



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



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## ARTICLE INFO

### Article history:

Received 18 June 2014

Received in revised form

3 May 2015

Accepted 7 May 2015

### Keywords:

Inland waterway transport

Infrastructure

IAD framework

Institutional analysis

Value

## 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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## 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 and 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 was 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 and 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,

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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). Inter-connecting 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 elements which 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 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 action arenas. The elements in Table 1 have been categorized into four groups representing four major views in the 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 analyzed, 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.

## 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 and 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 et al., 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 and Bryson, 1987; Bryson and 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 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

**Table 1**

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

Waterway as logistical corridor	Waterway as 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	
	Landscape/aesthetics	Fisheries	
	Cultural identity		
	Military purposes		

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