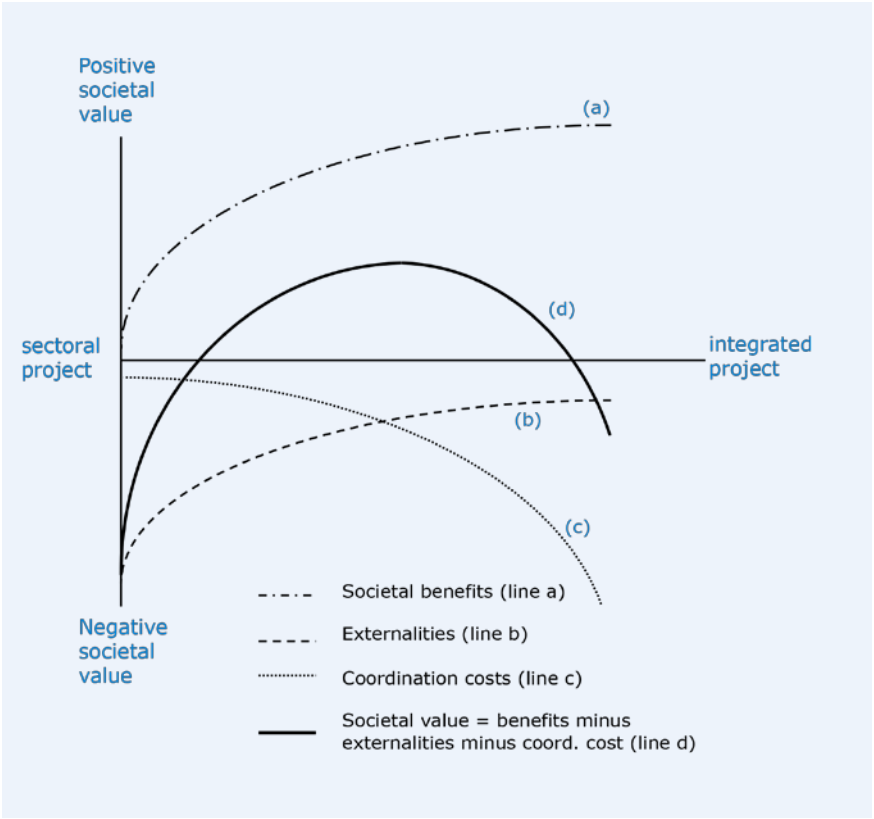

Figure 6-3: Societal value and the level of 'integratedness' of infrastructure projects

On the horizontal axis, the level of 'integratedness' is reflected, where at the left hand side a single sectoral goal of a single agency is pursued (not considering any stakeholder issues whatsoever), and at the right hand side, all actors having an interest in the area are engaged. The vertical axis shows the level of societal value added, which could also be negative. In line with policy intentions and literature, integrated planning (push to the right) will offer increased benefits (line a) and reduced externalities (line b). Transaction cost theory introduces a negative value element to this equation, as coordination costs (line c) will negatively influence the overall result (line d). It offers an explanation as to why comprehensive integrated planning is often not realized despite its widely supported advantages.

With the described concept in mind, one could conclude that optimization for societal value is a difficult task. Difficulty lies in such factors as the variety of options, involvement of diverse organizational levels and departments, coordination throughout the project phases and scarcity of information. Nonetheless, when implementing projects, choices are made (albeit on an informed basis or not) for the sake of steady progress. To gain insight in this process, it is important to know how these choices are being made, and how these relate to the transaction cost framework. In this article, the Dutch practice of waterway development is analysed and the elements on which the projects are optimized are linked to the mechanisms of value creation as shown in figure 3.

6.3 Materials and Method

The problem of finding a balance between sectoral optimization and integration of stakeholder issues plays a role in area-oriented planning in general (Heeres et al, 2015), and is of high importance for water-related planning in particular, due to the interconnectivity of water itself. When a single issue has become a dominant factor, it could block further balanced optimization of the planning process. Inland waterway transport often is such a dominant factor in countries where this kind of transport is of great economic importance. By carrying out an in-depth case study for this optimization problem, this phenomenon can be studied in its real life context. A single case study, the Rijkswaterstaat Agency, is chosen, as it enables the authors to study the phenomenon in detail. The Dutch context, and Rijkswaterstaat as the central agency responsible for waterway development, offers a rich and relevant context for investigating the limitations and opportunities for more inclusive approaches. This case is relevant for an international audience, as it is illustrative for the more broadly encountered difficulties in operationalizing inclusive approaches (Biswas, 2004; Pahl-Wostl et al, 2012). The Netherlands has a long history in waterway use and development, and even today these waterways are intensively used for freight transportation. More practically, the lead author of this article is working as a waterway specialist at Rijkswaterstaat, securing easy access to documentation, project locations and actors.

As previously mentioned, Rijkswaterstaat is the infraprovider responsible for management, operation and development of the Dutch waterways of national and international importance. Rijkswaterstaat should be seen as an exemplary case for authorities in national public management of infrastructure networks. The agency falls under the responsibility of the Ministry of Infrastructure and the Environment. Projects emerge through a formalized system of steps as prescribed in the MIRT process (Long term infrastructural, spatial and transport investments programming) (Heeres et al., 2010). The division of large projects and maintenance runs the actual development projects together with a regional division.

In case study, research data should be gathered in multiple ways, as each has its specific strengths and weaknesses (Yin, 2013). By combining these methods, an adequate image of the decision making-process can be given. The case study design for the Dutch case has been built up in two steps. The first step was a broad explorative study into area-oriented planning in Dutch waterway projects in 2014. To build insight in the broad context of waterway development, we made use of data from policy documents, project documents and 10 in-depth interviews with project officials (project officials are listed in appendix A, interview questions are listed in appendix B). The international PIANC (world association for waterborne transport infrastructure) working group on 'values of inland waterways' provided an international platform to reflect on the findings. This working group existed of representatives of seven waterways agencies (The Netherlands, Belgium, Germany, France, UK, USA, Egypt).

The second step of the study focussed on the specific working of transaction costs in practice. At the executive level, an in-depth interview was held with the chief financial officer of Rijkswaterstaat. At the project-implementation level, a focus group discussion was held with project officials. This group consisted of four officials: two project managers and two stakeholder managers of large waterways projects. The two-hour session was based on the results from the first step and was structured along four major questions related to the value of redevelopment and cooperation with stakeholders. After a brief introduction of the study's topic, i.e. cooperation with actors outside the Rijkswaterstaat agency, the following four questions were used in the focus group discussion:

1. Why do you cooperate?
2. How do you weigh and decide about cooperation?
3. What could be done better in anticipation of many projects replacing ageing assets?
4. What is required for that?

These questions formed the general lead of the discussion. Follow-through questions were used to deepen the detail of discussion. These questions addressed the elements of the theoretical framework as shown in fig 3; benefits (fig 3: line a), externalities (fig 3: line b), coordination costs (fig 3: line c), the positioning of the project in terms of 'integratedness' (fig 3: position horizontal axis), the overall value and optimum of the project (fig 3: line d), used methods to steer the outcome and type of projects. Value as a generic term was not used in the questions, as this term was considered to be susceptible to broad and varied interpretation, which might trouble the focus group discussion.

Data analysis took place by linking the statements to these same elements of the theoretical framework. The analysis resulted in an overview of generic planning aspects for each of these categories. The results anticipated for were the weighing of coordination costs against the potential gains in terms of benefits, and reduced externalities. Specific elements playing a significant role in influencing this choice to engage in transactions have been highlighted.

6.4 Results

The results of the study are discussed according to the categories as described in section 3. The central elements searched for were the acknowledgments of value propositions, and considerations and arguments weighing coordination costs against the gains in terms of benefits or reduced externalities.

6.4.1 Benefits

The data from both the first and second step of the study showed that benefits outside the scope of a project assignment are not investigated in a structured way. The level of inclusiveness appeared to depend on the

individuals and parties involved. *'You largely determine your own playing field. That's a chance and a risk. Therefore, it very much depends on the person'* – [interviewee, project manager]. One of the benefits captured that was mentioned several times, is partners' knowledge. This could be specific expertise or local knowledge of the area where the project will be realized. It was considered valuable to the project as it could reduce the risks of running into problems later on. Or, in the words of one of the focus group participants: *'You need them [local stakeholders]. They have lots of knowledge and expertise which neither we, nor consultants or contractors have on such a detailed level.'*

For other cases, combining projects to achieve economies of scope emerged as a potential additional benefit for projects. The evidence showed that this particularly played a role when local governmental bodies are planning on realizing infrastructural works adjacent to, or crossing, the project area. Cooperation was said to be found in including the local government's wishes in the project. If this were a clear 'extra', the costs would have to be reimbursed by the local government. For other cases, it was not so much seen as an extra, but a clear 'must' to seek cooperation with other on-going projects in the area. In such cases, certain issues could not be resolved within a single project, but needed to be addressed cooperatively.

No structured approaches came forward from the data for inventorying opportunities to increase the gains. But resistance against searching for opportunities did not seem to exist either. Whatever opportunity was identified, it had to have a logical link to the primary purpose of the project. In this context, one of the focus group participants literally stated: *'If I would have restricted myself to the project scope, I would have had difficulty realizing my project. I am forced to look beyond these limitations.'* Consensus amongst the focus group participant existed about the power of having a good story. If there is a good story to tell, with clear benefits, the flexibility to implement opportunities can always be found. Benefits, which fall within the scope of the ministry, were considered to be good candidates for inclusion in the project scope, even though this was not intended beforehand. Opportunities from outside, which do not benefit the project organization itself, were considered to be troublesome, as the agency is not programmed for outside partners with unexpected good ideas.

6.4.2 Externalities

The results showed that externalities are dealt with in two ways. First, externalities were addressed according to the legal framework for planning and implementation of projects. These legal frameworks included elements such as mandatory environmental impact assessments, spatial consent decisions, permits, and associated mitigation and compensation requirements. Externalities that typically came forward for waterways projects were loss of attractiveness of the landscape, various road traffic related issues due to rearrangement of adjacent road or rail infrastructure, and ecological effects. Actions to reduce externalities beyond legal requirements were sometimes taken as a kind of risk management for unsatisfied stakeholders. Not the externality was the issue here, but the potential influence of the unsatisfied stakeholder(s) on the progress of the project.

The second way that came forward, was communicating with stakeholders affected by the waterway development. Providing informative and reliable information about the effects of the projects was seen as helpful for acceptance of effects. Uncertainty and lack of solid information about externalities was considered a driver of resistance amongst stakeholders. Or, citing one of the focus group participants: *'A driver for resistance of people is uncertainty. What does it mean for my quality of living, permanently or temporarily?'* In terms of communication, it was also considered to be advantageous if planning took a long period of time. For the realization of a new stretch of canal, this was formulated by one of the interviewees as: *'They were against the canal but this opposition was limited. The advantage was that it had already been planned for a very long time. The plan came as a surprise to almost no one.'*

6.4.3 Coordination costs

A distinction was made between partners, who need to cooperate in order to make progress, and stakeholders, who need to be informed but are not required to take any action. The latter group exists of stakeholders exposed to project effects, but with no formal role in development. This group needs to be taken into consideration and a sound communication plan is often effective to

prevent opposition. The first group, for example agencies with the mandate to provide required permits, needs more dedicated attention, as their involvement in the project is more active. These were typically seen as partners to be stimulated to cooperate. A clear linkage was seen between these groups. If stakeholders in the area were strongly opposing the project, or opposing aspects of the project, it was less likely that the permits related to the project would be provided by local authorities. As stated by one of the focus group participants: *'A municipality is a formally involved party and you see that if inhabitants go along with the project, the responsible alderman will feel much more comfortable to cooperate in performing his legal obligations. When people are troubled by the project, he [the alderman] will resist much more for electoral reasons.'* Therefore, project teams had to put sufficient efforts in satisfying the local stakeholders in general, in order to ensure smooth cooperation with local authorities.

Local and regional authorities, like provinces, municipalities or water boards, are typical examples of permitting authorities for waterway projects. Due to the size and effects of the Rijkswaterstaat projects, these authorities may suddenly be facing exceptional amounts of work. Examples came forward where water boards did have a title to charge Rijkswaterstaat for these efforts, where others did not. In the latter case, the relationship could become difficult due to the lack of resources for cooperation on the side of the water board.

On the highest levels of involved agencies, trust is considered very important. If there is no trust between commissioners from different organizations, working relationships can become extremely formal, which is not at all helpful. One of the project managers phrased this as follows: *'If you can keep the roof watertight at the executives level, troubles can easily be taken away. But if these executives [from different agencies] start pointing fingers at each other, you will not be able to manage trouble away.'*

Recently, Rijkswaterstaat has adopted relation-managers, who oversee and maintain the relations with local and regional governmental bodies in the long term, overarching individual projects. The idea behind these functionaries is that projects come and go, but due to the regional interrelatedness of these governmental bodies, it is important to maintain contacts on a more continuous basis.

6.4.4
'Integratedness'

The central theme in the results regarding the level of 'integratedness' was the original scope of the assignment for the project. Cooperation with stakeholders was initiated only when this was expected to contribute to this assignment. Stakeholder involvement was expressed to be something that was required to reach the project goals, and for no other reason than that. Often, this was considered necessary for creating sufficient support at the local government level where permits needed to be granted. In cases where the scope of the project was altered to serve the needs of a local government, this was done for the same purpose: building support for the project. Cooperation sought was therefore instrumental to the original projects goals, or, as expressed by one of the participants: *'Suppose if I would implement a project with blinkers on, constructing a navigation lock and widening the canal. I would draw a line around it, and would not care about anything outside that line. If I had done that, I would have received no cooperation from the municipality at all.'*

Determining which stakeholder to build a relationship with was generally said to be based on the potential impact of the project to the stakeholder, and the potential impact of the stakeholder to the project. No exact criteria are used for these levels of impact. The decision is made intuitively, often jointly by the project manager and stakeholder manager. A focus group participant mentioned: *'When starting the project it is difficult to determine which stakeholder is important, and which one is not.'*

An important aspect with regard to stakeholder involvement was clarification of the room for adjustments. It was expressed that it should be made clear for all stakeholders what can be part of the discussion, and what decisions have already been taken and are therefore not open for discussion. About 15 to 20 years ago, most of these discussions did not have to take place as the stakeholders trusted the government to take their interests into account in the decision making process. This has changed considerably; nowadays stakeholders wish to be actively involved. At times, this was met with some scepticism by the agencies. Citing one of the interviewees: *'Staying within the scope is important, and other things are just ornaments. We are not here to be sustainable, but to build infrastructure.'*

6.4.5 Optimum

The participants of the focus group discussion reflected that no explicit consideration is given to the extent to which further cooperation adds to the value of the project. Implicitly, however, they recognized a kind of optimum. This optimum was considered to depend on the context, and would vary from case to case. This seemed to become difficult at times while trying to find fruitful cooperation with stakeholders, as energy starts lacking and resistance to interact with project officers seems to be growing. No particular tools or methods to determine this point were said to be used; it was expressed that this is a matter of experience and feeling. Paraphrasing one of the participants: *'There are no tools to determine the optimum. It is mostly the experience of the team. Experience and feeling.'*

6.4.6 Methods

We used a limited set of methods, related to seeking cooperation to increase the project value. Strategic stakeholder management was used to select which stakeholders to approach. Stakeholders were identified and categorized based on their potential impact on the project and vice versa. Categorizing stakeholder groups to apply strategic stakeholder management was done based on the opinion of project manager and stakeholder manager. Important elements are the potential of the impact of the project on that group, and the potential impact of the group on the project. Methods for evaluating opportunities to increase the benefits did not come forward, however, selection of team-members for the project team was considered to be important as this determines the sensitivity for detecting benefits. Generally, there is not a negative attitude against concepts other than the one being implemented. Good concepts always receive attention and careful consideration, or, as one of the participants stated: 'If you have a good concept, you always find support for that. And if you can show it is beneficial, a lot is possible within our organization.' Bringing projects into programs was also seen as a helpful strategy, as this generates power necessary to make changes happen. If benefits are identified which could work for multiple projects, it would be easier to implement these through a program of projects, than for an individual project.

6.4.7
Type of projects

The results from the second step of the study showed that distinctions were made between small and large projects, and between greenfield projects and redevelopment/renovation/replacement of assets-type projects. Large projects were considered to be easier in terms of seeking cooperation than smaller projects. Reasons mentioned for this were the limitation in resources for the project team to run a small project, as well as the lack of attention and commitment of high-level officers at the involved agencies. To quote one of the participants: *'There is a strange controversy in this. When there's a small project, because it is small, everyone thinks we can just take it along. Small in terms of money and area. [...] So at the top level, things are not arranged well. The roof is not closed entirely, because everybody thinks it is just a minor issue. It is perhaps for that reason that cooperation is more difficult.'*

6.5
Analysis and discussion

The Dutch waterway case shows a struggle in terms of realizing policy goals for broad optimization of waterway development versus project delivery targets. The institutions show a struggle to define, develop and capture value. Increasing benefits or reduction of externalities could increase overall societal value. Reduction of coordination costs could help to stimulate 'integratedness' which clears the way to adding benefits and further reduction of externalities. These notions ask for institutional innovations.

The results show that societal benefits of waterway projects do receive little upfront attention by project managers and their teams. The project managers primarily focus on risk reduction and risk management (Kerzner, 2013; Walker, 2015). However, as interaction with stakeholders grows, some benefits are captured through cooperative arrangements. The most frequently encountered benefits were economies of scope and economies of scale by incorporating adjacent work for local governmental entities, and special expertise provided by local stakeholders. Although the project teams appreciated these elements, these were not actively sought for. The data did show an opportunity scan has been developed within the agency with the purpose to actively seek for such opportunities. This tool is called 'Omgevingswijzer' (Heeres et al., 2015).

However, application of such a scan has not yet become standing practice. In current practice, it appears that the incentives for project teams do not direct the teams to increasing benefits, but these can be caught in the process. Benefits by third parties, not adding to the original goal of the project, were held off. From the point of view of project management, this is understandable, as it would raise coordination costs for the team without any pay-off.

In contrast to benefits, externalities do receive structured attention from project teams, as this is required by legal obligations (Arts et al, 2012; Morrison-Saunders & Arts, 2004). If externalities are further reduced, the project value could be increased beyond the level of these legal obligations. No evidence was found pointing directly in this direction. Further reduction of externalities did show to come into play indirectly, through attention paid to issues raised by stakeholders. Attention is mostly directed at those stakeholders with a potential to hinder project progress. So it seems that it is not the externality, but stakeholder satisfaction that is given priority in order to ensure timely project delivery and avoid budget overruns. For project management in general, these are core incentives, which do not align naturally with intentions to increase the projects' overall value.

According to the theoretical framework (figure 3), the third important element influencing the overall value of the project is coordination costs. The results show that a limitation of coordination costs determines the considerations to include or exclude cooperation with potential partners. Some partnerships were seen as very productive, such as partnerships with personally interested and engaged local individuals. Such partners would be able to effectively pave the way for the project by reaching out to the local community. In other cases, where cooperation was seen as crucial for success, the coordination costs at the partnering organizations were identified as problematic. If it was necessary to ensure such an organization's cooperation, ways to compensate the organization were sought in order to smoothen cooperation. The results showed that all situations involved some kind of balancing act; weighing the coordination costs against the beneficial effects of the cooperation for the project goals.

Project managers prefer to keep their project free of hard-to-manage external relationships, as bringing the project home within time and budget weighs heavily (Kerzner, 2013; Walker, 2015). But considering the policy intentions to increase societal value, and the crucial role of coordination costs in these

processes, more attention and sophisticated methods to evaluate deployment of resources for cooperative options would have been expected. In terms of 'integratedness' of projects, clear patterns were found. The results reflected that the realization of the single sectoral goal of the project is the underlying line of reasoning for almost any issue. It was mentioned that the strictly defined scope of the project is determining decisions about whether or not to engage in any kind of cooperation. This meant that all cooperative arrangements had to be adding to this assignment. The results show this generates a strong push to stay on the left side of the theoretical framework graph (fig. 3). In other words; further integration of issues, and therefore increasing benefits or reducing externalities, is not so much strived for, but tolerated in order to achieve a predetermined sectoral result.

6 . 6

Conclusions and recommendations

Countries with an ageing waterway system are facing the significant challenge to renew and improve these systems for modern society. Responsible agencies wish to carry out this renewal in a way that benefits society in a broad sense. An inclusive and integrated approach is advocated in policies (Koontz & Newig, 2014; Pahl-Wostl et al., 2010). Such integrated approaches require cooperation with partners outside the agency (see fig. 6-2). This is because issues outside the scope and mandate of the agency are to be addressed. These issues are studied in the Dutch case of waterway redevelopment. Through document study, interviews and a focus group discussion with practitioners, addressing of these issues in practice is analysed.

The analysis is based on the presumption that value beyond the scope of the agency requires cooperation with external parties. Value comes forth from satisfying a broad set of stakeholder issues through these cooperative arrangements (Page & Susskind, 2007; Raiffa, 1982). Broader satisfaction of stakeholders' needs also involves an increasingly place-oriented planning practice for waterway redevelopment. From a theoretical perspective, the overall value of a project can be increased by three elements: increasing benefits, reducing externalities and reducing coordination costs. The coordination costs relate to the cooperative options, which are required to improve the value beyond the mandate of the responsible agency.

6.6.1
Integrating additional benefits

The data revealed a clear pattern of decision making in developing waterway projects. The Dutch case shows that the central guiding principle in redevelopment is the reduction of risks in terms of time and costs. In all considerations whether or not to engage in interaction with external parties, this appeared to be the basis for decision-making. Integrating issues into the project by engaging with stakeholders came forth from risk reduction considerations, and not so much from increasing benefits or reducing externalities. Project teams appeared to be driven to reduce complexity. Further integration of functions or values into the project is allowed only if this will contribute to achieving the sectoral goal. This means that despite policy ambitions, increasing societal value is not actually strived for in practice. From the perspective of project management, this is understandable, as timely delivery of the project within budget is a universal way of measuring project management success.

The results showed that the major driving force for integrating stakeholders' issues into the project is reduction of risk for the primary project goal. This did not mean that benefits resulting from cooperation with stakeholders were not recognized. Two groups of benefits came forward. Knowledge and expertise from local stakeholders groups, agencies, or individuals, were highly valued by the Dutch waterway authority. Secondly, large waterway projects often touch upon many other infrastructural issues related to the project, which appeared to open up opportunities for economies of scope and economies of scale. Work for other agencies can be, and often is, integrated into the project in order to achieve overall cost reduction and increase project support.

6.6.2
Reduction of externalities

The Dutch case also shows that the efforts to reduce externalities in order to improve the overall value of the project are limited. Externalities are reduced to bring them within the limits of legal requirements. This can be considered a logical approach, as the agency is responsible for legitimate spending of taxpayer money. Indirectly, however, extra efforts were witnessed to reduce those externalities, which are closely tied to the resistance to the project.

Affected stakeholders with a potential to delay or block the project need to be satisfied. The Dutch waterway authority also anticipated for a second order effect. Limited local support for a project was seen as an indicator for difficult permitting processes, which was considered to be a high risk for achieving the project goals.

6.6.3 Reduction of coordination costs

The third component in the theoretical framework determining value is the coordination costs. These are the costs related to cooperation with actors outside the agency. The study showed that project officers base most of their decisions on experience and expectations. Priority was given to actors expected to be affected most, or having the highest potential to delay or block the project. Trust between partners is seen as an important requisite, which is in line with theoretical expectations as higher levels of trust ease the way for fruitful cooperation and harvesting mutual gains (Edelenbos & Klijn, 2007).

Overall, the Dutch case shows that incentives and behaviour in project management are not in line with general policy intentions to increase the overall value. Risk reduction is primarily directed at holding back the level of 'integratedness', whereas higher levels of integration are required for increasing the overall value. Project officials recognize this controversy. The focus on integrated planning is acknowledged, but within the current context it is difficult to align policy aims and project incentives.

6.6.4 Recommendations

The results of the study show that a structured approach to determine benefits, externalities and coordination costs and the trade-offs to be made would be helpful in practice, as this would make it possible to follow a much more explicit and business-like process of decision-making. And although such a rationalized approach can be helpful, one should bear in mind that the decision processes take place in a dynamic context where a variety of factors, other than rational ones, play a role (Simon, 1957).

Practical operationalization of this recommendation could be achieved by making project teams accountable for the inclusion of additional benefits in the project. These benefits can be identified through stakeholder relationships. Additionally, the project teams could be forced to carry out an 'opportunity-scan' (Heeres et al., 2015) to detect the possibilities for increasing value. When operationalizing an inclusive approach, special attention should be paid to renewal or renovation projects. These should be treated as if these were new projects, in order to avoid a straightforward rebuilding of current functionality where society is perhaps better served by a different set of functionalities.

In practice specifically, coordination costs appeared to be underexposed. This reveals the paradox that only well-sourced agencies can tolerate limited attention for these costs, while at the same time well-sourced organizations may be expected to have most opportunity to optimize their projects. The importance of attention for coordination costs is that these determine the tipping point of additional value for the project. Practice could therefore be helped by developments of tools and methods which a) provide insight in these costs and b) enable actors to reduce the transactions costs. Introduction of dedicated tools, standardized approaches or specialized officers or teams can, for instance, achieve reduction of these costs. Reduced transaction costs will allow more mutual gains to be captured. The point of optimized results of the project would reflect further integration of stakeholder issues and higher satisfaction degrees of these issues.

With regard to planning and implementation of infrastructural projects in general, the study has revealed two contrasts. Broadening value for society means a stimulus for wider interaction with actors related to the project area. This contrasts with project management incentives that try to avoid interactions, which do not directly add to delivery of the project. The challenge lies in aligning incentives. The second contrast is the importance given in literature to coordination costs as a decisive factor in building value, and the limited consideration this receives in practice. A structured approach, which would involve systematically identifying, monitoring and managing costs, would certainly be helpful in dealing with these costs.

More generically, the Dutch case shows a set of key hindrances which are internationally relevant. Key hindrances are poorly aligned policy ambitions with project incentives, limited systematic attention for coordination costs, and

limited availability or application dedicated tooling to increase socio-economic value. These hindrances can be addressed by a set of institutional innovations, which are helpful in stimulating socio-economic value in waterway development. When operationalized, these form the basis for more structured decision-making and aligning policy aims for socio-economic value with project management incentives. The set of innovations is as follows:

- Stimulation of wider interaction with stakeholders
- Including opportunity scans
- Making project teams accountable for seizing value opportunities
- Increasing transparency, monitoring and management of coordination costs
- Treating renovations and renewals of assets as new projects
- Aligning policy ambitions with project incentives

Contemporary practice in Dutch waterway development does show that practitioners are aware of and sensitive to issues related to increasing societal value for waterway projects. Practitioners are thinking on how to proceed, and are trying to take steps in a forward direction. The case shows that practice of Dutch waterway development seems to be changing.

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CHAPTER

7

Conclusions and recommendations: planning for redevelopment

ABSTRACT

In this chapter, the conclusions and recommendations of the study are provided. The central research questions are answered one by one followed by general conclusions about the central issue in this study; understanding the value of waterway redevelopment. The answers to the research questions also provide the building blocks for a planning approach for broadly valued waterways. These building blocks have been translated into a five-step approach to build value for infrastructure projects in a multi-actor context. This five-step approach is explained in detail and is meant to provide practitioners guidance on the basis of the finding on this study. This chapter concludes with stepping back from the details, and identifying three major elements where room for improvement in waterway planning can be found when pursuing the creation of value. First, the institutional analysis performed in the study showed that room for improvement lies in aligning incentives in project management with policy ambitions. This is because value comes from integrated approaches, but in project management the incentives direct decisions towards decreasing interactions. Secondly, brokering of interests helps including the broad set of issues in the optimization process efficiently. And thirdly, Increased and structured attention for transaction cost which come with inclusion of multiple interests would support value optimization efforts. These three elements proved to be key when planning for redevelopment of an ageing system in modern society.

7.1 Introduction

'Waterways, ways of value. Planning redevelopment of an ageing system in modern society'. This is the full title of this dissertation. A title of a book often reflects its content; for this dissertation, the title is indeed a reflection of the topic and the study done. Waterways can be seen as valuable infrastructure for society, and not only for its transportation function - it is valued in many more ways. The study shows a variety of examples of broad appreciation; in the cases of redevelopment projects, many elements as appreciated by society have been described in more detail. But 'ways of value' also has a second, more indirect meaning. It suggests value can be found, created or uncovered in multiple ways. In this study the fundamental possibilities and the practical approaches are shown.

The subtitle of the dissertation starts with saying 'Planning'. The research efforts did not aim to provide a 'best waterway system' as a kind of blueprint for society, instead, the intention of the study is to provide an approach that can be used for redevelopment of waterways. Planning in light of this study means coordination and action by various actors guided through institutional structures. It is these efforts and interactions that play a central role in this study.

The second word of the subtitle is 'redevelopment'. It suggests there is an existent system, which is in need of alteration or improvement. As the reader might have noticed, all chapters 1 through 6 refer to this need for redevelopment. The remainder of the subtitle provides clues for this need: '...of an ageing system in modern society'. Many assets like navigation locks, weirs, pumping station, dams, are ageing and due for renewal. The phrase 'modern society' is added for a reason as well. In the past, the solutions called for by society were different from the ones called for by our current, modern society. And not only are the called-for solutions different, they also need to function well in changing climatologic circumstances. Simple re-engineering of assets, which are to be replaced, would fall short in terms of societal expectations (Pahl-Wostl, Jeffrey, Isendahl, & Brugnach, 2010). It is for this reason a new approach is to be found, one that takes into account the wide variety of issues valued by society; planning for value.

In general, the topic as described does not seem to be understood well. In their planning activities, institutions responsible for waterway development do not take into account the broad value waterways can provide to society. Or if they do, their efforts appear to have a limited reach and effect (Allan & Curtis, 2005; Biswas, 2004; Brink van den, 2009; Pahl-Wostl, Lebel, Knieper, & Nikitina, 2012) The study takes an international view on the topic, with a focus on Western countries where redevelopment is foreseen. For these countries, a change is needed (Pahl-Wostl et al., 2012), breaking with classic assumptions and traditions, in order to realign waterway planning with contemporary needs and requirements.

Realigning waterway planning with contemporary needs and requirements is the reflection of realizing the potential societal value of waterways when redeveloping these. Acknowledgment of this value is generally insufficient, despite widespread market-oriented types of governance in Western countries (Bryson & Crosby, 2014; Saleth & Dinar, 2004; Stoker, 2006b). And when this value is acknowledged, it is a complex puzzle to be resolved due to the many interests, actors and options (Bryson, 2004). Acknowledgment of the value and finding ways to realize this value is a key issue to coordinate for waterways in the future. The general objective of this study is therefore to increase understanding of how societal value in waterway development can be realized and finding practical ways to increase the value of waterway projects.

In this chapter, the conclusions and recommendations of the study are provided. It shows the key issues of a planning approach where value for society is the key element. In the following section the central research questions, as described in 1.4.3 will be answered one by one. Answering these questions provides the building blocks for a planning approach for broadly valued waterways. In section 7.3, the general scope and objective of the study is discussed. This section also provides recommendations and the generic relevance of the study. The study also provides insight in directions for further research, which could further improve planning for redevelopment; these are given in section 7.4. Section 7.5 and 7.6 are set-up to translate the results of the study into options for practical use by professionals involved in waterway redevelopment. In section 7.5, the results of the study have been bundled into a five-step approach to build value for infrastructure projects in a multi-actor context. Subsequently, in section 7.6, the three key issues as central building blocks in this study are highlighted: alignment of incentives, brokering of interests and transaction costs related to that.

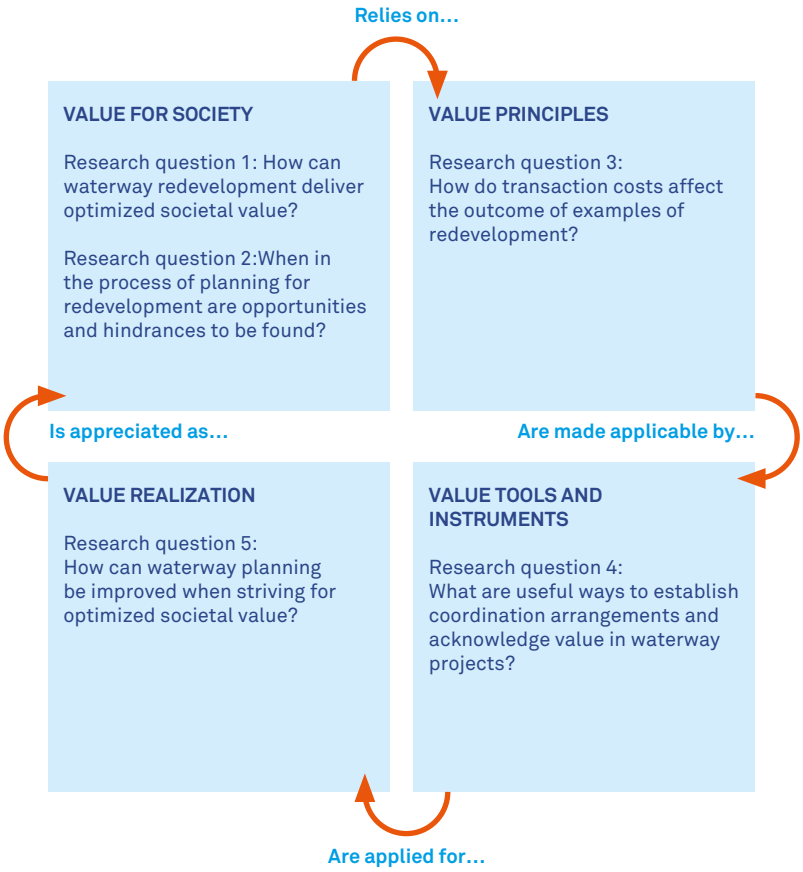


Figure 7-1: Research questions in relation to the conceptual framework

7.2 Analysing the value of waterway redevelopment

In this study to a planning approach for redevelopment of waterways an institutional-economics perspective is taken on this redevelopment process. In section 1.5, this research approach is explained in more detail. Internationally, a public re-drawal and a shifting position of the public sector is witnessed. The shifting position features a market-oriented type of governance and an entrepreneurial way of working (Bryson & Crosby, 2014; Pahl-Wostl et al., 2012; Stoker, 2006a). The research questions, as discussed in 1.4.3, fit such a context.

The questions have a rational economic angle related to the institutional context of waterway redevelopment. The research questions for the study address the issues of a set of building blocks for societal value in waterway development. Figure 7-1 shows the research questions as related to these building blocks. These building blocks show in what way societal value is related to the more detailed issues of planning practice, and vice versa. In this section the results of the study are provided in answer to the research questions related to these building blocks for societal value.

7.2.1 Value for Society

Value for society of waterway development comes forth from the appreciation of elements of these waterways by the public. This raises a generic question on how to build on this spectrum of appreciated elements and a more specific question of when in the process of development opportunities and hindrances can be found. The first two research questions address these topics.

Q1: How can waterway redevelopment deliver optimized societal value?

In chapter 2, the discussion mainly focused on this question. From the empirical evidence of the study, a set of five notions come forward that play a key role in delivering optimized societal value for waterway redevelopment. In brief, these reflect the legacy of the past, current needs, future uncertainty, brokering of interests, while the fifth notion is about coordination.

First, and perhaps most obviously, waterways were developed in an era that was different from today's society. The functionality built into the design of the system quite often still reflects the needs and ideas of those times. In practice, this means the system was designed for a small functional envelope. The transportation function was often one of the main issues, sometimes combined with one or a few others.

The second notion that came forward is that redevelopment of waterways in Western countries touch upon the interests of many stakeholders such as farmers, hydropower companies, tourist industry, nature conservation groups and mining companies. A rich context surrounds the waterways, and these are valued for many reasons. If, for example, the water level would be raised to facilitate deep draft ships, groundwater effects would be felt in a wide area.

Some stakeholders could benefit just like the shipping industry (e.g. farmers in need of moister soil), while others would incur damage (e.g. basements or foundations affected). These examples not only show there are pros and cons, but relate to entirely different issues as well.

The third notion relates to future uncertainty. The findings of the study as shown in chapter 2, suggest there is no optimal way of planning for value as a kind of blueprint system optimisation. As said, water relates to many stakeholders, and these stakeholders value these waters for many reasons. And as time will evolve, one might expect these stakeholders, and their priorities and valuations of issues, will change as well. A blueprint for an optimized system will inevitably miss a variety of hard to predict developments.

The fourth notion comes forth from a variety of examples drawn from current waterway development practice where stakeholder issues have been successfully integrated into a project. Brokering of interests takes place, in some situations accompanied by compensations to pay off the stakeholders that are worse off, but allowing for further optimization. This notion shows how creation of value can take place, with real-world pieces of evidence leading the way.

The previous notion led to a fifth notion; a clear difference in outcomes between alternate planning regimes. In chapter 2, the example of the 'Hoven canal' shows the difference between a traditional sectoral way of planning and an alternative, inclusive way of planning. In the latter, society benefits in a much broader sense, but this requires considerable action and coordination by the waterway authority. Without providing the specific strategy, or solution to this problem, the example shows that it is possible to have redeveloped waterways, valued in a broader sense than current waterways.

As mentioned, an inclusive way of planning - as often advocated for - has it challenges. If a waterway authority is urged to take action, it might be inclined to focus on the essence of the urgency to take action, and not so much on the opportunities and possibilities surrounding this issue. A focus on 'hedged problem solving' requires fewer resources than a broader approach. The broader approach might include issues beyond the mandate of the authority and can therefore be considered to be problematic.

All together, it is clear that waterways can deliver value to society in a broad sense, as shown in chapter 2, but current practice appears to fall short in developing the full potential. Cooperative strategies appear to be useful for developing this potential, as this is a way to optimise beyond the scope of the waterway authority itself. However, these cooperative strategies have shown to be troublesome as well, as they require transactions, and transactions come with costs. It is for these reasons that cooperation with a keen eye on the associated costs of transactions are important to increase societal value when redeveloping waterways. In other words; a clear and inclusive approach is needed, taking into account the downsides of cooperative strategies as well as the upsides.

Q2: When in the process of planning for redevelopment are opportunities and hindrances to be found?

Navigable waterways often have a long history of improvement for the shipping sector. Improvements have to be planned, prepared and implemented. For this reason, many countries formed public waterway authorities. Through institutional analysis of two waterway authorities' decision-making in and around mentioned organizations, insight is gained into where opportunities and hindrances lie to increase value for society in the planning process. The findings, as discussed in chapter 3, make clear that both authorities show signs of well-developed hierarchies and structured ways of decision making to serve the organisation's mission. In other words, vertical coordination is well-developed and institutionalized.

With regard to creation of value, the study shows the importance of seeking cooperation beyond the mandate and scope of the authority itself. In other words, the horizontal coordination is important when pursuing societal value. The institutional analysis made clear that the investigated national waterway authorities recognized such opportunities and aim to realize such potential. According to theory, in the entire field of related action arenas, the rules should be aligned to support this desire. This appeared not to be the case. The vertically well-developed structures are not optimized to allow for this.

Most striking examples are found in the planning and implementation phase. The lack of alignment of scope rules (the range of outcomes that can be affected by decisions), aggregation rules (how decisions of actors are taken, for instance based on majority or unanimity) and pay-off rules (distribution of benefits and

costs for actors) to support broader optimization is found to be a hindrance. It is in these phases that project managers are in charge and have considerable authority and room for decision-making. In terms of the actions arenas, this led to the findings that the rules of the action arena in this phase are focused on efficient project realization, risk adversity and the reduction of complexity. For waterway authorities it would be helpful to align project management incentives with policy ambitions.

7.2.2 Value principles

Value for society relies on value principles. These principles form the fundament on which maximization of value can take place. As this optimization takes place in a context of institutions, maximization of value can be defined as an institutional economics optimization process. Transaction costs economics is key to such optimization. Transaction cost economics reveals the influence of drivers and hindrances when integrating appreciated elements in the waterway development process. Real world examples bridge the theoretical notions with practice, as is shown in chapter 4.

Q3: How do transaction costs affect the outcome of examples of redevelopment?

As concluded previously, value can be increased by cooperative strategies. Such cooperative strategies include multiple actors in the developments process and require transactions between these actors. Logically, transactions only take place if both parties expect to gain. Whether or not parties can gain from a transaction depends on the value principles they address. The above-mentioned elements can be referred to as the benefits of transactions. But, as mentioned before, transactions are not without costs – they come with a multitude of cost elements, which can be real, or sometimes perceived, but in either case these form a counterweight against the benefits. If this counterweight is too heavy, the transaction is not perceived as beneficial. In fact, the transaction leads to specific benefits and specific costs for each party involved. For each party, the benefits need to outweigh the costs in order to have a deal which is indeed beneficial for both. Logically the deal will be off if this is not the case for either one of the parties.

There is, however, an additional condition that can impede the realization of a deal, even if the deal is perceived as beneficial for both parties. If the best alternative to a negotiated agreement (BATNA) for either one of the parties is to be preferred over the agreement in casu, no deal will be made. In practical terms, this refers to the situation that resources can only be invested once, and the most beneficial way is to be preferred. So if a 'win-win' situation between party A and B is recognized, a better 'win-win' for instance between party A en C, or a situation without an agreement but with better-perceived results can prevail.

Last but not least, it goes for both parties that it must be possible to seize the benefits that come forth from the transaction. In other words; benefits have to be captured to be actually appreciated as benefits. The exception is if this is seen as a strategic value, for instance to improve reputation. In that case, the benefits are expected to be gained in future operations, rather than directly from the transaction considered.

By considering elements of transaction costs and transaction benefits, a more fundamental understanding of the process of value optimization is gained. Maximizing benefits is certainly important, but minimizing transaction costs equally so. As far as the latter is concerned, it would certainly be helpful in practice as it opens up new opportunities, provides more room for iteration towards optimized results and reduces cost in general.

7.2.3 Value Tools and Instruments

Value principles need to be made applicable in order to resort effect in practice. Coordination arrangements are needed to translate these principles into practical results. With a recurrent need for coordination in a multi-actor setting and interrelated issues, tools and instruments are effective ways of achieving this. However, as shown in chapter 5, effectiveness depends on how these tools and instruments address the value principles in a balanced and harmonized way.

Q4: What are useful ways to establish coordination arrangements and acknowledge value in waterway projects?

In practical terms, the value principles need to be translated into useful coordination arrangements for planning in practice. As they encounter these problems on a regular basis, waterway authorities have a variety of tools and instruments at their disposal to support multi-actor-optimization processes. The use of such tools can improve the institutional capabilities significantly. The tools and instruments found in this study fall into five types of governance; (1) permitting instruments, (2) financial instruments, (3) contracting instruments (4) cooperative instruments, and (5) trading houses. The challenge for waterway practitioners is to find a mix of governance types that fits the coordinative needs of an institutional setting and waterway context. This mix should effectively address transaction costs and transaction benefits in order to pave the way for realizing value. Tools applied in practice showed a rather dispersed image of transaction cost and transaction benefit elements addressed. Essentially, this is positive in terms of capabilities for increasing value. However, in practice, just a few tools and instruments are used for each individual project, so only a limited set of relevant parameters in the equation is addressed.

For value capturing mechanisms, the variation of mechanisms addressed was found to be even more restricted. Reduced risk and/or cost receive most attention. Other mechanisms, like sharing costs/risk or increasing return flows and adding new return flows, appeared to receive little attention. In terms of value capturing options, significant improvements for current practice could be gained by bringing these elements into the development process in a more substantial way. More generally, current practice could be improved by mapping out the value elements addressed by tools and instruments, which enables deployment of these tools and instruments in a balanced and harmonized way.

In this study, a distinction has been made between waterway projects with a focus on replacing assets, a focus on waterway improvement and projects with a primary focus on flood protection. Projects framed as waterway improvement received the broadest attention in terms of addressing issues related to creating and capturing value. Projects with a focus on replacing ageing assets were often framed more narrowly, leading to limited attention to the wider spectrum of value elements. Flood protection projects seemed to fall somewhere in between the former two in terms of attention for the broad spectrum of value elements. In practice, value can be increased by keeping an open eye for value

opportunities for all types of projects, as no evidence was found that projects framed as straightforward replacement of assets offer fewer opportunities than other projects. The same counts for projects that are seen as major overhauls or renovations.

7.2.4 Value Realization

With value for society in mind, value principles defined, and tools and instruments at the practitioner's disposal for effective coordination, actual realization of value in waterway development can take place. However, as discussed in chapter 6, practice does provide its hurdles and incorporating all mentioned elements is challenging. By analysing waterway planning practice in the waterway-rich Dutch context, guidance was found for practitioners.

Q5: How can waterway planning be improved when striving for optimized societal value?

In many countries, current values of waterways are under pressure due to changing societal requirements, ageing assets and climate change. Exemplary is the Dutch waterway network, which is - similar to networks in other Western countries - in need of adaptation. The results of the study show that practitioners already seem to be sensitive for opportunities to improve societal value of waterway projects. Not only did practitioners seem to be sensitive to this; the policy field also shows strong ambitions to move towards value arrangements. Policy documents and directives include elements like improving cooperation with local governmental agencies and seeking cooperation with regional initiatives relevant to the infrastructure managed. This means there seems to be fertile ground in the Netherlands for advancing towards more value-oriented approaches aiming at integrating a wider variety of stakeholders' interests and achieving higher degrees of satisfaction of those.

The study shows that coordination costs are a major factor when applying value-oriented approaches aimed at high degrees of stakeholder-issue integration. Not only do these efforts provide a direct cost as they are resources-consuming, but more importantly, they influence the entire equation. Reduction of those costs can automatically open up new opportunities and provide more room for optimization iterations. The results of the study make clear, however, that coordination costs do not receive a great amount of attention in practice. As

discussed in chapter 6, increased and structured attention for these costs would support value optimization efforts. As mentioned earlier, the institutional analysis of waterway authorities revealed strong policy ambitions to seek wider cooperation with actors in the field. This was found to be in contrast with the operational level. In project management, the incentives appeared to direct decisions towards decreasing complexity and interactions. This is not to say that interaction has to be avoided, but the incentives appeared to solely stimulate interactions with an aim to decrease risks for project implementation. In other words, seeking interaction in order to increase value in a broader sense is considered to be resources-consuming and has no pay-off to the project team. Therefore, it would certainly be helpful to align project management incentives with policy ambitions.

Although the study highlights the crucial position of transaction costs in the optimization process, the study shows that coordination costs, externalities and benefits, all three influence the overall outcome of projects. Externalities receive structured attention due to the applicable legal framework including mandatory environmental impact assessments. The importance of coordination costs has been highlighted in the previous section. The third component, the benefits, should similarly receive dedicated attention as well. Typical opportunities that emerged were synergetic alignment of actions with municipalities and water boards, for instance by combining or integrating construction works. Other examples were the shared use of local knowledge, expanding the recreational possibilities, or amplifying the general aesthetic appeal in order to enhance the appreciation of an entire area.

Another practical way to improve value, as discussed in chapter 6, is performing an ‘opportunity scan’ at the initiation of each implementation project. Performing such a scan emerged as way to ensure beneficial elements receive dedicated attention. Such a scan has already been developed in Dutch practice; it is called the ‘Omgevingswijzer’. This scan ensures attention at an early stage of the project for a broad set of topics that might play a role, but could be overlooked easily.

Besides identification of opportunities, the findings also suggested ways to operationalize improved waterway planning. If project teams are made accountable for including additional benefits by building on relationships with stakeholders, the overall proposition could improve significantly. This

suggestion is actually an operationalized element of the recommendation to align project management incentives with policy ambitions. A variation of this option is to operationalize this alignment of incentives by analyzing opportunities beforehand, and then include additional benefits straight into the assignment for project implementation.

7.3 Understanding the value of waterway redevelopment

The general objective of this study is to increase understanding of how societal value in waterway redevelopment can be realized, and to find practical ways to increase the value of waterway projects. The findings of the study have emerged based on international investigations of waterway projects and related institutions. Waterway systems in Western countries were particularly good candidates for studying value creation, as these offer such rich contexts. Water is tied to many societal functions and is appreciated in many ways. And as Western countries were early in developing their systems, these counties need to deal with ageing assets urging them to take action.

The study looked at current international waterway development practice by investigating waterway development in the Netherlands and the USA. For both investigated situations, the data showed well-developed and institutionalized vertical coordination structures and activities, specifically with regard to the navigation function of these waterways (see chapter 3). Clear examples of such vertical orientation are the hierarchic structures from ministries to the operational waterway agencies like the US Army Corps of engineers in the USA and Rijkswaterstaat in the Netherlands. Broad optimization, however, means acting beyond the vertically organized silos with their restricted width of focus. Acting beyond the vertically organized silos requires horizontal coordination. Such coordination includes entities outside the hierarchical influence of the national bodies responsible for waterway development. These could be, for instance, municipalities, provinces or private sector entities.

As both of the investigated national authorities responsible for waterway management showed to be keen on moving forward towards value-oriented approaches, enforcement of horizontal coordination was recognized to improve the value proposition. By taking an institutional economics perspective, a framework was developed to analyse current practice of horizontal coordination

of these authorities. As explained in chapter 4, this framework shows that seven principles are fundamental for waterway authorities to deliver broad societal value beyond their restricted mandate. These principles are;

1. To create value beyond your own abilities, you need to seek cooperation,
2. To build value in cooperation, some sort of transaction needs to take place,
3. Transactions need to be beneficial for both parties,
4. However, transactions come with costs as well,
5. The benefits need to be greater than the costs for each party,
6. The result of the transaction needs to be better than the BATNA for each party,
7. It has to be possible to capture the benefits.

Principles 3 and 4 refer to the benefits and the costs that come with transactions and need some more explanation. The benefits and costs can be split up into multiple elements. With regard to the benefits, the following six elements can be distinguished; (a) Joint assets value surplus, (b) Joint surplus of complementary skills, routines and capabilities, (c) Cooperative use of asset X increasing pay-off generated through asset Y, (d) Economies of scope, (e) Economies of scale; and (f) Level of trust.

In terms of transaction costs, a total of eight elements can be distinguished: (a) Exploring and evaluating cooperative options, (b) Preparing, crafting, negotiating an agreement, (c) Inter-agency coordination: local representation, preparing and attending meetings, communicating, (d) Intra-agency coordination: communicating, administrating, and addressing partnership issues internally, (e) Education and training related to the cooperation, (f) Monitoring interagency issues, (g) Transaction enforcement (e.g. dispute resolution, litigation, financial hostage); and (h) Activities for building trust.

With such a framework, current practice was investigated and further insight was gained. As waterways relate to many stakeholder interests, optimization of projects in a multi-actor setting is a common challenge for waterway authorities. In other words: horizontal coordination strengthening is encountered frequently. For this purpose, these authorities have developed tools and methods. Transaction cost theory provides a powerful framework to investigate the elements addressed by these tools and instruments (chapter 4). With all above-mentioned elements of the framework in mind (the seven principles, transaction

benefits elements (a-f) and transaction cost elements (a-g)), these tools and instrument were identified, classified and structured in a systematic way (chapter 5).

The results of the study show that, in practice, a broad set of tools and instruments is used to improve the value proposition of projects (chapter 5). It was found that a great variety of instruments and tools are used in practice to influence the value outcome of projects in a positive way. Tools and instruments with a specific focus to investigate the balance between coordination costs and benefits, or with a focus on the reduction of coordination costs, were limited in number. When the toolbox for practitioners were to be equipped with such kind of tools, this would add to the repertoire of possible actions that could be taken. This also led to the notion that applying new mixes of tools and types of governance can be considered an emerging issue in the waterway sector. Selecting of effective mixes of governance, improving tools and instruments and

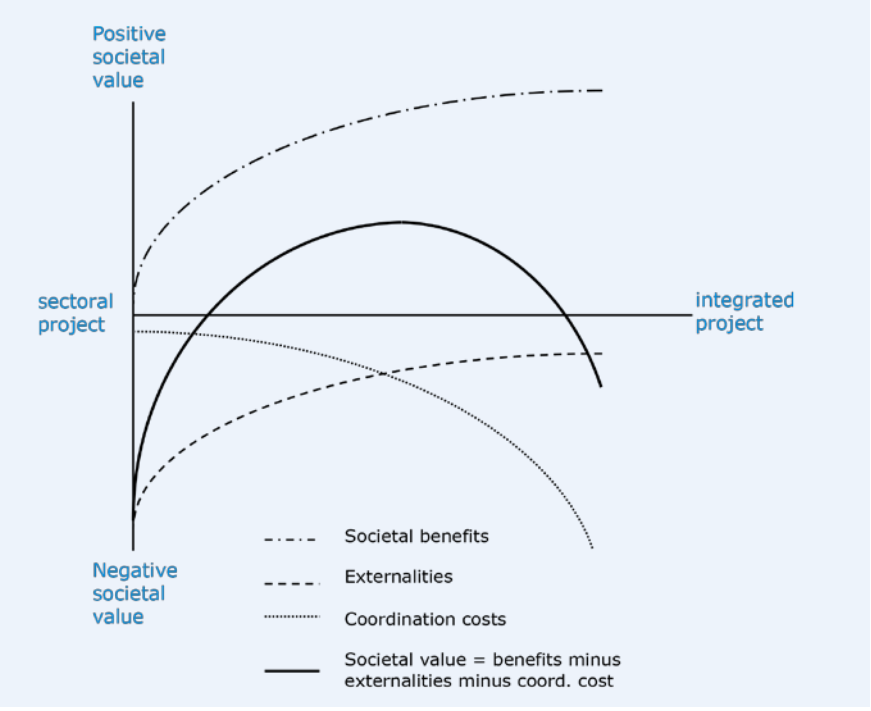


Figure 7-2: general concept of value in projects.

providing guidance for harmonization of deployment of tools could strengthen the advancements in the sector.

In general, coordination costs appeared to be underexposed in all optimization efforts of waterway authorities. The importance of attention for coordination costs is that these determine the tipping point of additional value for the project as shown in Figure 7-2. The lines in figure 2 show the trade-off due to these coordination costs in a schematic way, although the exact positions are hard to determine. With these trade-offs in mind, practice could be helped (see chapter 6) by developments of tools and methods which;

a) provide insight in coordination costs, and
b) enable actors to reduce the coordination costs.

Standardized approaches, dedicated tools, or specialized officers or teams could achieve reduction of these costs. A structured approach, which would involve systematically identifying, monitoring and managing coordination costs, would certainly be helpful in dealing with these costs.

In summary, the study provides a set of key hindrances that are internationally relevant. As set out in chapter 6, key hindrances found are poorly aligned policy ambitions with project incentives; limited systematic attention for coordination costs, and limited availability or application dedicated tooling to increase socio-economic value. These hindrances can be addressed by institutional innovations, as come forward from the focus group discussions held. Identified innovations helpful in stimulating socio-economic value in waterway development are;

- Stimulation of wider interaction with stakeholders,
- Including opportunity scans,
- Making project teams accountable for seizing value opportunities,
- Increasing transparency, monitoring and management of coordination costs,
- Treating renovations and renewals of assets as new projects,
- Aligning policy ambitions with project incentives.

When operationalized, these form the basis for more structured decision-making and aligning policy aims for socio-economic value with project management incentives.

This study focused on redevelopment of waterways. The aspect of redevelopment also brought specific relevant elements to be aware of. In current practice, distinctions are made between renovation and new construction projects. These distinctions are rooted in institutional aspects related to financing these projects. But the distinction brings a downside: renovation projects do not always receive the full attention in terms of development potential. The results of the study revealed that action was aimed at restoring or improving existing functionality, instead of trying to optimize in a broader sense in line with societal needs. By giving these kinds of projects the same attention that new projects receive, the societal value of renovations can be improved as well.

7.4 Generic relevance of the conclusions

The angle of this study is a institutional economic one and focused on waterway development by taking the Dutch and American context as exemplary for waterway redevelopment in Western countries. The study was set up to have broad meaning for the international community concerned with waterways, but the way it was set up also brings restrictions to the validity of the findings.

In the study the American and Dutch context is taken to gain insight in the research questions. These two countries were taken, as these are exemplary for the challenge of redevelopment of waterways in Western countries. These countries also offer a rich context for these investigations and both have waterway authorities with intentions to improve the value for society. The findings can be used in a broader international context where waterway authorities aim to improve the value proposition when redeveloping waterways and where they wish to include a wider selection of stakeholder interests into the optimization process. In cases where broad optimization does not play a role, the findings have much less relevance.

The entire study is set up around the problem of waterways and the authorities responsible for redevelopment. Other types of transportation infrastructure show different features, but also show similarities. Road systems and railroad systems seem to have a less diverse appreciation by its stakeholders. In general, these systems are highly appreciated for mobility (Filarski & Mom, 2008), but also have clear downsides in terms of externalities (Heeres, Tillema, & Arts, 2012). The same can be said about airports and air traffic; these also

show a clear spectrum of externalities and rather strictly defined benefits. But although the different types of transportation infrastructure may show differences in types of benefits and externalities, and the balance between those, it does not mean these should be seen as entirely different when compared to waterways. The basis of this study was to seek value opportunities in waterway redevelopment. Insight came from looking at this from a perspective of limited mandates for development for the responsible authority, but seeking opportunities to cooperate with external parties to broaden the scope and improve the overall value proposition. In the core, it is about evaluating the returns adding to the mission of the authority, taking into account the efforts required to make cooperative arrangements successful. This is no different for a waterway authority than for any other transportation infrastructure authority.

A similar perspective as taken for waterway authorities also applies for other infrastructure authorities, like those for rail, roads or airports. The dynamics and outcomes will most probably be different. Externalities will most likely play a more important role, and resistance to developments can be rather strong. For railroads, it is perhaps difficult to imagine a wider spectrum of benefits to the railroad tracks, but if we consider construction of bridges or railway stations, opportunities are suddenly much more apparent. Opportunities can also be found in reduction of externalities beyond the mandatory levels defined in legislation. For roads, opportunities lie in smart alignment, place-making and multiple land use, to name just a few (Heeres, Tillema, & Arts, 2010).

The term ‘infrastructure’ is often used in a context that is wider than transportation infrastructure alone. Utilities like water and sanitation infrastructure, power grids or pipeline systems are infrastructure systems as well. In literature, the infrastructure definition is sometimes used in an even much wider context, including for instance power plants, hospitals and schools (Hooper, 2009; Malano, Chien, & Turral, 1999; Whittington, 2012)research strategy, and findings: Public agencies traditionally request bids and award contracts to private firms after infrastructure designs are complete (bid-build. These elements have not been included in this study and no direct conclusions can be drawn for these sectors on the basis of the findings for waterways. Nevertheless, a transaction cost and benefit framework is not restricted in its use to waterway authorities only; literature shows examples of application in a wide array of sectors. Applying a dedicated framework for these types of infrastructure has the potential to improve insight in value optimization as well.

So, in general, the use of a transaction costs and transaction benefits framework as applied in this study is not restricted to waterway developments alone. It offers opportunities for other types of transportation infrastructure developments as well. According to literature, the framework of reasoning can be considered valid in the broader infrastructure domain, with the notion that outcomes will always differ from project to project. In terms of generic relevance of the study the set of 'Operationalization characteristics of value creation for infrastructure' as shown in table 4-2 seizes the heart of the line of reasoning. This set of characteristics can be applied in a wide range of sectors where rational economic optimisation on the basis of a wide set of interests plays a role.

Although, as said, the results and framework as described in this study have a broader application, they also have clear restrictions. The framework and results are based on voluntary transactions, in analogy of a free market situation where alliances are based on efficiency considerations (Giddens, 1998; Gruening, 2001). This means the findings are valid for situations in which actors have the liberty to either engage in a form of cooperation, or not. Where mandatory types of cooperation or legal obligations enter the arena, the findings have to be interpreted more carefully. In such cases, the use of a transaction cost and transaction framework can reveal problematic elements in the cooperation, but the framework is limited in its validity when legal aspects become dominant in the process.

7.5 Recommendations for further research

Redevelopment of waterways as a type of infrastructure has been the topic of this study. Fresh data have been added to literature and a transaction cost theoretical framework has been operationalized for this field. By doing so, a variety of issues were encountered which could not be studied in more depth in this study, but could offer the academic community leads to further deepening of understanding of the field. This section describes pointers and paths offering such potential.

Planning for waterway redevelopment as a type of infrastructure to facilitate navigation is a specific field within the broad fields of water resources, transportation studies and planning studies. In practice, it seems to be a mix

of those three; in academics, it tends to lean toward transportation studies or water resources studies, but *de facto* seems to miss the elements typical for waterway infrastructure. Additional empirical data would certainly help to improve understanding. Further emancipation of the field of waterway planning is needed to address the multitude of issues at play.

For the academic community involved in applying transaction cost theory, the study provides guidance for practical operationalization on the basis of this theory. The application of a transaction cost and transaction benefits framework to analyse the creation of value in a public domain proved to be useful. This framework has been made operational for application in infrastructure development situations. By using this framework, new insights were generated, and new paths for further research were identified. As application of such a dedicated framework for the infrastructure sector was new, it also showed a variety of elements, which are in need of further exploration. When engaging in cooperation, it is clear a transaction cost and transaction benefit evaluation ought to be made by individual potential partners. All have to come to a positive balance in order to engage in interaction. This appears to be a rather implicit process. Both costs and benefits are often based on assumptions and expectations. Further research could provide increased insight in these processes.

The inter-organizational interactions studied were based on the premises of voluntary engagement, similar to market sector behaviour. This aligns well with the framework used. But as some of the actors in this process are also empowered to take actions in terms of permitting or adopting legislation, a broader mix of instruments can be used to influence project outcomes. This study provides some understanding of these issues, but further research is needed to provide insight in the interaction between these different groups of tools. For the transaction cost and transaction benefit framework, further research would also be helpful in order to fully understand the correlation between the widely advocated idea of integrated approaches versus the associated increased coordination costs. This interaction was found to be at the root of the often-cited problematic implementation path of integrated approaches, but only limited data could be found on this. Specifically for the academic community involved in integrated water resources management, studying the transaction costs could serve as an entry point to detect hurdles for integration.

Time considerations were touched upon briefly in this study. However, time does create challenges for waterway development specifically, but also for infrastructure development and multi-actor optimization processes in general. Typically, infrastructure has a long development path, as well as long life cycles. Over such long time spans, society, circumstances and stakeholder interests change. Optimizations have to take into account future scenarios, large uncertainty, and the element of interests of future generations not present in current process. Secondly, time can play a major role in planning and delivery of projects as well. Delivery dates can put great pressure on decision-making and change its dynamics. Otherwise, timing and phasing issues can become apparent when striving for integrated development. Deeper understanding of the role of time in both the decision-making process and the lifecycle of infrastructure would be helpful in strengthening the field of waterway planning.

In a broader sense, the study addresses the redevelopment of waterways. Where planning development of infrastructure receives broad attention in literature, redevelopment of large-scale transportation networks is a topic in need of attention (Willems, Busscher, Hijdra, & Arts, 2016). It brings a variety of new elements into the debate compared to green-field development. The high sunken costs and its inflexibility to adapt to new needs and requirements require smart approaches. And as networks will not be replaced in their entirety at once, the transition from an existing situation based on historical needs towards a future-ready system requires thorough understanding of all factors involved. Specifically, the discrepancy between the slowly evolving networks and the dynamics and uncertainty of society and technological developments require well-developed insights.

Last but not least, in the field of infrastructure planning in a broad sense, the tension between line-oriented thinking as in networks and the place-oriented thinking as in place-making, still deserves considerable attention (Brink van den, 2009; Heeres et al., 2012; Heeres, Tillema, & Arts, 2015; Heeres et al., 2010). In countries with fully developed infrastructure systems, the move towards integration with locally and regionally valued elements needs thorough understanding. As local and regional governments are becoming increasingly aware of the strengths and potential of individual regions, they wish for infrastructure fitting and adding to these attributes. Vice versa, infrastructure systems function efficiently by viewing and optimizing these systems from much wider network perspectives. Finding ways forward to connect these views,

in addition to the results of this study, would help to bring both planning domains in closer harmony. In short, these recommendations for further research reflect the desire to strengthen our understanding with regard to planning for waterway redevelopment, its context and infrastructure development in a broad sense. This study, which addresses planning redevelopment of an ageing system in modern society, sheds light on this specific topic. It provides a path forward for a sector feeling the urgency to change. Further insights supporting this change will strengthen this path and will be welcomed by the community of practitioners.

7.6 Value creation in five steps

As the study touches upon many aspects related to waterway development, and at times penetrates deeply into theoretical background and mechanisms, this section will discuss a summarized 5-step approach. Such an approach can be used more directly, although it certainly needs translation to the local context. The fundamentals behind the development of this 5-step-model are described in more detail in chapter 4. Basically the 5-step-model aggregates the rational economic core elements of value creation in negotiation theory, transaction cost theory and design theory. Negotiation theory elegantly shows how to increase the pie in situations with a wide variety of actors and interests, transaction cost theory provides a way to economize on the institutions involved and design theory helps moulding a physical reality delivering maximum results. In practice steps will blend together to some extent, but for clarity purposes these have been framed in 5 steps.

The general approach to improving value is to include as many issues as possible into the optimization process, but limiting these at the point where coordination requirements are countering the positive effects. In such a way, the externalities can be minimized and the benefits maximized to the point where this is no longer effective. Figure 7-2 shows that value can be improved by increasing benefits, reducing externalities, or reducing coordination costs (see also chapter 6). By doing so, the top of the overall curve will shift upwards and to the right, delivering increased value in a broad sense. This is still a rather conceptual idea, but it can be broken down into a five-step plan (Figure 7-3). These five steps can be walked through, but will most probably need some iteration to come to a robust plan for development.

In step 1, the starting point is identified. What is the issue moving an agency towards action, what is the formal interest to be served in order to make the agency successful, and how is this interest related to interests of others in the context (see also chapter 2)? In step 2, the process of optimization as shown in figure 7-2 takes place. Cooperative options are to be identified and evaluated upon potential for value development. Cooperative options can, for instance, include cooperation with farmers, municipalities, provinces, water boards or industry. Both benefits and costs of transactions for potential mutual gains are to be taken into account. In step 3, the design process is defined which has the potential to deliver the value and capture opportunities as emerging from the deals made in step 2 (for more detail on step 2 and 3 see also chapter 4).

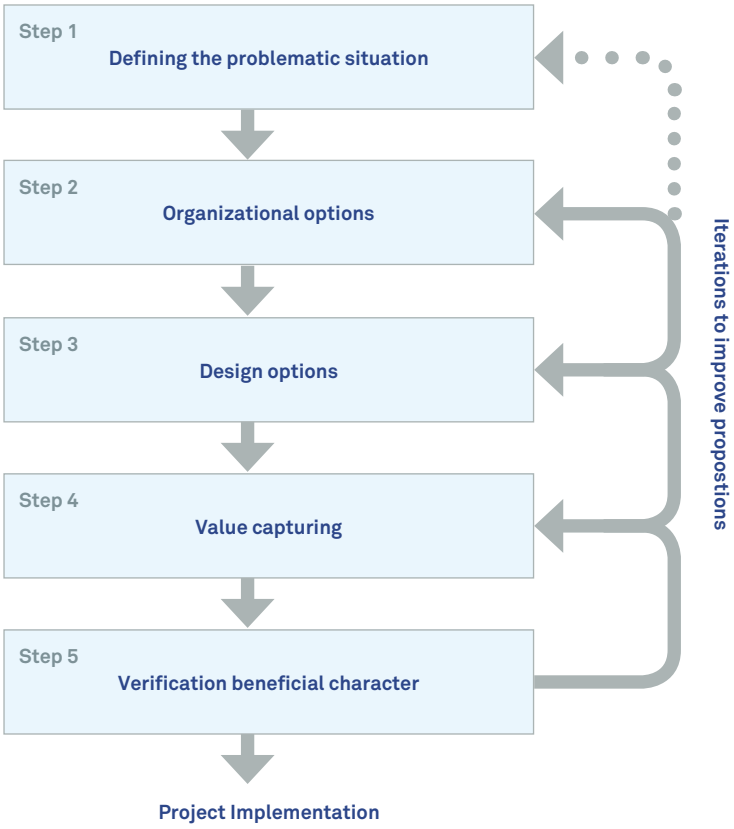


Figure 7-3: Value creation in five steps

Fundamental different approaches exist that lead to different outcomes on the basis of the same input. In step 4, the value capturing process is realized. This largely depends on both step 2 and step 3. Going back and forth through these steps with a light approach would be a practical way to gain understanding of effective routes to investigate more thoroughly. In step 5, the realism of potential value and cooperative options is checked. Mutual gains are often identified on paper, but willingness of partners to join in depends on more issues than a projected mutual gain alone. These partners might, for instance, have limited resources, which restrict them from entering into a partnership. Or in other cases, they just have better opportunities they would like to use their resources for.

In practice, all steps from 1 through 5 need to be passed through. If the proposed solution does not pull all involved actors on board in step 5, new iterations can be carried out to improve the proposition. If through multiple iterations a feasible solution does not come into view, one might even consider to go all the way back to step 1, and review the definition of the problematic situation once more. In table 7-1, the described step-by–step approach is shown in more detail, followed by more detailed descriptions of each step.

Table 7-1: Five Value steps for public projects

Step 1: Defining problematic situation	
What is the catalyst to take action?	Defining the catalyst makes clear what issue is to be addressed. Depending on the options for cooperation and design, this catalyst can be defined as the problem, or it can become part of a wider problematic situation with a variety of other issues.
What is the formal interest to engage in interaction?	The formal interest or interests, which are to be addressed in order to add value for the organization. Interests can be e.g.: fulfilling assignment, continuity, strategic, political or power gain.
What interlinkages are to be explored?	The interlinkages between optional partners reflecting the degree of inter-organizational integration. Cooperation can be based on sharing of capacities, data, facilities, financing and risks or a combination of these. A myriad of combinations is found in practice and literature.

Step 2: Organizational options	
Transaction Costs relate to: (a) *Exploring cooperative options* (b) *Preparing agreement* (c) *Inter-agency coordination* (d) *Intra-agency coordination* (e) *Education and Training* (f) *Monitoring interagency delivery/efforts* (g) *Transaction enforcement* (h) *Activities to build trust*	The investments to make, or drawbacks to accept which are specifically correlated to the transaction with others. Examples of costs: man-hours to manage complex contracting, administrative activities for payments, verification of progress and quality in the works.
Transaction Benefits relate to: *(a) joint assets value surplus,* *(b) complementary skills, routines, capabilities,* *(c) payoff x increased by y,* *(d) economies of scope,* *(e) economies of scale,* *(f) level of trust*	The benefits one expects to get in return by teaming up with others. Examples are; linking networks (a), high expertise and efficiency in works by experienced or specialized partner (b), increased tax revenues (c), combine projects with earth shortage and earth excess (d), dredging a river bed and local port-basins in one effort (e), low coordination costs due to long standing work-relationship (f)
Step 3: Design options	
Value creation through design relates to; (a) *functional value: effectiveness of the design* (b) *functional value: spectrum of functions included* (c) *esteem value: design aesthetics* (d) *esteem value: symbolic value* (e) *value in time: life cycle cost optimization* (f) *value in time: build-in flexibility (preparing for uncertainties)* (g) *value in time: adaptive, step by step, approach*	The way value is employed or increased through its physical, functional and esteem value aspects and the choices made to optimize value during the lifetime of the works. Examples are: an integrated design, asset management, embedding possibilities for adaptation, real option strategizing.
Step 4: Value capturing	
Value to society	General value which is created by the joint effort
Value capturing relates to; (a) *reduced cost/risk* (b) *cost/risk sharing* (c) *increased return flows* (d) *additional return flows* (e) *strategic benefits (reputation, skills, access to new opportunities)*	Elements of the created value, which are directly beneficial. These elements can be tangible or intangible and adding to the formal interest as defined in step 1. Examples are: joint design with environmental group (f), dredging adjacent waters of other agency in one effort (b), increased shipping providing increased fuel taxes (c), leasing out concession for hydropower generation at lock complex (d), high public appreciation of a project allows easier development of a next project in the area (e).
Step 5: Verification of beneficial character of cooperation: TB > TC ?	
BATNA (no cooperation between any of the parties)	The Best Alternative To a Negotiated Agreement is the verification of value creation in the partnership. The transaction benefits should outweigh the transaction costs in order to create value on top of the general profits in case the project (or a part of it) was done without others.

Step 1 Defining the problematic situation

The issue that moves an actor into action is not the same as the definition of the problematic situation. By defining the problem on the basis of a single issue big enough to call for action, the playing field is directly hedged. This limits opportunities for broader value optimization. Keeping the definition open for interaction with other parties, instead of defining it as a hedged problem, is to be preferred when value opportunities are to be seized.

In practice, this choice of hedging the problem versus keeping it open has to be made carefully. Opening a simple technical problem for interaction with a broad variety of stakeholders does not make sense. Providing a good definition for problems to be hedged and problems to be kept open is difficult. Like the example of the simple technical problem, in a specific context it could be wise to postpone action on fixing such a problem so that it can become part of a wider operation addressing multiple issues at once. In such a case, the simple technical problem could indeed open up opportunities for a more open approach.

The previous sections in fact refer to the catalyst to take action. Somehow, the status quo is no longer seen as acceptable and an agency is willing to take action. From that point on, it should be clear what is driving this agency to take action. The agency takes a specific interest in the issue and certain needs are to be satisfied. It should be clear what they are, in order to be able to satisfy those needs. This is valid for other stakeholders as well, even though they are perhaps not the first movers in the process. By finding out the interests of the variety of stakeholders in the problematic situation, the problematic situation becomes more tangible.

When the interests are clear, the interlinkages of the interests can be explored. As Raiffa (Raiffa, 1982) explained, all value comes forth from differences and similarities of what parties want, can, own and expect. Based on a multitude of ways in which value can be realized, taking into account a multitude of actors with an interest in a problematic situation, it will be clear that this is not a linear optimization process. These are not just pieces of a puzzle that fit together in one particular order, but they can be seen as building blocks that are part of a structure to be developed. Finding out which interlinkages between the interests exist provide valuable pointers for finding a suitable ‘structure of building blocks’ to define what has to be done; step 2 in the process.

Step 2: Organizational options

On the basis of the interests of actors and linkages of these interests as found in step 1, the cooperative options to increase value can be explored. As the options can be abundant, this can be a rather time- and resources-consuming effort. Even more so, as it is not an effort that can be done internally, but requires interactions with these stakeholders. Stakeholders may, for instance, be farmers with an interest in irrigation or drainage of their lands, municipalities thinking about waterfront development, or industry with specific logistical needs. Deployment of smart tools and methods can be helpful to cut through these options and their consequences. One has to bear in mind though, that most of the available tools and method do not take the transaction costs into account in a structured, systematic way.

The most pragmatic way to cut through the complexity of the multitude of options and their consequences, is to assess the options in a lightly explorative way, ranking these, and then further investigate the ones with the most potential. This is often done intuitively. One has to bear in mind though, that finding a viable path to resolving a problematic situation does not necessarily mean there would not have been other paths. And those other paths might have led to even higher levels of satisfaction of stakeholders' interests. Perhaps the most valuable asset in this process is time; time to explore those paths and enable the actors to optimize mutual gains and to come to agreements. This step of optimization of satisfaction of stakeholders' interests and coming to agreements on such basis is positioned as a step that preludes step 3; the design options. In practice though, the possibilities, limitations and consequences of a variety of design options have to be known in a generic way. It would be of no use to come to an agreement that cannot be materialized later on. But putting design first would be counterproductive. It would limit the exploration of options to build value. In other words, this is a delicate balance with feedback loops back and forth.

Step 3: Design options

Design follows the agreements as arranged in step 2, bearing in mind the feedback loops back and forth, as mentioned. To come to a proper design, addressing the various elements as agreed to, a suitable design methodology can be chosen. Literature offers many; it is up to the designers to select their instruments. Examples of approaches and methods which can be used are:

- systems engineering (Blanchard & Fabrycky, 1990; Browning, 2003),
- value engineering (Miles, 1961)
- real options strategies (Neufville, Hodota, Sussman, & Scholtes, 2007; Scholtes, 2010)
- parametric design (Hanna & Turner, 2006)
- participatory design (Björgvinsson, Ehn, & Hillgren, 2010)
- architectural design (Shen et al., 2009)

It is not the purpose of this study to prescribe a certain design method, but practitioners should bear in mind that each method has its advantages and drawbacks. Using a method one is accustomed to has clear advantages in terms of efficiency, but that method could lack the attributes to address specific elements as agreed to in step 2. For instance, not all methods address time components of the design determining the effectiveness and efficiency in an uncertain future. Aesthetic or symbolic value of the design is another example of an issue not addressed by all methods.

Optimizing the design to bring maximized value to the stakeholders can be split along three dimensions. These are:
1. Functional value
2. Esteem value
3. Value in time

Traditionally, engineering disciplines have a strong focus on the first dimension, the architectural trades often show much care and dedication for the second one, and in infrastructure especially the last dimension appears to be the perspective on the rise.

Neither one of the three dimensions is more important than others; it all depends on stakeholder needs and the context of the situation in general. Although functional value is a dominant line of thought in infrastructure development, at times the esteem value can easily overshadow the functional value. A great example is the system of canals in Amsterdam, the esteem value puts the limited functional use in its shadow.

Value in time is a particular element to take into consideration on the basis of the agreements in step 2. Bounded rationality from step 2 can lead to specific time considerations for the design to prepare for unexpected developments.

Flexibility in design, rationalized by real option strategies or even adaptive management type of solutions offer answers to such considerations.

Step 4: Value Capturing

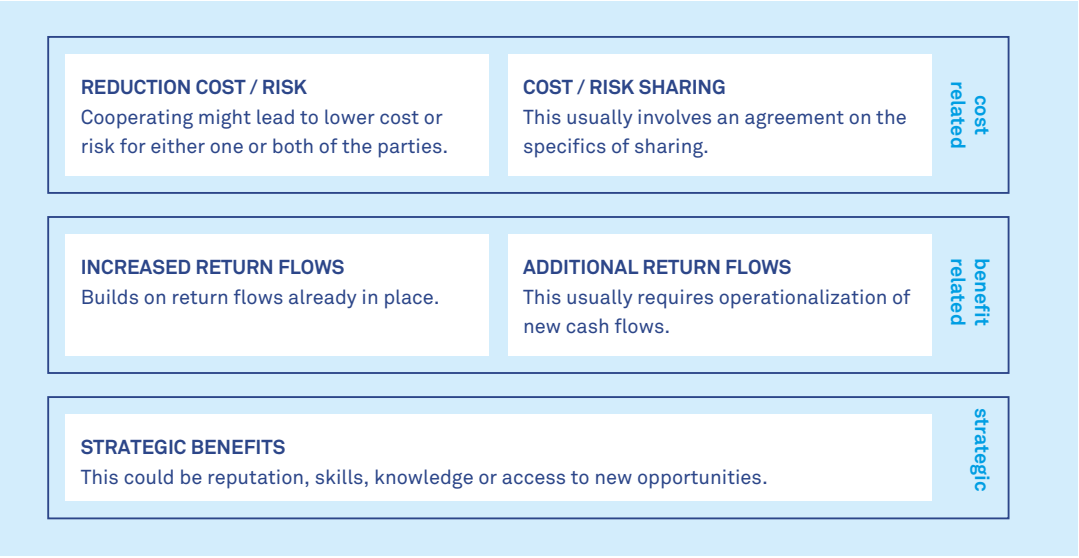
When step 3 delivers an option in which synergy is expected, such synergy is only valued as such if gains can be captured. Actors do not engage in cooperation for the sole benefit of the greater good (Axelrod & Hamilton, 1981). In other words: actors need to be able to capture value serving their individual needs. Capturing can take place through new cost-reduction opportunities through partner choice, shifting costs to the partner, increased or new income streams, or a better (market/political/power) position of the agency in general (figure 7-4).

In practice, capturing value through cooperation that induces cost reductions appeared to be pragmatic for actors. Generally, no special arrangements need to be made for payments; no additional transaction costs are perceived. This is different for capturing of value where arrangements need to be made for cost-sharing or where additional income streams need to be administered. These kinds of value-capturing options generally increase coordination, monitoring and at times enforcement efforts (see step 2). Increased return flows often hold the middle ground. Transaction costs can be limited if return flows increase almost automatically or are embedded in processes which take place anyway and do not introduce extra efforts (e.g. higher tax revenues due to real estate value increase, higher fuel tax revenues due to increased shipping). In other cases, some extra effort is required to generate the extra income, but it can be facilitated through processes already in place (e.g. leasing out an extra piece of land).

Step 5: Verification

If the four previous steps taken, mutual gains are identified, value capturing options foreseen and designs envisioned fitting all these requirements. Now, a final check can be made to see if Pareto efficiency has been achieved. This means the following: if any of the stakeholders is able to be better of without compromising the benefits of others, or at least willing to compensate for that, value to be seized is still on the table. Each actor, therefore, should question for themselves if the synergetic transaction foreseen can be topped by a better one. In negotiation terms, this is called the Best Alternative to Negotiated Agreement (BATNA)(Susskind, 1999). Rationally, a

Figure 7-4: Value-capturing options



win-win situation is often perceived as an opportunity to seize value. But if an actor has limited resources, and all these resources are needed to engage in the transaction leading to captured value, no additional transactions can be done. In a commercial environment this is often seen differently, as mutually beneficial transactions often deliver additional resources which can be deployed in new transactions. For public entities, this is not always the case, as additional monetary revenues can often not be converted into extra man-hours which can be used for additional transactions. Actors need to consider each potential transaction carefully, and check if this is the most beneficial way of spending valuable resources, delivering maximum value. Sound decision-making for such issues requires full information, which is rarely available. Alternative transactions and their respective benefits are often not known, or tentative and uncertain at best. Getting to a situation with full information and certainty about the best transaction to engage in would potentially open up the way for complete Pareto efficiency, but requires an iterative process going back and forth through steps 1 to 5 multiple times, pushing transaction costs upwards. In current practice of waterway development this is not witnessed, but such a pathway can be cleared by steadily improving brokering of interests and limiting transaction costs at the same time.

7.7

Three key issues to build value: alignment of incentives, brokering interests and limiting transaction costs

As discussed in chapter 1 and 2, due to changing societal preferences, climate circumstances and ageing of assets, redevelopment of waterways is an emerging issue in planning. Redevelopment that takes these new circumstances and preferences into account will lead to waterways that have a changing value for society. This changing value requires a change in coordination, as different issues and interests are at play. Much has been said about this, in detail, in the previous sections and chapters. But if we step back a little from the details, and reflect on current practice in a more generic way, the study provides three major issues open to significant progress. These issues are the alignment of incentives, brokering of interests and limiting transaction costs.

The first issue, alignment of incentives, is rooted in the existence of hurdles in the process of creating value. Waterway agencies show specific problematic characteristics, which are to be addressed in order to move from cost-efficient network solutions towards socio-economic value optimization. A major hurdle was found in the lack of alignment of project incentives with policy aims. Room for improvement lies in aligning these. This can be achieved by, for instance, the application of mandatory co-funding, as found in American practice, or otherwise by rewarding project-teams for achieving inclusiveness. So what if these agencies indeed align internal incentives with policy ambitions to strive for further improvement of socio-economic value in their projects? Suppose the hindrances as described in chapter 3, and in summary in section 7.2, do not play a role any longer. Still, building value on the basis of maximizing stakeholder satisfaction will not be an easy task.

As mentioned in the 5-step-plan, building value on the basis of maximizing stakeholder satisfaction is a process with many variables. It might take considerable effort to find a pathway which addresses a problematic situation in such a way that stakeholders are not worse off. Pushing forward while attempting to increase the value proposition could be perceived as too much of a stretch, especially as more iterations in the process are expected to require considerable efforts. However, it is through these iterations that value can spiral up, delivering solutions with maximized stakeholder satisfaction. This notion brings forward the core element of this study. Maximizing the value of

waterways is founded on the basis of maximizing stakeholder satisfaction. Maximizing stakeholder satisfaction is straightforward when interests line up in a similar direction. Considering the wide variety of interests found around waterways, this will rarely be the case. Interests appear to be not in line or even conflicting. This requires smart processes in which finding mutual gains is key. The study showed that finding or creating a pragmatic platform where interests can be discussed, options explored, and effects weighed by all stakeholders, gives form to such a smart process. This could be called brokering of interests, and finding the option delivering most value as opposed to a linear process converging to a single solution. Such brokering was found in the Miami case (Miami River Commission as brokering agency), the Napa Valley case (Friends of the Napa river as brokering agency), the Room for the River case ('omwisselbesluit' as an open format for brokering). In all these cases, a variety of options were considered, while step-by-step moving towards materialization of the ideas.

Key in the process of brokering of interests is keeping transaction costs low. Keeping these costs low produces three major advantages;

- A greater set of options delivering mutual gains
- Options have better net results as costs are lower
- More iterations in the process are tolerated within the resources available

From this perspective, it is surprising that these types of costs appeared to receive limited attention. At first sight, transaction costs might seem of minor interest within the entire set of costs related to waterway projects, but effects of these costs are leveraged by these three mechanisms.

If waterway agencies are driven to create value for society, it is highly recommended to align incentives, to focus on ways to enable brokering of interests, and to ensure transaction costs are minimized. As Ronald Coase argued in the 1960s, land use value would maximize instantaneously if transaction costs would not exist. Coase clearly stated that such a situation was utopic, as transactions will inevitably bring transaction costs. But keeping these as limited as possible would indeed smoothen the process of brokering of interests, leading to maximization of stakeholder satisfaction. Taking such a route will lead to the delivery of redeveloped waterways of maximized value – or in brief, reciting the title of this study: 'Waterways, ways of value'.

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I Case studies

List of case studies

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5. Beatrixsluis, Netherlands
6. Zuidwillemsvaart, Netherlands
7. Room for the river Waal, Netherlands
8. Napa Valley, USA

Description of case studies

This appendix describes the different types of cases used in the study.
The descriptions are based on excerpts from published (or submitted) material by Hijdra, Arts and Woltjer. A chapter number in which the case is used follows each heading.

1 Institutional setting Dutch Waterways (Chapter 3 and 6)

The public agency in the Netherlands responsible for all the main arteries of the waterway system is Rijkswaterstaat. It was established in 1798. The Agency falls under the remit of the Ministry of Infrastructure and the Environment. The Ministry is responsible for initiating, budgeting and prioritizing navigation projects. Rijkswaterstaat is the infraprovider responsible for management, operation and development of the Dutch waterways of national and international importance. Projects emerge through a formalized system of steps as prescribed in the MIRT process (Long term infrastructural, spatial and transport investments programming). Funding for projects comes from the treasurer and usually covers the entire cost of a project. The division of large projects and maintenance together with a regional division manages the planning and development projects.

In 1815 at the Conference of Vienna, it was decided that major waterways in the countries along the Rhine river had to be free of toll and obstacles. This agreement still stands and implies that users of waterways should not be charged for use of the system in any sense. The network that falls under the responsibility of *Rijkswaterstaat* is a mix of adapted rivers and artificial canals (Figure).

Main waterway network of the Netherlands (figure courtesy of Rijkswaterstaat)

The Ministry has a broad array of responsibilities and each has its own internal line of decision making and funding. Transport policy and projects are evaluated and prioritized within the Directorate General of Mobility and Transport. User groups, which can also exert influence over representatives in Parliament, are consulted in this process.

A project's scope is agreed in cooperation between the local offices of Rijkswaterstaat, a central advisory unit from Rijkswaterstaat (Dienst Water Verkeer en Leefomgeving) and responsible officials at the Ministry. Local stakeholders are consulted early in the process. The actual project design results from an interactive process involving market parties. As funding is

earmarked for transportation purposes, there is only limited opportunity to provide for other requirements if these are costly. The legal project planning process includes informing and facilitating stakeholders in expressing their objections. Overall, waterway projects are agreed at a variety of arenas at national, regional and local levels.

2 Institutional setting American Waterways (Chapter 3)

The US Corps of Engineers, established in 1802, is responsible for the vast majority of the waterway network in the US, and all major stretches fall under their responsibility. The Corps is in essence a military organization which includes a civil branch within which waterway management and development is located. Its mission is defined as: 'Deliver vital public and military engineering services; partnering in peace and war to strengthen our Nation's security, energize the economy and reduce risks from disasters. The Army Secretary Assistant for Civil Works (ASACW) oversees the activities and determines policies for the navigation works of the US Corps of Engineers. The Secretary of Defense (SoD) is the highest official under the President of the US overseeing the nation's entire armed forces, including the US Corps of Engineers.

Main waterway network of the US (figure courtesy of US Corps of Engineers)

The network under the responsibility of the Corps is around 19,000 km in length (Figure 3). By law, a local partner must be found to carry the burden of part of the expense of any waterway project to secure federal support. These expenses can be monetary or in kind. The federal funding comes from the federal budget along with funds raised from the waterway trust fund. These funds come from fuel taxes paid by waterway users. The Inland Waterways Users Board (IWUB) is an advisory board monitoring the trust fund and advising the Army Corps of Engineers and Congress on priorities for spending from the Inland Waterway trust fund. Although the IWUB has an advisory role in the process, congress and the US Corps of engineers rely heavily on the opinion of the Board.

3 Miami River (chapter 4 and 5)

The city of Miami was founded at the riverbanks of the Miami River. In the 19th century the riverbanks became an industrialized and port zone. The Miami River runs through the highly urbanized area of Miami, Florida. The stretch of the river of interest to this case study is its first 5.5 miles, which are navigable for seagoing ships. This stretch can be described as a canalized river, straightened and with artificial embankments. The river's discharge is very low, to zero. The inflow of water comes from the Everglades, and eventually the river flows into Biscayne Bay. This bay is located between the Miami Beach peninsula and mainland Miami and has an open connection to the Atlantic Ocean. The bay is also part of the Intracoastal Waterway route.

The Miami River has several port facilities along its embankments. The main port business is dedicated to trade with Caribbean islands and super yacht maintenance. In the 80s and 90s of the 20th century, the river was neglected. It was polluted, navigation depth was reduced by sedimentation, it gathered derelict vessels and the neighbourhoods along the river were deprived. During the 1990s the river's condition became part of the public debate, primarily due to pollution and the loss of functionality for commercial shipping. Around 32 agencies had some kind of authority over one or more aspects of the river, which made the situation institutionally highly complicated.

The most pressing and costly question was the one of dredging the river. The City of Miami was, in fact, the authority for the Miami river port and had a direct interest. However, the river was just one of many urban issues the city had to deal with. The Florida Inland Water District, closely cooperating with the US Corps of Engineers was responsible for maintaining the intracoastal waterway

in the Biscayne Bay, and these organizations were confronted with fast inclining dredging costs as sediments in the Bay became contaminated by the Miami River outflow. Eliminating the source of pollution was considered far more efficient than continually coping with the dispersed contamination throughout the bay. The public increased the pressure to act on the situation as Biscayne Bay, unlike the Miami River, is considered one of the region's most valuable assets. The State of Florida added extra pressure, being of the opinion that a river should add to the attractiveness of a city and a region, as is the case in many cities around the world. Yet the complexity was not easily resolved.

Proposals for a port authority were introduced in 1996 and 1997 in the Florida legislative sessions. However, these proposals met substantial resistance from local interest groups, businesses, residents and the City of Miami Commission. The controversy concerned the lack of local representation. A 14-member study commission (MRSC) was appointed in 1997, its members represented public and private sector interest groups. In 1998 the MRSC presented its conclusions and recommendations; the problems can be solved, the payoffs can be enormous, but absolute commitment and cooperation is required. Furthermore they proposed to establish a permanent Miami River Commission (MRC).

In 1998 the State creates the MRC, which became the official coordinating platform responsible for the redevelopment of the Miami River. The MRC is the official coordinating clearinghouse for all public policy and projects related to the Miami River and it acts as the principal advocate and watchdog to ensure that river projects are funded and implemented in a proper and timely manner. The commission may seek and receive funding to further its coordinating functions regarding river improvement projects of the commission. Regulatory authority and responsibility remained as it exists with city, county, state and federal government. The MRC will use powers of persuasion to achieve its objectives through the process of building a consensus work plan. After 12 years of acting on this basis, the MRC is widely acknowledged for its accomplishments. The river has been dredged, pollution is tremendously reduced, a river walk along the water has been partly established, and the river has become a recreational destination and a place attracting commercial and residential investments.

4 Inner Harbor Navigation Canal in New Orleans (chapter 4 and 5)
The IHNC lock is a deep draft single lock built in 1923. It is located in the IHNC, a 9km long canal connecting the two most intensively used waterway systems of the USA, the Mississippi and the Gulf Intracoastal Waterway. It is located in industrial and residential areas (lower 9th ward) of New Orleans. Policy documents indicate that the current lock is considered too small to accommodate modern generations of oceangoing vessels. Another problematic issue coming forward from these documents is that inland pushing convoys need to be disassembled to pass through. Therefore a larger, deeper lock to replace this old lock is proposed. According to the plans, the canal and bridges have to be adjusted as well. Project officials stated that two tools played a prominent role in the process with regard to their stakeholders: a co-financing agreement with the Port of New Orleans (IHNC – cofounding), and a design and tendering process with a focus on local mitigation elements and local revenue generation (IHNC – tendering).

The Inner Harbor Navigation Canal (IHNC) is the official name of the 9 km canal connecting the Mississippi river to Lake Ponchartrain. The canal is often referred to as the Industrial Canal, and indeed serves the industry along its embankments. The Intracoastal Waterway bisects the canal and connects it to Lake Borgne. At the canal's south entrance, the Industrial Canal Lock provides a connection with the Mississippi River. The lock dates back to the 1920s and has become a bottleneck in the system both in terms of capacity and size. The pushing convoys sailing the Mississippi need to break down their convoys to get through. A larger lock could also serve a larger part of the world's ocean- going fleet in terms of size. This is particularly interesting, as the industry along the canal has direct access to a class I railway, a unique feature in the area. A class I railway connection allows competition between railway firms on those tracks which is a highly favourable situation for the industry along the canal. Most other ports in the region, which are connected to the railway system, either lack a deep draft facility, or lack competition on the railways for hinterland transport

The deal between the Corps and the Port is based on the concept that the Corps needs to improve the shallow draft shipping route, and the Port needs the deep draft ships to get access to the port zone. The agreement states that the Corps pays 50% of the costs for a shallow draft navigation lock, the other 50% will be supplied by the Inland Navigation Trust Fund, which is funded by a tax on barge fuel. The additional cost for upgrading the facility for deep draft vessels has

to be paid for by the Port of New Orleans. So, the facility in fact combines two types of transport: inland navigation and deep see shipping, funded by multiple sources. Table 4 shows the results of applying the value creation framework for the New Orleans Inner Harbor Navigation project.

5 Beatrixsluis, the Netherlands (chapter 5)

The Beatrixsluis in the Netherlands is a navigation lock complex with two chambers. It is located in the Lekkanaal, a short canal of 4km. This canal connects the Amsterdam-Rijnkanaal with the Nederrijn-Lek. It is an intensively used shipping route. The lock complex was built in the 1930s. Policy documents indicate its capacity is viewed as insufficient to handle the busy shipping traffic, therefore the construction of a third lock has been announced. Together with this third lock the canal has to be adapted to allow pushing convoys to align properly for this new lock. Widening of the approaches runs into a variety of interactions with other, current, uses of the land adjacent to the canal. Project officials mentioned they deployed a variety of tools. The most prominent tools mentioned in the interviews were stakeholder group involvement (Bea – Stakeholder), and the application of a contract form in which the contractor is responsible for design, construct, finance and maintenance of the new lock (Bea – DBFM contract).

6 Zuidwillemsvaart, the Netherlands (chapter 5)

The Zuidwillemsvaart project embodies digging 9 km of new canal around the city of Den Bosch. The old canal ran straight through the historic city. The project documentation describes this old situation as narrow, lacking upgrading possibilities, and shipping traffic causes congestion in the inner city due to many bridge openings. Policy documents mention that a new stretch of canal is required to facilitate and stimulate transport of goods over water. By-passing the city by such a new stretch of canal had long been anticipated for. Currently, the new canal is completed and officially opened in February 2015. The project documentation showed the project had considerable implications for a wide variety of current and future infrastructure plans of the city. Through an intergovernmental agreement, cooperation, co-development and co-financing were arranged. The construction works itself were tendered to construction companies. The contract for construction was a design-build contract. Such a contract allows the contractor to optimize the design of the works and the associated construction processes as long as the functional requirements of the contract are met.

7 Room for the River Waal, the Netherlands (chapter 5)

The Room for the river Waal project refers to a problematic narrow curved zone of the River Waal exactly where the city of Nijmegen is located. To prevent future flooding, the river had to be made capable discharging up to 18.000 m3/s. The project documentation showed that Rijkswaterstaat, the national agency responsible for navigation and flood management of the river, calculated and designed a cost efficient solution by deepening and widening the river where possible. Where other institutions had additional ambitions for the zone, these institutions were invited to present alternative local plans, including their own ideas and ambitions. The original cost efficient design was taken as a reference for comparison. When alternative plans required no increase in national financial contribution, and showed to be equally effective, these could be awarded. Awarding such plans was called a 'swap decision'. This process resulted in the execution of an alternative plan where riverfront development, recreation, housing and flood protection go hand in hand. Instead of Rijkswaterstaat, the city of Nijmegen took the lead. Furthermore, project officials stated that private developers could get involved by presenting plans adding to the broad project goals in return for real-estate development opportunities. The project is completed in 2015.

8 Napa Valley (chapter 5)

Napa valley is located in California in the proximity of the San Francisco bay area. The valley is named after the Napa river. The city of Napa emerged at the riverbanks of the river in the early 19th century, as this was the furthest inland place to be reached by a cargo vessel. The city of Napa is nowadays often referred to as the most flooded city of the USA. Documentation showed that the US corps of engineers initiated a flood protection project to prevent further floodings. The plan comprised straightening and widening of the river, and protecting the riverbanks with artificial constructions. Inhabitants of the valley rejected this plan. From documentation, interviewed city officials, project officials and stakeholders came forward that a group of volunteers continuously negotiated with a variety of stakeholders. A more broadly defined plan, including nature restoration, riverfront developments and landscaping was embraced. Additional funding had to be found, which was done by raising local taxes, based on a 2/3rd majority of the voters. The contracting was done is such a way that most of the spending was directed to local and regional contractors.

II Interviewees

Nr.	Function	Organization type	Country	Year
1	Deputy Director City Development Agency	Local government	USA	2012
2	Manager Inland Navigation District	Local Government	USA	2012
3	River Commission Chairman	Local Government	USA	2012
4	River Commission Director	Local Government	USA	2012
5	Former River Commission Chairman	Private	USA	2012
6	Project Manager Navigation lock	Federal Government	USA	2012
7	Project Engineer Navigation Lock	Federal Government	USA	2012
8	Project Engineer Navigation Lock	Federal Government	USA	2012
9	Project Manager Storm Surge Barrier	Federal Government	USA	2012
10	Sr. Project Manager Storm surge barrier	Federal Government	USA	2012
11	Director Business Development, Port of New Orleans	Local Government	USA	2012
12	Director Business Development, Port authority	Local Government	USA	2012
13	Real Estate Development Manager, Port authority	Local Government	USA	2012
14	Project official, municipality	Local Government	Netherlands	2013
15	Project engineer, contracting consortium	Contractor	Netherlands	2013
16	Project engineer, contracting consortium	Contractor	Netherlands	2013
17	Chairman, voluntary stakeholder group.	Volunteers group	Netherlands	2013
18	Former project manager of a waterway project and currently project manager of two waterway projects	National Government	Netherlands	2013
19	Stakeholder manager of a project	National Government	Netherlands	2013
20	Assistant stakeholder manager of a project	National Government	Netherlands	2013
21	Former project manager of a project	National Government	Netherlands	2013
22	Environs manager of a project	National Government	Netherlands	2013
23	Former project manager of a project	National Government	Netherlands	2013
24	Environs manager of a project	National Government	Netherlands	2013
25	Former technical manager of a project	National Government	Netherlands	2013
26	External hired project official	Local government (hired external)	Netherlands	2013
27	Program officer: works at the program-office of RWS and deals with inland shipping	National Government	Netherlands	2013
28	Program officer 5 locks that use a DBFM-tendering and contracting	National Government	Netherlands	2013
29	Chief Financial Officer Rijkswaterstaat	National Government	Netherlands	2014

III Interview questions

Type of interviews: semi structured
Purpose of the interviews: getting first-hand information about the relevant topics. Find out how the issues are experienced and weighed by key players in the cooperation.

Questions (questions in italic, in plain text the reminders for interviewer)

General questions

Q1: *For the record; date, location, organisation and name interviewee.*
Q2: *Thinking about the project, what makes you most proud?* Background; warming up question, giving room to ventilate.
Q3: *This research project is about the way value is created in water projects. Can you describe what in your opinion are the societal values or functions this project is creating?* Checking the degree of integration of the project and getting the mindset into the topic of investigation.
Q4: *Can you describe how these values got integrated in one project/program?* Getting the mindset into the topic, giving space to a general holistic view on the topic, avoiding annoyance by diving deep directly.
Q5: *What were the key moments or agreements where integration of values took place?* After open reply check; public decisions, contracts, permits, hearings

Transaction cost and benefits

Q6: *What is the key goal of your organisation related to this project?* Background; check the main purpose to be able to distinguish the 'special issues' from the 'common business'
Q7: *How would you describe the way your organisation is involved in this project?* Deepening questions; contracted, cooperation, alliance, joint venture, hierarchy? Background; determine the way of connectedness.
Q8: *can you describe the reasons or drivers for your organisation to participate in this project?* After open reply, check the following items;

- Joint assets value surplus (e.g. integrating railroad networks)
- Joint surplus of complementary skills, routines and capabilities
- cooperative use of asset x increasing pay-off generated through asset Y
- economies of scope (vertical integration)
- economies of scale.

- Cooperation as a way to increase trust and therefore decreasing transaction costs.

Q9: *Were there any hurdles, costs, hesitations, doubts or alike which had to be overcome?*

After open reply, check the following items;

- **Interdependency**, asset specificity, human asset specificity, site specificity?
- **Uncertainty;** limited and/or asymmetric information about a transaction, non-observerability, lack of transparency, 'cognitive complexity', limited information about the values and goals of other relevant actors, uncertainty in the relevant organisational environment and ignorance about the relevant cause-effect relations. Transaction costs can be costs for information or costs of resulting delays.
- **Timing;** Ongoing transactions?

Q10: *How do these relate to the key moments as mentioned in Q4?* Background; get the general direction, verification will follow in the document study.

Value creation, capturing and alternatives (Batna, Mutual Gains):

Q11: *Were there any alternatives for your organisation to accomplish the organisational own goals?*

Q12: *If so, what would have been the difference for your organisation?*

Q13: *Is the overall result delivering what was expected?* Background; Determine possible gaps between intentions and results, proof of the pudding in the eating.

Q14: *Did the cooperation deliver the expected results for your own organisation?*

Q15: *How is the value, which is created, captured by your organisation?*

Q16: *How did the overall design develop?* Check; Any specific value increasing methods? Value engineering? Value Sensitive Design?

Closing questions

Q16: are there any remaining issues which you feel are relevant which have not been discussed?

Q17: If you could do it all over again, what would you do differently?

Q19: What was the key to success in this project? Background; giving once more room to round off.

IV International Workshop and Focus group discussion

Embedded in the PIANC conference in Maastricht/Liege from the 23rd to the 27th of September an international workshop was held on value creation in inland waterway projects. The workshop took place in Maastricht, 24th on September 2013. Part of this workshop was a focus group discussion. The participants of the workshop were split in two subgroups to create group sizes suitable for discussion. The subgroups had 6 and 7 participants and a chairman to lead the discussions. A short series of questions was used as guidance. The discussions were recorded, transcribed and analyzed. Underneath the program of the workshop is shown, the questions for the focus group discussions and the list of participants for each group.

Announcement text for the workshop:
In this workshop the draft results of the working group on 'values of inland waterways' will be presented, discussed and used for further joint exploration. The workshop offers an interactive learning experience based on the extensive work of the working group and learning by peer to peer interaction. Participants of this workshop will be learning about;

1. The wide variety of values, uses and benefits related to waterways
2. The ways these values can boost the cost-benefit ratio of your project
3. Examples of increasing the benefits of your project
4. Practical tools used by various professionals and waterway authorities to increase the value of a project.

The workshop will take place in the afternoon and the program is as follows;

12:00–13:00 u	Lunch
13:00 u	Welcome and introduction to the topic by Chairman of Working group 'Values of Inland Waterways' Andreas Dohms. *He will explain about the purpose, scope and background of the working group and will lead the audience though the process followed.*

13:15 u	Overview and background of values related to Inland Waterways by Rashed Thabet. *He will show the broad spectrum of values, uses and benefits which are related to waterway (re) development and will explain the significance of these. Synergy can be achieved in some situations, where in other situations one has to deal with conflicting uses.*
13:45 u	Case studies showing the relevance and significance of the broad spectrum of values by Hughes Duchateau. *Mr. Duchateau has an extensive background in the field of waterway economics and evaluation, and he will show the audience how value matters beyond the aim for efficient transport only.*
14:15 u	Group discussion

Break (14:45 u – 15:15 u)

15:15 u	Introduction to interactive sessions focusing on 'how to increase the value of your project' by Arjan Hijdra. *Integrating multiple values and uses into your waterway project is not an easy task. The context, local situation and background of involved stakeholders matter. However, tools can be identified which have shown to be effective in the implementation phase of a project and which can help to increase the value of your project. Exchanging experiences and listing pros and cons of these tools is the purpose of the discussions in groups which follow.*
15:30 u	Breakout into smaller groups for interactive discussion
16:30 u	Plenary feedback from small groups, and discussion about the findings.
16:45 u	Conclusions and closing remarks by Andreas Dohms
17:00 u	End of program.

Questions in the focus group discussion (interactive discussion in program)
Questions focus groups discussion:

1. How can you increase the value of a waterway?
2. How can cooperation with other organizations/stakeholder/public take place?
3. What typical problems do you run into?
4. What solutions did you come up with?

Participants of the international focus groups

Group Yellow		Group Green	
Participant	**Country**	**Participant**	**Country**
Officer Rijkswatertstaat (chair)	Netherlands	Officer Rijkswatertstaat (chair)	Netherlands
Officer Wasserstrassen-shifffahrtsverwalung (1)	Germany	Officer Via Donau	Austria
Officer Wasserstrassen-shifffahrtsverwalung (2)	Germany	Officer Egypt (ad-hoc representative)	Egypt
Officer consultancy firm	Belgium	Officer Waterwegen en Zeekanaal	Belgium
Officer Shipyard	Netherlands	Officer Port of Pittsburgh	USA
Officer Via Donau	Austria	Officer Flemish Hydrography (1)	Belgium
Officer US army Corps of Engineers	USA	Officer Flemish Hydrography (2)	Belgium
Officer PIANC Belgium	Belgium		

V Rijkswaterstaat Focus Group Discussion

A focus group discussion was held with project officials with the aim to gain deeper understanding of value creation in waterway projects as managed by Rijkswaterstaat, Netherlands. This group consisted of four officials: two project managers and two stakeholder managers of large waterways projects. A two-hour session was structured along four major questions related to redevelopment of waterways and cooperative arrangements with stakeholders. The results of this focus group discussion are shown in chapter 6.

Focus Group Questions

After a brief introduction of the study's topic, i.e. cooperation with actors outside the Rijkswaterstaat agency, the following four questions were used in the focus group discussion:

1. Why do you cooperate?
2. How do you weigh and decide about cooperation?
3. What could be done better in anticipation of many projects replacing ageing assets?
4. What is required for that?

Focus Group Participants

- Project Manager
- Project Manager
- Stakeholder manager
- Stakeholder manager
- Technical Chairman
- Discussant

VIa Elements of the action arenas (chapter 3)

Arena	Agenda setting/ policy making	Programming	Project Planning	Project preparation and implementation
Boundary rules	How actors enter/ leave agenda/ setting policy making arenas. E.g. politicians, lobbyists, government officials.	How actors enter/ leave programming arenas. E.g. politicians, lobbyists, government officials.	How actors enter/ leave project planning arenas. E.g. project members, permitting officials, project partners.	How actors enter/ leave project preparation/ implementation arenas. E.g. contracting team, construction team, local stakeholders.
Position rules	What do these actors want or need? How many have similar wishes?	What do these actors want or need? How many have similar wishes?	What do these actors want or need? How many have similar wishes?	What do these actors want or need? How many have similar wishes?
Choice rules	What policy actions do they take?	What programming actions do they take?	What planning actions do they take? Permitting process and intergovernmental agreements play a role in this phase.	What preparation/ implementation actions do they take? Design and contracting are important elements.
Scope rules	What is the result about? E.g. policy acts, guidelines.	What is the result about? E.g. programming sequence.	What is the result about? E.g. Environmental Impact Statement, inter-governmental agreements.	What is the result about? E.g. technical design, construction contract, agreements with local stakeholders.
Aggregation rules	How are decisions made? (voting/ consensus/ruling/ negotiating)	How are decisions made?	How are decisions made? This determines options for negotiating/ trading for value.	How are decisions made? This determines options for negotiating/ trading for value.
Information rules	What information is, or must be shared among actors?	What information is, or must be shared among actors?	What information is, or must be shared among actors? In this phase this determines the perception of transaction cost for value opportunities.	What information is, or must be shared among actors? In this phase this determines the perception of transaction cost for value opportunities.
Pay-off rules	How are benefits and costs distributed to actors in positions?	How are benefits and costs distributed to actors in positions?	How are benefits and costs distributed to actors in positions? (determines incentives to seize opportunities)	How are benefits and costs distributed to actors in positions? (determines incentives to seize opportunities)

VIb Arenas and rules determining the development of American waterway projects (chapter 3)

Arena	*Agenda setting/policy making*	*Programming*	*Project Planning (permits and local partnering arena)*	*Project preparation and implementation*
Position rules	This is a mostly political process played in the political arena. Political parties, representatives and senators determine positions on the basis of their constituents and political beliefs.	The IWUB defines its position on the basis of its members' interests. All members are commercial navigation companies. Congress representatives and senators usually follow the IWUB's advice.	Legal authorities determine their position on the basis of legislation and plans submitted by the project team. As local support is required for federal navigation projects, regional partners participating/ co-financing usually have a strong interest in improving navigation conditions (often these are local governments).	The project team is committed to adopt a position on the basis of the US Corps' assignment to facilitate navigation. The position of local stakeholders depends on the local situation. Often these positions relate to project externalities.
Boundary rules	Actors at this level are political and act at the national level. They are chosen by ordinary electoral rules or appointed by the US president. The President appoints the ASACW and SoD, the responsible actors for drafting policies.	Actors from the IWUB are chosen from fuel-tax paying companies using the waterway system. Candidacy and appointments follow a regular pattern of taking turns.	Project group members are assigned through the staffing procedures of the US Corps. The district commander as decision-maker for the Corps is appointed according to Army regulations. Representatives of legal authorities and committees are appointed based on their respective procedures.	Project group members are assigned through the US Corps' staffing procedures. Contracted private parties are involved through a public bidding process. Involved stakeholder representatives depend on the project. The number of stakeholders and their degree of involvement can vary greatly from project to project.
Choice rules	The Secretary of Defense defends the proposition, representatives express their opinions.	The IWUB's members express opinions and advise Congress and the US Corps. Unanimity for the IWUB's position is pursued as otherwise political follow-up would be doubtful.	The project group is committed to defend the plan: the committee can express opinions or ask questions. Cooperation with local partners is a negotiation process.	The project group, contracted parties and local stakeholders can express their opinions.

Scope rules	The ASACW establishes policy direction and prepares bills for congress. The result is an act determining the general scope and direction for the Civil Works under the Army's responsibility.	The result is a recommendation to congress, the SoD and ASACW. The recommendation is on funding, spending and prioritizing of waterway projects. It is followed by a proposal and decision-making in Congress.	Record of decision/ Environmental Impact Statement. The result is a plan in which effectiveness, scope, spatial and environmental impact and obligatory local co-funding is determined. The scope of the agreement with local partners can be about monetary support or support in kind by local partners. Support in kind is usually by transferring land for the project and procedural assistance.	The result is the design, construction and delivery of a waterway project, and compensatory and mitigative measures.
Aggregation rules	Decisions are taken by voting according to congressional voting rules.	Consensus for the recommendation is sought through negotiation. Final decision comes from Congress through voting.	The legal authorities decide on the approval of the project. Supplemental studies or changes to plan can be required to obtain approval. Agreement with local parties and co-funding emerges from a negotiation process.	The project manager decides the arguments put forward by project members and contracted parties. Contracted parties are bound by contract rules. Stakeholders can block or impede the process by litigation.
Information rules	All participants must have adequate and free access to information. Information is supplied through a formal process.	USACE is bound to provide support, information and advise where required by the IWUB's members.	A series of formal reports are provided by the project team and serve as the formal information for decision-making. Information supply and gathering does not follow any formal rules for the agreement with local partners.	Generic information is publically available. The US Corps makes special care to be transparent toward the public. Project progress, reports and other information are made available.
Pay-off rules	Political gain by parties, distribution of benefits over regions.	The IWUB's recommendations strongly determine the regional distribution of investments.	Distribution and the effects for local and regional stakeholders of the specific waterway project.	Detailed effects, land purchases, compensatory payments, and contracted deals with local parties.

VIc Arenas and rules determining the development of Dutch waterway projects (chapter 3)

Arena	*Agenda setting/ policymaking*	*Programming*	*Project Planning (permits and local partnering arena)*	*Project preparation & implementation*
Position rules	Political parties, representatives and the Minister define their positions on the basis of their political beliefs and the interests of their constituents. Waterways receive little specific attention in political programmes.	The DGs of the Ministry of Infrastructure determine their position on their respective portfolios, based on stakeholder and specialist advice. Waterway programming falls under the DG for Transport (DG *Bereikbaarheid*). Positions in Parliament are based on political beliefs and constituents.	Legal authorities determine their position on the basis of legislation and the plans submitted by the project team. Regional partners interested in participating in the project determine their positions depending on the type of organization.	The project team defines its position on the basis of their assignment and findings. The position of local stakeholders and the involved market parties is determined by their respective interests.
Boundary rules	Access is determined by electoral rules. The Minister is nominated and appointed by his or her political party and coalition decision-making.	Political access is determined by electoral rules. DGs and senior staff functions at the Ministry are allocated by ministerial appointment, but are not changed if a new minister takes post. Stakeholder groups for navigation and transportation have regular access to the discussion table.	The legal authorities involved are usually the Commission for Environmental Impact Assessments and the permitting authorities at provincial and municipal levels. Involvement is part of the formal process. Provinces and municipalities are often involved as project partners.	Project team members are appointed through *Rijkswaterstaat* processes. Contracted private parties are involved through public tenders. Stakeholder involvement depends on the project.
Choice rules	The Minister lays a proposal before Parliament and defends it. Waterway issues are usually part of wider infrastructure or transportation policy proposals.	Stakeholder groups and advisors express their opinions; the DG for Transport prepares and coordinates the programming proposal for the minister to defend. The proposal is known as 'MIRT' (Multi-year programme for infrastructure, spatial and transport projects).	The project group is committed to defend the plan submitted before the legal authorities. Regional authorities interested in participation have representatives who negotiate on behalf of their organization.	The project group, contracted parties and local stakeholders express their opinions. Legal committees can express opinions or ask questions.

Scope rules	The result is a decision on the proposal for all national transport and spatial projects, priorities and budgets.	The result is a long-term (5 to 10-year) financial commitment (MIRT) for infrastructure and environmental projects by Parliament. Each year this is updated in a new round.	In the legislative arena the result is a ruling, '*plan-besluit*' and permits. For local partnering the result is an agreement, '*bestuursovereen-komst*', on scope, cost-sharing and spatial/environmental impact.	The outcome includes the design and the delivery of a waterway project, and compensatory and mitigative measures.
Aggregation rules	Decisions are taken by vote, a simple majority ensures the outcome.	The DG decides on the basis of the advice and opinions received. The Minister presents a programming proposal before Parliament, parliament approves or disapproves.	Parties decide on the basis of a negotiated outcome whether to sign an agreement. Authorities with a say on the project decide on the basis of legislation and the opinions of the committee members.	Contracted parties are bound by the contract. The project manager decides on other issues. Stakeholders can block/delay the process through litigation.
Information rules	A formal package of background information is part of the proposals in Parliament.	The MIRT proposal is supported by extensive background documentation. This is made available in a book published yearly and on the internet.	All participants of a regional agreement must have adequate and free access to information. The authorities for granting permits are provided with a constraint set of information.	Generic information about the project is publically available.
Pay-off rules	Political gain by parties and the distribution of benefits across regions and sectors, influence the generic effects of waterway projects on stakeholders	Programming determines the prioritization of projects and programmes. Programming through the MIRT not only determines the distribution of funds across regions, but also across sectors such as roads, railroads, flood defence, public transportation, ports etc.	Distribution of benefits and cost for regional and local governmental bodies. Distribution of the impact of the specific waterway project on local and regional stakeholders. Municipalities and provinces can often benefit from including smaller works in the main project to achieve economies of scale or scope.	Detailed effects, land purchases, compensatory payments and contracted deals with local parties.

VII Biography

Arjan has 20 years of experience in developing waterways. He started his career at Royal Haskoning in international consultancy. The past 15 years he has been working for the Dutch Ministry of Infrastructure and the Environment. He is a specialist in waterborne transport infrastructure. Arjan holds a MSc. in Civil Engineering from Delft University of Technology. Research for his masterthesis was performed at the Universidad Politecnica de Catalunya, Spain.

Arjan started his career in 1995 at Royal Haskoning, international consultants and architects. Arjan was involved in a variety of projects in Venezuela, Colombia, India and other countries. He worked as a project engineer designing waterborne traffic related infrastructure like breakwaters, navigation channels and berthing facilities.

In 1999 Arjan became a project engineer at Rijkswaterstaat, Division Limburg, dept. of nautical studies. He worked on a variety of projects part of the Meuse Works, the large scale redevelopment of the Meuse river for improve navigation, reduce floodings and enhance spatial quality.

In 2003 Arjan switched to the corporate infrastructure development division of Rijkswaterstaat, De Bouwdienst. This division is responsible for planning and realization of all major construction works of Rijkswaterstaat. Arjan led a team of specialists in waterway and nautical studies in preparation for major works. He became the sr waterway advisor for the Infrastructure division, involved in a wide variety of projects like the upgrade of the IJmuiden Locks, an international benchmark study for lock construction, and the upgrade of the Julianacanal to facilitate navigation of two barge pushing convoys.

Internationally Arjan represented Rijkswaterstaat at missions to the Panama canal Authority and the South Korean peninsula, advicing Mr. Lee Myung Bak, the later president of the country, on his ambitious waterway plans for the country. Arjan also served as the Dutch representative in the International PIANC working group on Innovations in Navigation Locks, and the PIANC working group on Values of Inland Waterways.

Arjan started his research work as a PhD candidate at the University of Groningen in 2010. With this research position he was affiliated to the Faculty of Spatial Sciences, Dept. of Infrastructure and Environmental planning, guided his promotors Professors Jos Arts and Johan Woltjer. In the academic year 2011–2012 he conducted research for his dissertation at the Massachusetts Institute of Technology in Cambridge, MA, USA under guidance of Ford Professor Lawrence Susskind.

Back in the Netherlands, Arjan started in 2013 a research group for the standardized replacement of an upcoming series of 50 locks due for renewal. This research group built on expertise and research at the University of Groningen, Technical University of Eindhoven, Delft University of Technology and the Deltares Institute.

Since 2015 Arjan is the responsible officer to develop a Performance Management Framework, enabling Rijkswaterstaat to make decisions on quality of infrastructure in a coherent and transparent way. This framework ties policy ambitions to action on the ground and enables decision-makers to oversee consequences of various strategies both at operation and policy levels. As part of this effort an international scan on performance management at other infrastructure agencies, nationally and internationally, is performed.

With the aim to improve the value proposition for infrastructure development in a broad sense, Arjan, together with Peter Kamminga, founded the Global Infrastructure Institute in 2015. This not-for-profit initiative builds on the experience and knowledge of an international network of infrastructure specialists. The institute aims to provide evidence-based guidance for implementation of the UN sustainable development goals for infrastructure.

Peer Reviewed Scientific Publications

- Troubled waters: an institutional analysis of the ageing Dutch and American waterway infrastructure. *June 2015. Journal of Transport Policy. Elsevier publishers.*
- Value creation in capital waterway projects: application of a transaction cost and benefit framework for the Miami River and the New Orleans Inner Harbor Navigation Canal. *Journal of Land Use Policy, May 2014. Elsevier publishers.*
- Do we need to rethink our waterways? April 2014. *Journal of Integrated Water Management, Springer publications.*

- Dutch and American Waterway Development: identification and classification of tools for value creation. *Forthcoming.*
- Changing Practice in Dutch Waterway Planning. *Forthcoming.*

Conference Papers and Presentations

- Waardecreatie in infraprojecten. Een essay over 12 waardeprincipes. 83p. 2013.
- Resilience of waterway systems. An explorative study of Dutch, German and American Waterways. Paper TRA 2014, Paris.
- Market making in Dutch waterway development: experiences of value creating arrangements. ACSP conference Philadelphia, 2014.
- Ageing of waterways, large-scale replacement of hydraulic works in the Netherlands. Presentation at Smart River Conference in Maastricht/Liege, 2013.
- Alternatives for the projected sea lock for the Port of Amsterdam, A.C.L. Hijdra and A. Vrijburcht, PIANC congress Estoril 2006.
- Dutch waterways, Canal Seminar Korea, J.U. Brolsma, A.C.L. Hijdra, May 2007. Including conversation with president candidate, and later president of South Korea Mr. Lee Myung Bak.
- Maas wordt bevaarbaar voor tweebaks duwvaart (River Meuse navigable for pushing convoys), L.M.A. Claes, A.C.L. Hijdra, Land + Water magazine, november 2007
- Innovations in lock design, PIANC technical seminar Beijing 2008, Rigo Philippe, Peng Wu, Hijdra Arjan et al.
- The Zuidwillems-Canal Reinvented. Keynote speech World Canals Conference, Sept. 2008, Kingston, Canada.
- New design loads for bollards for inland navigation, A.C.L. Hijdra and A. Vrijburcht PIANC congress Estoril 2006
- Innovations in lock design, PIANC technical seminar Beijing 2008, Rigo Philippe, Peng Wu, Hijdra Arjan et al.
- Guest lectures at Delft University of Technology; ‘Waterway development’
- Lecturer ‘Design of waterways’ at the Foundation for Post Academic Education (PAO)

VIII Summary

For centuries development of society was closely related to nearby waters for a variety of reasons. Navigation often played an important role. In many situations it was the reason to improve navigation conditions in rivers and develop new canals. Today, societal needs and perspectives are different than in those years. Moreover, assets like navigation locks, bridges and dams are ageing, and climatologic circumstances are changing. With these three challenges, changing societal needs, ageing of assets and climate change, a sense of urgency for redevelopment is apparent. However, the wide set of issues related to mentioned challenges makes redevelopment a difficult task.

In the water sector, the widely embraced Integrated Water Resources Management framework and Adaptive Management framework may provide guidance. This guidance can be taken as a lead, but is not tailor-made for 'asset-heavy' navigable waterways. Moreover these frameworks are criticized for their lack of implementation power and the focal point in the optimization process remains unclear. Contemporary literature on public administration does fill this gap. A shift towards public value management is advocated since early 21st century, reflecting contemporary societal dynamics. The public sector is gradually adopting a market-oriented type of governance and an entrepreneurial style of operating. Contemporary societal dynamics imply that developments in the public arena are not dominated by sectoral governmental actors, but instead rely on involvement of a variety of actors, efficient coordination and inclusion of interests in a broad sense. The focus shifts from addressing sectoral interests, such as navigation and public investment, to including broader values associated with waterways, and delivering efficient coordination.

It is this value proposition the study focuses on. Waterways are in need of adaptation. Climate change, ageing assets and changing societal preferences are key driving forces behind it. Modern society calls for solutions, which build on the variety of aspects valued by stakeholders of all sorts. By taking value as the pivotal point, the road opens up for better returns on investment for funding agencies, broader and better appreciation of results, and efficient interaction between public agencies and stakeholders during planning and development activities. In concreto this study takes an institutional economic perspective and value is defined as cumulative maximized stakeholder satisfaction (Pareto efficiency).

In chapter 2 a constructed case, 'the Hoven canal', illustrates the problematic state of a waterway and the potential of value driven redevelopment. It makes clear that not all incentives to rethink waterways arise from re-establishing the traditional function by bringing these to modern standards. Opportunities to enhance the significance of waterways for society are an important factor as well. In a document study of current practice, applied elements to enhance the significance of waterways were collected. These elements were used to build the construct and show that investment strategies for current waterway projects assume a broader consideration of both the physical and institutional context in which these projects operate. In particular, linkages (or couplings) between waterway values and other land-use values are imperative. The construct of the Hoven canal clearly illustrates the advantages for society to build on these linkages. And as useful as a stylized case might be for illustrative purposes, it indeed raises the question how in the complexity of real life decision-making value is understood.

Understanding current institutions
In order to find out where steps can be made towards societal value, it is key to understand the decision-making of waterway authorities in the current situation. Such decision-making is dependent on its institutions; institutional analysis would be useful to gain such understanding. The Institutional Analysis and Development (IAD) framework is suitable for this purpose, as it breaks down the action arenas of the process into concrete elements. This framework is used in this study to determine where opportunities and barriers to improve the planning process can be found.

In chapter 3, two major waterway systems, the American and the Dutch system, have been analysed using the IAD framework to reveal those obstacles and opportunities. Sources used to investigate were the proceedings of sessions of the international PIANC working group on the variety of functions of waterways, documentation of the systems in both countries and various site visits, observations and interviews of waterway officials in both countries. The process of decision making in both institutional settings are broken down into action arenas and the rules associated with these arenas. The arenas and associated rules are set out along the planning phases in infrastructure development: agenda setting/policy making, programming, and planning and implementation. Such schematization proved to be helpful in understanding the institutions.

The US and Dutch situations were found to be alike in many aspects, which is remarkable given the different planning traditions in these countries: the Anglo-Saxon and the Rhineland traditions. Both have a centralized system for managing and developing waterways, which is also found in many other Western countries where waterways are of significant societal importance like for instance France, Germany and Austria. In the policy/agenda setting phase, decisions are taken about the outline of the waterway development. Similarities were also identified further down the line, as the national waterway authorities, US Corps of Engineers and Rijkswaterstaat both play a dominant role at the planning and implementation level. These agencies negotiate with a variety of local and regional government bodies to determine the detailed scope and impact of waterway development.

In both cases the data showed well-developed and institutionalized vertical coordination structures and activities, clear examples are the hierarchic structures from ministries to the operational waterway agencies like the US Army Corps of engineers in the USA and Rijkswaterstaat in the Netherlands. Opportunities and incentives for horizontal coordination were found in both countries; however, the rules of the action arenas do not seem to be aligned in such way that opportunities are easily captured. Specifically in the planning and implementation phase, the lack of alignment of scope rules, aggregation rules and pay-off rules to support broader optimization is found to be a hindrance. Room for improvement is found in aligning these. The first signs of recognition of the narrow scope as a hindrance is observed in the Netherlands, programming now includes spatial projects in addition to infrastructure projects.

The American case also reveals a promising aspect – mandatory local co-funding for federal navigation projects acts as a stimulus for broad stakeholder involvement. Improving horizontal coordination and seizing opportunities for multifunctional development can open pathways to optimize the value of waterway systems for society.

Finding rational economic logic

The findings from Dutch and American context provide insight in opportunities and barriers in terms of institutional arrangements. These insights underscore the relevance of horizontal coordination in order to realize societal value. Horizontal coordination does, however, provide endless possibilities. Because they can invest resources in a great many different ways, they need a way to

calculate the efficiency of the decisions they make. In chapter 4 this type of decision-making is analysed. Transaction cost theory, and the analysis that goes with it, has emerged as an important means of justifying efficiency decisions in the economic arena. A dedicated framework on the basis of this theory is used to unravel transactions in waterway development.

The power of the used transaction cost framework lies in the fact that transaction cost theory performs strongly at revealing hindrances in striving for societal value. It rationalizes the balance between potential benefits of cooperation and the resources needed to ensure this cooperation is delivering those benefits. It goes beyond the normative perception that water issues should be dealt with in an integrated way and sheds light on infrastructural projects from a perspective that differs from engineering perspectives or macro-economic perspectives. Applying this framework in real-life rich contexts helps to reveal the practical pointers today's practitioners need.

Transferring a transaction cost and transaction benefit framework to the sector of waterway development mean applying a well-known framework to a sector distinctively different from the private sector. The participating organizations are public, or are a mixture of public and private parties, the product has significant spatial implications, affects many stakeholders, and value capturing may be indirect and non-monetary. Nevertheless, the application of a transaction cost and transaction benefit framework appears to be a tool, which can improve insight in the complex system of value creation in waterway projects. This framework shows that seven principles are fundamental for waterway authorities to deliver broad societal value beyond their restricted mandate. These principles are;

- To create value beyond your own abilities, you need to seek cooperation,
- To build value in cooperation, some sort of transaction needs to take place,
- Transactions need to be beneficial for both parties,
- However, transactions come with costs as well,
- The benefits need to be greater than the costs for each party,
- The result of the transaction needs to be better than the BATNA* for each party,
- It has to be possible to capture the benefits.

* Best Alternative to Negotiated Agreement.

With such a framework, current practice was investigated and further insight was gained. The framework is applied to two case studies, which represent two distinct but common situations in waterway (re)development in Western countries; a neglected waterway in an urban setting, and a waterway in an industrial setting where economies of scale call for investments.

The case studies conducted were the Miami River project, and the New Orleans Inner Harbor Navigation Canal project. Through document study, site visits and interviews with project officials data was collected. The case studies showed that value could be created when transaction costs related to cooperation are overcome. This obstacle was overcome by the fact that BATNAs represented less value, transaction benefits were substantial, and transaction costs were kept low. The Miami River case study showed the usefulness of an agent, the Miami River Commission, whose assignment implicitly focuses on decreasing transaction cost in a complex cooperative development. In the New Orleans case the cooperation was focussed on a more narrow set of goals. The benefits of cooperation were high in terms of cost-sharing and economies of scope, transaction costs for cooperation were low due to a high level of trust, and he BATNAs represented a non-appealing outcome for both parties. The arrangements of both cases therefor represented high benefits, low transaction costs, and negative BATNA's. Or in other words: both represent fertile grounds for joint value creation.

The results from these first three steps in the study show that a) alternative arrangements can deliver societal value, b) that current institutions could do so by stimulating horizontal coordination and c) that by means of a transaction cost theoretical framework the rational economic logic behind real life situations can be explained. As the study aims to provide practical guidance, these in-depth insights need to be translated to useful systemized responses.

Systemizing institutional responses

Systemized responses by Waterway authorities to improve the value proposition in infrastructural projects can be obtained through structured use of tools and methods. By identification and characterization of tools and methods used for waterway redevelopment these can be checked on their expected effects on the rational economic logic from the earlier findings. This was done for the Dutch and American situation (chapter 5). Both countries have strong national authorities responsible for the navigation function of waterways. The societal

call for broader optimization is recognized, and both authorities make attempts towards increasing the socio-economic value of their capital waterway projects by deploying tools for broader optimization. Six recent cases, in which such attempts were made, are studied with the aim of identifying and classifying the tools deployed. From these cases a total of 15 tools are identified which stimulated broad optimization. These tools are classified by identifying the transaction characteristics associated with these tools. These characteristics can relate to cost, benefits or value capturing.

At a more abstract level the tools could be categorized into five types of governance based on the purpose related to value elements pursued. These were: (1) permitting instruments, (2) financial instruments, (3) contracting to optimize benefits or stimulate local returns, (4) cooperative instruments, and (5) trading houses. And although the purpose of each instrument might be clear and defendable, the data provided a rather dispersed image on the elements addressed according to transaction cost theory. This means room for further optimization is likely to be found. Ideally all transaction costs are to be minimized and all benefits and value capturing elements maximized.

Internationally, practitioners can expand their set of tools by adopting and application of successful tools as seen in other countries. Examples could be application of trading facilities or an obligatory requirement for co-funding in the Netherlands (as found in the USA), or trying out alternative contract forms in the USA (as found in the Netherlands). Ideally, deployment of mixes of tools should be complimentary and synergetic.

More broadly the study shows that current planning process in waterway development seems to be advancing. Both in the Netherlands and the USA a shift is seen from a traditional cost effective sectoral approach towards the application of tools to stimulate inclusiveness. Applying new mixes of tools and types of governance can be considered an emerging issue in the waterway sector. These mixes vary greatly in characteristics. Systematically considering application of tools in a structured way is a practical step forward. Dedicated research for selecting effective mixes of governance, improving tools and instruments and providing guidance for harmonization of deployment of tools could further strengthen advancements in the sector.

Practical guidance

After exploring the potential of a value driven approach (chapter 2), institutional analysis of waterway authorities (chapter 3), deeper understanding of the rational economic logic (chapter 4) and exploring the usefulness of tools and methods (chapter 5), the results can be translated to practical guidance. Such a translation has been made for the Netherlands (chapter 6). This country has an intensively used and economically important waterway system. Earlier results from the case studies have been used in focus group discussions. Two international and one Dutch focus group discussions were held. In these groups project officials, consultants and policy advisors all related to waterway projects participated and provided insight and feedback on the findings.

The Dutch case reveals that incentives in implementation are not typically aligned with policy ambitions to increase societal value. The results also show that a structured approach to determine benefits, externalities and coordination costs and the trade-offs to be made would be helpful in practice, as this would make it possible to follow a much more explicit and business-like process of decision-making. And although such a rationalized approach can be helpful, one should bear in mind that the decision processes take place in a dynamic context where a variety of factors, other than rational ones, play a roll.

In practice, coordination costs appeared to be underexposed. This reveals the paradox that only well-sourced agencies can tolerate limited attention for these costs, while at the same time well-sourced organizations may be expected to have most opportunity to optimize their projects.

More generically, the Dutch case shows a set of key hindrances that are internationally relevant. Key hindrances are poorly aligned policy ambitions with project incentives, limited systematic attention for coordination costs, and limited availability or application dedicated tooling to increase socio-economic value. These hindrances can be addressed by a set of institutional innovations, which are helpful in stimulating socio-economic value in waterway development. When operationalized, these form the basis for more structured decision-making and aligning policy aims for socio-economic value with project management incentives. The set of innovations is as follows:

- Stimulation of wider interaction with stakeholders
- Including opportunity scans
- Making project teams accountable for seizing value opportunities

- Increasing transparency, monitoring and management of coordination costs
- Treating renovations and renewals of assets as new projects
- Aligning policy ambitions with project incentives

Contemporary practice in Dutch waterway development does show that practitioners are aware of and sensitive to issues related to increasing societal value for waterway projects. Practitioners are thinking on how to proceed, and are trying to take steps in a forward direction. The case shows that practice of Dutch waterway development seems to be changing.

Overall findings
Although the title of the study clearly indicates waterways are the topic of interest, the institutional economic perspective taken provides a much wider relevance. The use of a transaction cost and transaction benefit framework, as applied in this study, proved to be useful and offers opportunities for the broader infrastructure domain. In terms of generic relevance of the study the set of '*operationalization characteristics of value creation for infrastructure*' (table 4-2, chapter 4) seizes the heart of the line of reasoning on the basis of this framework. This set of characteristics can be applied in all sorts of infrastructural developments where rational economic optimisation on the basis of a wide set of interests plays a role.

Specifically for waterways the study provides more detailed findings which can be of help as these networks will need considerable attention in the years to come. Due to changing societal preferences, changing climatological circumstances and ageing of assets redevelopment of waterways is an emerging issue in planning. Redevelopment that takes these new circumstances and preferences into account will lead to waterways that have a changing value for society. This changing value requires a change in coordination, as different issues and interests are at play. With the aim of the study to provide practical guidance, a 5-step approach is provided on the basis of the findings (Chapter 7).

If we step back a little from these practical steps and reflect on current practice in a more generic way, the study provides three major issues open to significant progress. These issues are the alignment of incentives, brokering of interests and limiting transaction costs.

The first issue, alignment of incentives, is rooted in the existence of hurdles in the process of creating value. Waterway agencies show specific problematic characteristics, which are to be addressed in order to move from cost-efficient network solutions towards socio-economic value optimization. A major hurdle was found in the lack of alignment of project incentives with policy aims. Room for improvement lies in aligning these. This can be achieved by, for instance, the application of mandatory co-funding, as found in American practice, or otherwise by rewarding project-teams for achieving inclusiveness.

The second issue, brokering of interests, pursues maximizing stakeholder satisfaction. As mentioned in the 5-step-plan, building value on the basis of maximizing stakeholder satisfaction is a process with many variables. Maximizing stakeholder satisfaction is straightforward when interests line up in a similar direction. Considering the wide variety of interests found around waterways, this will rarely be the case. Interests appear to be not in line or even conflicting. This requires smart processes in which finding mutual gains is key. The study showed that finding or creating a pragmatic platform where interests can be discussed, options explored, and effects weighed by all stakeholders, gives form to such a smart process. This could be called brokering of interests. It aims at finding the option delivering most value as opposed to a linear process converging to a single solution. Such brokering was found in the Miami case (Miami River Commission as brokering agency), the Napa Valley case (Friends of the Napa river as brokering agency), the Room for the River case ('omwisselbesluit' as an open format for brokering). In all these cases, a variety of options were considered, while step-by-step moving towards materialization of the ideas.

Key in the process of brokering of interests is keeping transaction costs low. Keeping these costs low will provide a greater set of options delivering mutual gains, options will have better net results and more iterations in the process are tolerated within the resources available. From this perspective, it is surprising that these types of costs appeared to receive limited attention. At first sight, transaction costs might seem of minor interest within the entire set of costs related to waterway projects, but effects of these costs are leveraged by these three mechanisms.

Internationally these findings are relevant for waterway agencies driven to create value for society. It is highly recommended to align incentives, to focus on ways to enable brokering of interests, and to ensure transaction costs are minimized. Keeping these costs as limited as possible would indeed smoothen the process of brokering of interests, leading to maximization of stakeholder satisfaction. These elements can be seen as cornerstones in an institutional economic perspective for waterway development around the globe. Taking such a route will lead to the delivery of redeveloped waterways of maximized value – or in brief, reciting the title of this study: 'Waterways, ways of value'.

IX Samenvatting (Summary Dutch)

Rivieren en meren hebben veelal een belangrijke rol gespeeld in de ontwikkeling van de samenleving. De aanwezigheid van water was om diverse redenen belangrijk, het vervoer van goederen en personen was vaak één van deze redenen. Om de bevaarbaarheid van wateren te verbeteren werden tal van ingrepen gedaan zoals aanpassing van bodem of oevers, afsnijden van rivierbochten en het aanleggen van stuwen en sluizen. De behoefte om scheepvaart te faciliteren leidde in veel landen bovendien tot het aanleggen van kunstmatige scheepvaartkanalen. Vandaag de dag zijn de maatschappelijke behoeften echter anders dan destijds en is ook het perspectief op deze wateren veranderd. Bovendien staat ook de bestaande functionaliteit van vaarwegen onder druk doordat vele kunstwerken zoals sluizen, bruggen en stuwen, verouderd zijn geraakt en klimatologische omstandigheden aan het veranderen zijn. Hiermee liggen er voor de vaarwateren een drietal uitdagingen: veranderende maatschappelijke behoeften, veroudering van kunstwerken en veranderende klimatologische omstandigheden. Herontwikkeling van vaarwegen is hiermee urgent geworden. Herontwikkeling is echter niet eenvoudig. Doordat de verwevenheid met tal van maatschappelijke belangen en instituties groot is, brengt herontwikkeling een uitgebreid scala van kwesties met zich mee.

Voor de watersector als geheel is het een bekend gegeven dat aanpassingen ingewikkeld kunnen zijn en vele belangen raken. Integraal waterbeheer en adaptief management zijn breed gedragen raamwerken om hiermee om te gaan. Deze raamwerken leveren sturende principes voor het beheren en ontwikkelen van wateren. Deze principes kunnen als leidraad gebruikt worden, maar bieden geen maatwerk voor de soms erg kunstmatige vaarwegen met vele harde kunstwerken. Bovendien is een algemeen kritisch aspect van deze raamwerken dat onduidelijk blijft hoe implementatie tot stand gebracht moet worden en wat nu het richtpunt van optimalisatie is. Hedendaagse bestuurskundige literatuur biedt hier echter juist aanknopingspunten voor. Vanuit deze literatuur wordt vooral sinds begin 21e eeuw ‘value management’ bepleit als antwoord op de maatschappelijke dynamiek waarin verwacht wordt dat aan de veelheid aan belangen recht gedaan wordt. Passend hierin is dat de publieke sector een marktgerichte aard heeft en een ondernemende stijl van werken kent. De hedendaagse maatschappelijke dynamiek maakt dat de ontwikkelingen in de publieke arena niet gedomineerd worden door sectorale publieke entiteiten, maar in plaats daarvan een beroep doen op de betrokkenheid van een groot

aantal actoren. Centraal staan efficiënte coördinatie en integratie van de belangen in brede zin. De focus verschuift dus van het aanpakken van sectorale belangen, zoals scheepvaartbelangen en publieke investeringen, naar het sturen op bredere waarde en het leveren van efficiënte coördinatie daarin.

Dit onderzoek richt zich op deze waarde propositie. Verouderende kunstwerken, klimaatverandering en veranderende maatschappelijke voorkeuren maken dat herontwikkeling van vaarwegen in urgentie toeneemt. De hedendaagse maatschappij vraagt om oplossingen die voortbouwen op de verschillende aspecten die gewaardeerd worden door de diverse belanghebbenden. Door het begrip *waarde* centraal te zetten ontstaat een perspectief van een beter rendement van investeringen, bredere en betere waardering van de resultaten, en een efficiënte interactie tussen overheidsinstanties en belanghebbenden tijdens de planning en ontwikkelingsactiviteiten. Hiermee neemt deze studie een institutioneel economisch perspectief. Waarde wordt hierbij gedefinieerd als de optelsom van alle belangen en de mate waarin deze worden bediend (Pareto efficiëntie).

In hoofdstuk 2 wordt deze waarde gedreven benadering geïllustreerd aan de hand van een geconstrueerde casus; het ‘Hoven kanaal’. In deze casus wordt de problematische toestand van een vaarweg beschreven gevolgd door het potentieel van een waarde gedreven herontwikkeling. De casus maakt duidelijk dat herontwikkeling niet alleen draait om het herstellen en moderniseren van de traditionele functies, maar ook om het vergroten van de betekenis van vaarwegen voor de samenleving in brede zin. Middels een documentenstudie van de huidige praktijk zijn elementen verzameld welke dit bredere belang dienen. Deze verzameling van elementen welke de betekenis van vaarwegen voor de samenleving vergroten zijn gebruikt om de casus op te bouwen. Hiermee wordt aangetoond dat het loont om de bredere fysieke en institutionele context mee te nemen in lopende en nieuwe investeringsstrategieën rond vaarwegen. Speciale aandacht is hierbij vereist voor de vele koppelingen tussen het water en het landgebruik in de omliggende zones. De casus van het ‘Hoven kanaal’ illustreert de voordelen voor de samenleving wanneer voortgebouwd wordt op deze verbanden. De casus betreft echter een gestileerde situatie. Voor illustratieve doeleinden is dit zeker nuttig, de vraag rijst echter wel hoe de complexiteit van besluitvorming in werkelijke praktijksituaties effectief te benaderen is.

Inzicht in de huidige instituties
Om stappen te kunnen maken richting het vergroten van maatschappelijke waarde, is het van belang inzicht te krijgen in de besluitvorming van vaarwegbeheerders in de huidige situatie. Dergelijke besluitvorming is afhankelijk van de instituties; institutionele analyse is daarmee een nuttig instrument om het inzicht te vergroten. Het Institutional Analysis and Development (IAD) raamwerk is hiervoor geschikt omdat het het proces van besluitvorming opdeelt in concrete elementen en de bijbehorende spelregels uiteenrafelt. Dit raamwerk wordt gebruikt in dit onderzoek om te bepalen waar kansen en barrières voor planologische verbeteringen te vinden zijn.

In hoofdstuk 3 zijn twee belangrijke vaarwegsystemen, de Amerikaanse en het Nederlandse systeem, geanalyseerd met behulp van het IAD raamwerk. Doel hierbij is om de belemmeringen en kansen voor een waarde gedreven benadering in beeld te krijgen. Bronnen welke hiervoor zijn gebruikt zijn: verslagen van de internationale PIANC werkgroep over de verschillende functies van vaarwegen, documentatie over de systemen in beide landen, observaties tijdens diverse projectbezoeken in beide landen en interviews met betrokken personen bij deze vaarwegprojecten. Het proces van besluitvorming rond vaarwegontwikkeling is op basis van de data onderverdeeld in actie-arena's en de bijbehorende bepalende regels conform het IAD raamwerk. De actie-arena's zijn daarbij gecategoriseerd naar de planfasen van ontwikkeling van infrastructuur: agendastelling/beleidsvorming, programmering, planning en uitvoering. Een dergelijke schematisering is instrumenteel voor het begrijpen van de instituties.

De Amerikaanse en Nederlandse situaties blijken vergelijkbaar te zijn in diverse opzichten, wat opmerkelijk is gezien de verschillende planning tradities in deze landen; de Angelsaksische en Rijnland tradities. Beide hebben een nationaal gecentraliseerd systeem voor het beheer en de ontwikkeling van de vaarwegen. Een dergelijke inrichting wordt aangetroffen in veel andere westerse landen met vaarwegen van significant maatschappelijk belang, zoals bijvoorbeeld Frankrijk, Duitsland en Oostenrijk. In beide onderzochte landen wordt op dit nationale niveau de koers en ambitie bepaald voor vaarwegontwikkeling; de invulling van de agendastelling/beleid fase. Een overeenkomst is ook dat beide landen beschikken over een nationale uitvoeringsorganisatie voor het beheer en ontwikkelen van vaarwegen te weten het US Corps of Engineers en Rijkswaterstaat. Deze uitvoeringsorganisaties spelen in beide situaties een

dominante rol bij de planning en implementatie van ontwikkelingen. Deze organisaties onderhandelen met een verscheidenheid aan lokale en regionale overheden om de invulling, reikwijdte en de impact van vaarwegontwikkeling te bepalen.

De data liet voor beide landen goed ontwikkelde en geïnstitutionaliseerde verticale coördinatiestructuren zien. Beide casussen zijn duidelijke voorbeelden van hiërarchische structuren waarbij de ministeries de operationele vaarwegbeheerders aansturen. Kansen en stimulansen voor horizontale coördinatie werden ook gevonden in beide landen. Echter, de regels van de actie arena's blijken niet eenduidig te zijn ingericht om mogelijkheden voor maatschappelijke waardevermeerdering te creëren. Met name in de planning- en uitvoeringsfase blijkt een gebrek aan afstemming van 'scope' regels (reikwijdte van besluitvorming), 'aggregation' regels (hoe komt een beluit voort uit de groep deelnemers in een actie-arena) en 'pay-off' regels (hoe betaalt een besluit zich terug aan de individuele deelnemers) belemmerend te werken voor verdere optimalisatie. Hier ligt dan ook de belangrijkste ruimte voor verbetering. Tekenen van erkenning van deze belemmering werden waargenomen in de Nederlandse casus; programmering omvat nu ruimtelijke projecten in aanvulling op infrastructuurprojecten. De Amerikaanse casus toont ook een veelbelovend aspect; verplichte lokale cofinanciering voor de nationale vaarwegprojecten. Deze verplichte cofinanciering werkt als een stimulans voor een brede betrokkenheid van belanghebbenden. De bevindingen op basis van beide casussen geven aan dat verbetering van horizontale coördinatie en benutten van kansen voor multifunctionele ontwikkeling het perspectief op vergroting van de maatschappelijke waarde verbetert.

Het vinden van rationele economische logica

De bevindingen uit de Nederlandse en Amerikaanse context geven inzicht in de kansen en belemmeringen op het gebied van institutionele arrangementen. Deze inzichten onderstrepen het belang van horizontale coördinatie met het oog op het realiseren van maatschappelijke waarde. Horizontale coördinatie kan echter op een groot aantal manieren worden ingevuld. Omdat de beschikbare middelen voor horizontale coördinatie echter beperkt zijn, is het voor actoren van belang om vroegtijdig in te kunnen schatten welke keuzes het meeste rendement zullen opleveren. In hoofdstuk 4 wordt dit soort besluitvorming geanalyseerd. Transactiekostentheorie en de bijbehorende analyses hebben zich bewezen als een belangrijk instrument om institutionele efficiency te waarderen. Een

specifiek geoperationaliseerd raamwerk op basis van deze theorie wordt gebruikt om de transacties in vaarwegontwikkeling te ontrafelen.

De kracht van het gebruikte transactiekosten raamwerk ligt in het feit dat transactiekostentheorie gericht is op het inzichtelijk maken van fricties en belemmeringen in het streven naar maatschappelijke waarde. Het rationaliseert het evenwicht tussen de potentiële voordelen van samenwerking - de synergie - en de prijs die betaald moet worden om te garanderen dat deze samenwerking de voorziene voordelen gaat opleveren. Hiermee gaat het dieper dan de alom geprezen perceptie dat waterkwesties integraal aangepakt moeten worden. Bovendien belicht deze benadering infrastructurele projecten vanuit een perspectief welke aanvullend is op de veelal gehanteerde technische en macro-economische perspectieven. Het toepassen van dit theoretische kader in de rijke context van de praktijk helpt daarbij professionals in het vormgeven van de institutionele arrangementen rond vaarwegontwikkeling.

Het toepassen van een transactiekosten raamwerk voor de vaarwegensector betekent dat een welbekend raamwerk uit de private sector toegepast wordt in het publieke domein. De betrokken organisaties zijn publiek, of zijn een mix van publieke en private partijen. Het product is op een aantal punten ook veelal afwijkend van producten uit de private sector; het heeft belangrijke ruimtelijke implicaties, treft vele stakeholders, en het vangen van waarde is vaak indirect, niet-monetair of beiden. Maar net als in de private sector geldt ook voor de publieke sector dat de toepassing van een raamwerk gericht op de transactiekosten en transactiebaten het inzicht in het complexe systeem van waardecreatie in vaarwegprojecten kan verbeteren. Dit raamwerk laat zien dat zeven beginselen van fundamenteel belang zijn voor de vaarwegbeheerders om brede maatschappelijke waarde te leveren uitgaande van hun gereguleerde en begrensde mandaat. Deze principes zijn;

1. Om waarde te creëren buiten je eigen capaciteiten, moet je zoeken naar samenwerking,
2. Om waarde te creëren in samenwerking, moet een soort van transactie plaatsvinden,
3. Transacties dienen gunstig te zijn voor beide partijen,
4. Echter, transacties komen met kosten om deze tot stand te brengen,
5. Voor iedere partij moeten de voordelen van de transactie groter zijn dan de kosten die de transactie met zich meebrengt,

6. Het resultaat van de transactie moet voor ieder beter zijn dan de respectievelijke BATNA's*,
7. Het moet mogelijk zijn om de voordelen te vangen.

** Best Alternative To Negotiated Agreement.*

Met behulp van het transactiekosten raamwerk is de huidige praktijk onderzocht aan de hand van een tweetal casussen. Deze casussen representeren twee verschillende, maar veelvoorkomende, situaties voor binnenwateren in westerse landen; een verwaarloosde vaarweg in een stedelijke omgeving, en een vaarweg in een industriële omgeving waar behoefte is om de economische voordelen van schaalvergroting te benutten.

Deze situaties werden gerepresenteerd door respectievelijk het Miami River project, en het New Orleans Inner Harbor Navigation Canal project. De gebruikte bronnen voor deze casussen bestonden uit documenten, observaties tijdens projectbezoeken en semigestructureerde interviews met medewerkers van betrokken organisaties. De casussen laten zien dat waarde kan worden gecreëerd door diverse vormen van samenwerking, mits de hieraan relateerde transactiekosten overwonnen kunnen worden. Deze hindernis werd overwonnen door het feit dat in beide situaties de BATNA's weinig waarde vertegenwoordigden, de synergetische voordelen aanzienlijk waren, en de transactiekosten laag gehouden konden worden. De Miami River casus toonde het nut aan van een makelaarsplatform waarbij belangen bij elkaar gebracht konden worden; de Miami River Commission. Deze commissie richtte zich op het langdurig en laagdrempelig bijeenbrengen en uitonderhandelen van belangen waarbij in feite transactiekosten gereduceerd werden in een complexe samenhangende opgave. In het geval van New Orleans is de samenwerking gericht op een smallere set doelstellingen. De voordelen van de samenwerking waren hoog in termen van het delen van kosten en het behalen van 'economies of scope' (voordeel doordat werk met werk gemaakt kan worden). De transactiekosten voor de samenwerking waren laag als gevolg van een hoge mate van vertrouwen, en de BATNA's vertegenwoordigden een niet-aansprekend resultaat voor beide partijen. In algemene zin lieten beiden casussen dus grote voordelen zien van samenwerking, lage kosten om tot samenwerking te komen en slecht scorende BATNA's. Met andere woorden; beide casussen hadden vruchtbare grond voor gezamenlijke waardecreatie.

De resultaten van deze eerste drie stappen in het onderzoek laten zien dat a) alternatieve arrangementen aanvullende maatschappelijke waarde kunnen leveren, b) dat de huidige betrokken organisaties dat kunnen realiseren door het stimuleren van horizontale coördinatie en c), door middel van een transactiekostentheoretisch raamwerk de rationele economische logica achter bestaande situaties kan worden verklaard. Het doel van de studie is echter om praktische handvatten te bieden, de opgedane inzichten zullen daartoe vertaald moeten worden naar bruikbare gesystematiseerde acties.

Systematiseren institutionele acties
Om effectief gebruik te maken van de kansen die de instituties bieden om maatschappelijke waarde tot stand te brengen, en tegelijkertijd barrières te slechten is het van belang hier systematisch op in te spelen. Door op gestructureerde wijze gebruik te maken van beschikbare instrumenten en methoden kunnen de institutionele acties in sterke mate gesystematiseerd worden. De beschikbare instrumenten en methoden dienen daartoe eerst geïdentificeerd en gekarakteriseerd te worden. Hierdoor kunnen de effecten op de rationele economische logica zoals eerder gevonden in beeld worden gebracht. Dit is gedaan voor de Nederlandse en Amerikaanse situatie (hoofdstuk 5). Beide landen hebben sterke nationale autoriteiten die verantwoordelijk zijn voor goed functionerende vaarwegen. De maatschappelijke wens tot bredere optimalisatie wordt door beiden erkend, en beide autoriteiten doen pogingen om de socio-economische waarde van hun vaarwegprojecten te vergroten door toepassing van specifieke instrumenten en methoden. Zes recente casussen waarin dergelijke pogingen zijn gedaan zijn geanalyseerd met als doel het identificeren en classificeren van het gereedschap wat hiervoor is gebruikt. Uit deze casussen zijn in totaal 15 hulpmiddelen geïdentificeerd die een brede optimalisatie van de waarde beogen. Deze gereedschappen zijn geclassificeerd aan de hand van transactiekenmerken. Deze kenmerken kunnen betrekking hebben op de kosten, de baten of het vangen van waarde.

Op een meer abstract niveau zijn de gevonden instrumenten onder te verdelen in vijf bestuurlijke typen op basis van de relatie met de socio-economische waarde. Deze typen zijn: (1) vergunningen, (2) financiële instrumenten, (3) instrumenten ter optimalisatie van aanbestedingsprestaties, (4) samenwerking-instrumenten en (5) platforms om belangen bijeen te brengen. Hoewel het doel van elk instrument helder en verdedigbaar is, laat de data zien dat de inzet van instrumenten vrij onevenwichtig de diverse waarde-elementen van het

transactiekostentheoretisch kader adresseert. Hiermee laten de casussen zien dat er ruimte ligt om met de beschikbare gereedschapsset effectiever op waarde te sturen. Idealiter zouden alle transactiekosten worden geminimaliseerd en alle voordelen en waarde captatie elementen gemaximaliseerd.

Vanuit internationaal perspectief valt er voor professionals veel te leren van andere landen. Zij kunnen hun voordeel doen met instrumenten welke al met succes worden toegepast over de grens. Voorbeelden hiervan zijn het toepassen in Nederland van makelaarsplatforms of verplichte cofinanciering (zoals in de VS gevonden), of andersom door het toepassen van alternatieve contractvormen in de VS (zoals in de Nederlandse praktijk wordt gedaan). Idealiter is de inzet van combinaties van instrumenten complementair en synergetisch.

Meer in het algemeen blijkt uit de studie dat de planologie van vaarwegen zich aan het ontwikkelen is. Zowel in Nederland als in de Verenigde Staten is een verschuiving waar te nemen van een traditionele kosteneffectieve sectorale benadering naar het toepassen van instrumenten om een meer inclusieve ontwikkeling te stimuleren. Het toepassen van nieuwe combinaties van instrumenten en typen van bestuur kan worden beschouwd als een opkomende ontwikkeling in de vaarwegensector. De toegepaste mix van instrumenten in relatie tot de benodigde elementen om een evenwichtige waarde gedreven aanpak te komen varieert sterk. Een meer systematische en samenhangende toepassing van instrumenten zou daardoor een praktische stap voorwaarts zijn. Toegepast onderzoek gericht op het vinden van de meest effectieve combinaties van bestuur en verdere verbetering van instrumenten zou de ontwikkeling in de sector verder kunnen stimuleren.

Een praktische leidraad

Na het verkennen van de mogelijkheden van een waarde gedreven aanpak (hoofdstuk 2), institutionele analyse van vaarwegbeheerders (hoofdstuk 3), dieper begrip van de rationele economische logica (hoofdstuk 4) en het verkennen van het nut van instrumenten en methoden (hoofdstuk 5) kunnen de resultaten worden vertaald naar een praktische leidraad. Een dergelijke vertaling is gemaakt voor de Nederlandse praktijk van vaarwegontwikkeling (hoofdstuk 6). Omdat Nederland een economisch belangrijk en intensief gebruikt vaarwegennet heeft met tal van verouderde kunstwerken is een leidraad hier zeer relevant. Om tot deze leidraad te komen zijn de resultaten van de eerdere case studies gebuikt in een drietal focusgroepdiscussies. Twee focusgroepen

hadden een brede internationale bezetting, één focusgroep een specifiek op de Nederlandse praktijk gerichte bezetting. De deelnemers in deze groepen hadden een achtergrond als projectmedewerker, projectleider, consultant of beleidsmedewerker, allen gerelateerd aan vaarwegprojecten. In de discussies werden inzichten uit de praktijk gedeeld en werd gereflecteerd op de bevindingen uit de case studies.

De Nederlandse casus laat zien dat stimulansen in de uitvoering vaak niet in lijn zijn met de beleidsambities om de maatschappelijke waarde te verhogen. De resultaten tonen ook aan dat het nuttig is om voor vaarwegprojecten een gestructureerde aanpak te volgen waarbij de positieve effecten, externe (negatieve) effecten, coördinatiekosten en de mogelijke afwegingen transparant worden. Hiermee kan een veel explicieter en zakelijk proces van besluitvorming worden gevolgd. Een kanttekening hierbij is dat een dergelijke gerationaliseerde benadering weliswaar houvast kan bieden, maar dat beslissingen en processen zich afspelen in een dynamische context waar een verscheidenheid aan factoren, ook andere dan rationele, een rol spelen.

Het onderzoek brengt ook naar voren dat coördinatiekosten in de praktijk onderbelicht zijn. Hiermee ontstaat een paradox dat organisaties die wat ruimer in de middelen zitten een relatief grote tolerantie voor deze kosten hebben, terwijl op hetzelfde moment voor dergelijke organisaties verwacht mag worden dat deze de meeste kansen bieden om hun projecten te optimaliseren.

Meer in het algemeen, laat de Nederlandse situatie ook een aantal belemmeringen zien welke internationaal relevant zijn. De belangrijkste belemmeringen zijn slecht afgestemde beleidsambities met project stimulansen, weinig systematische aandacht voor de coördinatiekosten en de beperkte beschikbaarheid of toepassing van instrumenten gericht op het vergroten van de sociaaleconomische waarde van projecten. Deze belemmeringen kunnen worden aangepakt door een reeks institutionele vernieuwingen die van nut zijn bij het stimuleren van deze sociaaleconomische waarde in vaarwegontwikkeling. Wanneer geoperationaliseerd, vormen deze de basis voor een meer gestructureerde besluitvorming en afstemming van beleidsambities met uitvoeringsprikkels. De volgende institutionele vernieuwingen komen hierbij naar voren:

- Stimulering van grotere interactie met stakeholders,
- Inclusieve kansen scans,
- Projectteams verantwoordelijk maken voor het grijpen van kansen owaarde vergroting,
- Het versterken van de transparantie, monitoring en beheersen van coördinatiekosten,
- Het behandelen van renovatie en vernieuwingen als nieuwe projecten,
- Uitlijnen van beleidsambities met project prikkels.

De hedendaagse praktijk van vaarwegontwikkeling in Nederland laat verder zien dat betrokken professionals zich bewust zijn van, en gevoelig voor, mogelijkheden voor het vergroten van de maatschappelijke waarde van vaarwegprojecten. Deze professionals zoeken manieren om hiermee om te gaan, en proberen stappen voorwaarts te nemen. De casus laat zien dat de praktijk van de Nederlandse vaarwegontwikkeling aan het veranderen is.

Algemene bevindingen
Hoewel de titel van het onderzoek duidelijk aangeeft dat vaarwegen het onderwerp van studie zijn, levert het gehanteerde institutionele economische perspectief een aanmerkelijk bredere relevantie. Het gebruik van een transactiekosten en transactiebaten raamwerk, zoals toegepast in dit onderzoek, biedt ook aanknopingspunten voor het bredere infrastructuur domein. Resultaten zullen echter altijd verschillen van project tot project. In termen van algemene relevantie van de studie is het hart van de redeneerlijn weergegeven met de set van ‘operationalisering kenmerken van waardecreatie voor de infrastructuur’ (tabel 4-2, hoofdstuk 4). Deze set van eigenschappen kan worden toegepast in een brede waaier van sectoren waar rationele economische optimalisatie op basis van een brede set van belangen een rol speelt.

De genoemde rationele economische optimalisatie is in dit onderzoek specifiek toegepast op de vaarwegensector, een sector die de komende jaren de nodige aandacht vraagt. Als gevolg van veranderende maatschappelijke voorkeuren, klimaat omstandigheden en veroudering van kunstwerken is herontwikkeling van vaarwegen een opkomend onderwerp in de planologie. Herontwikkeling welke rekening houdt met deze nieuwe omstandigheden en voorkeuren zal leiden tot vaarwegen met een veranderende waarde voor de samenleving. Dit vereist een verandering in de coördinatie omdat een grotere diversiteit van belangen en onderwerpen onderdeel van herontwikkeling worden. Om deze veranderende

dynamiek van handvatten te voorzien, is een 5-staps-benadering opgesteld op basis van de bevindingen (hoofdstuk 7).

Reflecterend op de huidige praktijk in algemene zin, identificeert het onderzoek een drietal belangrijke onderwerpen waar aanzienlijke vooruitgang geboekt kan worden. Deze gebieden zijn het uitlijnen van stimulansen over alle planfasen, de makelaarsrol van belangen en het beperken van transactiekosten.

Het eerste onderwerp, uitlijnen van stimulansen over de planfasen, komt voort uit de identificatie van hindernissen in het proces van waarde creëren. Vaarwegautoriteiten tonen specifieke problematische kenmerken welke geadresseerd moeten worden om van kostenefficiënte netwerkoplossingen naar een waarde gedreven aanpak te komen. Niet uitgelijnde beleidsambities met projectstimulansen is zo'n problematisch kenmerk, ruimte voor verbetering ligt in de uitlijning van deze twee. Dit kan worden bereikt door bijvoorbeeld de toepassing van verplichte cofinanciering, zoals gevonden in de Amerikaanse praktijk, of op andere wijze door het belonen van projectteams voor het bereiken van inclusiviteit.

Met het tweede onderwerp, makelen van belangen, wordt het maximaliseren van de tevredenheid van belanghebbenden nagestreefd. Zoals beschreven in het 5-stappenplan is het creëren van waarde op basis van het maximaliseren van tevredenheid van belanghebbenden een proces met vele variabelen. Het maximaliseren van de tevredenheid van belanghebbenden is niet ingewikkeld wanneer deze belangen zich netjes uitlijnen in een vergelijkbare richting. Echter, gezien de grote verscheidenheid van belangen in de context van vaarwegontwikkeling zal dit zelden het geval is. Belangen zijn vaak verschillend of lijken zelfs conflicterend te zijn. Dit vraagt om slimme processen waarbij het zoeken naar wederzijdse voordelen de sleutel is. De studie laat zien dat het een pragmatisch makelaarsplatform hier invulling aan kan geven. Met een dergelijk platform kunnen door betrokkenen belangen worden besproken, opties onderzocht en effecten worden gewogen. Dit zou het makelen van belangen kunnen worden genoemd. Dit makelen beoogt uit alle mogelijkheden de optie met de maximale waarde te vinden in tegenstelling tot een lineair proces waarin pragmatisch wordt geconvergeerd naar een oplossing voor een specifiek gedefinieerd probleem. Een dergelijke makelaarsplatform werd gevonden in de Miami casus (Miami River Commission als platform), de Napa Valley casus (de stichting 'Vrienden van de Napa rivier' als platform), en de casus Ruimte voor de

Rivier (‘omwisselbesluit’ als een open format voor een makelaarsfunctie). In al deze gevallen werd een diversiteit aan opties overwogen, terwijl stap-voor-stap richting verdere ontwikkeling van ideeën werd gewerkt.

Cruciaal in het proces van het makelen van belangen is dat de transactiekosten laag blijven. Wanneer deze kosten laag zijn zal een grotere reeks opties synergetische voordelen opleveren, hebben deze opties betere nettoresultaten en kunnen meer iteratieslagen in het proces voor lief genomen worden om het maximale uit de beschikbare middelen te halen. Vanuit dit perspectief is het opvallend dat dit soort kosten beperkte aandacht blijken te krijgen. Op het eerste gezicht lijken de transactiekosten misschien van ondergeschikt belang in het geheel van de kosten van infrastructurele uitvoeringsprojecten, maar de drie genoemde mechanismen van deze kosten hebben een hefboomwerking op het algehele resultaat.

Internationaal zijn de bevindingen relevant voor vaarwegbeheerders met een ambitie om de waarde van vaarwegen voor de samenleving te versterken. Aanbevolen wordt om stimulansen over alle planfasen uit te lijnen, aandacht te besteden aan het makelen van belangen en ervoor te zorgen dat transactiekosten worden geminimaliseerd. Wanneer deze kosten minimaal zijn is de frictie om het maximale resultaat boven water te krijgen minimaal en leidt dit tot maximalisatie van tevredenheid van belanghebbenden. Deze elementen kunnen worden gezien als de hoekstenen in een institutioneel economisch perspectief voor vaarwegontwikkeling in brede zin. Een dergelijk perspectief leidt tot (her)ontwikkelde vaarwegen met maximale waarde of om de titel van dit proefschrift te citeren; ‘Waterways, ways of value’.

Waterways – Ways of Value

Historically, many western countries developed networks of navigable waterways to serve their transportation needs. Today these networks face a threefold challenge: assets like navigation locks, weirs and bridges are ageing, climate change influences operational circumstances, and society calls for consideration of the broader values waterways can provide. These issues induce an urgent need to redevelop this type of infrastructure, building on those broader values like for instance recreation, flood protection, ecology and waterfront development, as well as serving contemporary transportation needs. This study focuses on this intent and provides practical guidance to maximize societal value. A well-known framework to optimize value propositions in the private sector is adapted for the public sector and used in six American and Dutch case studies. The findings show that cooperation between all kinds of actors is crucial to build value, that successful cooperation relies on synergy, and that synergy is built according to specific rules. For practical guidance this process is detailed following a five-step approach. More in general three fields for improvement of current practice are identified: aligning policy ambitions with project management incentives, use of platforms for brokering of interests, and reduction of frictions in cooperation to stimulate synergy. The results are of use in the infrastructure sector in general, and specifically for the redevelopment of ageing waterways in today's society.

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