Nieuw beleid voor verouderde vaarwegen: buiten de bestaande en gebaande paden?

Jannes Willems – Rijksuniversiteit Groningen – j.j.willems@rug.nl
Tim Busscher – Rijksuniversiteit Groningen – t.busscher@rug.nl
Jos Arts – Rijkswaterstaat / Rijksuniversiteit Groningen – jos.arts@rws.nl

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Samenvatting

De Nederlandse 'traditionele infrastructuur' – vaarwegen, spoorwegen, snelwegen – staat op een kruispunt. Veel infrastructuur is verouderd en moet de aankomende decennia vervangen worden. Waar voorgaand beleid met name gericht is op uitbreiding en het aanleggen van nieuwe infrastructuur, lijkt er een nieuwe fase te zijn aangebroken waarin er ook beleid moet worden ontwikkeld voor verouderde infrastructuur. Dit artikel reflecteert enerzijds op de ontwikkeling van infrastructuurbeleid en verkent anderzijds op basis van de historische ontwikkeling nieuwe beleidsrichtingen. Het Nederlandse vaarwegennet dient hierbij als voorbeeld van een verouderd infrastructuurnetwerk. Hierin staat het idee van matches en mismatches tussen de staat van de infrastructuur en het beleid centraal.

Dit idee is gebaseerd op een Large Technical System perspectief. Hierin zijn infrastructuurnetwerken het resultaat van een wisselwerking tussen sociale en technische elementen. Tussen beide elementen moet een zekere mate van congruentie bestaan om het systeem optimaal te laten functioneren. Deze verandert gedurende de ontwikkeling van een netwerk. De congruentie kan bekeken worden op drie verschillende schaalniveaus: geografie, tijd en functie. De wisselwerking resulteert in een co-evolutionair systeem, waarin vier opeenvolgende fases zijn te onderscheiden: (1) 'stichting'; (2) expansie; (3) verzadiging/volwassenheid; (4) vernieuwing. In elke fase is congruentie te verwachten – elk met een eigen geografische schaal, tijdshorizon en functionaliteit.

Door middel van een beleidsanalyse van het Nederlandse vaarwegennet (1878-nu) is de congruentie in de vier verschillende fases onderzocht. Het Nederlandse vaarwegennet was eind 19^{e} eeuw sterk regionaal georganiseerd. In de loop van de 20ste eeuw heeft het netwerk een grote capaciteitssprong gemaakt. De inbedding van nieuwe technische inzichten en een sterke centrale sturing vanuit Rijkswaterstaat waren hierbij belangrijk. Hiermee verschoof de aandacht van regionale verbindingen naar het netwerkniveau. Vanaf de jaren '70 kwam er meer aandacht voor een integrale benadering en werden transportopgaven gecombineerd met ecologische en ruimtelijke vraagstukken. De aandacht richt zich in deze fase niet zozeer op de omvang, maar meer op de kwaliteit van het netwerk. Hiermee verschuift ook de focus van beleid. Losstaande objecten worden opgeknapt om de betrouwbaarheid te verbeteren. Sinds 2010 komt nadrukkelijk de vraag naar voren hoe verouderde netwerkonderdelen vervangen gaan worden. Kleinschalige initiatieven verkennen hiervoor nieuwe beleidsrichtingen, waarbij een langere tijdhorizon wordt beschouwd en meer vanuit (onderdelen van) het netwerk wordt gedacht. Het huidige beleid verfijnt daarentegen de reeds gebaande paden. Met de verschuiving richting een periode van vernieuwing lijkt er daarom een potentiële mismatch te ontstaan tussen het beleid en de staat van de infrastructuur.

1. A new challenge: renewing infrastructure networks

Infrastructure planners in western countries are increasingly confronted with new challenges related to mature transport infrastructure networks, such as waterways, railways and highways. The main linkages in these networks are established and networks can therefore be considered more or less complete (OECD, 2007). This has resulted in highly advanced infrastructure networks that serve essential needs for societies. At the same time, western countries are in need to keep these networks competitive (G20, 2014). Much infrastructure has been built in the first half of the 20th Century and is currently ageing and in some cases even "structurally deficient" (CAP, 2013; see as well OECD, 2007; Deltaprogramma, 2012). Examples from Germany and the United States illustrate the disrupting effects of deficient infrastructure, challenging the country's competitiveness (Die Welt, 2013; The Economist, 2013). As a result, the state of the existing infrastructure network is nowadays a bigger concern than it used to be, since these networks remain to function as an important backbone to society (Hijdra et al., 2014; IMF, 2014). In other words, as also Barack Obama, president of the United States, argued in his fiscal year budget, we need to begin with "the hard work of rebuilding our infrastructure (…). We need to repair our existing infrastructure, and invest in the infrastructure of tomorrow" (OMB, 2013, p.2).

From a Large Technical System perspective, infrastructure networks are entering a phase of renewal. This perspective considers an infrastructure system as the interplay between multiple components, both social and technical. The interplay between the two elements makes that a system co-evolves, in which four phases can be distinguished: establishment, expansion, maturity and renewal (Hughes, 1987; Kaijser, 2004; Geels, 2007; Bolton & Foxon, 2015). Much research has been carried out to examine the emergence and growth of novel systems, i.e. a focus on the establishment and expansion (e.g., Hughes, 1987; Geels, 2007). Also the concept of path dependency has received considerable attention, explaining how systems develop over time (Pierson, 2000; Unruh, 2000). Yet, as Summerton (1994) and Geels (2007) argue, limited research has been conducted to examine how systems are moving from a state of maturity towards a state of renewal.

This paper aims to explore which policy directions are being taken to deal with the issue of renewal and if these directions are congruent with the state of the network. Based on Finger et al. (2005), we argue that a certain degree of congruence is required between social and technical components to make a system function. The congruence evolves simultaneously with the co-evolution of an infrastructure network. Hence, a different congruence can be expected in the different system stages. This will be further explained in the second section. If infrastructure networks are shifting from a state of maturity towards a state of renewal, the question arises how infrastructure policies should adjust to ensure a new congruence (cf. Finger et al., 2005). The coherence will be researched on the base of push and pull factors. The paper discusses a case study of the Dutch inland waterway network (1878-now), as it is a topical example of a mature system that is increasingly facing the issue of aging components. The third section elaborates on the methodology and introduces the case study. In the fourth section, a policy analysis of the inland waterway network is carried out to describe the congruence in previous phases as well as to look ahead exploring the congruence in the novel phase of renewal. The main conclusions are presented in the fifth and final section.

2. Towards renewing infrastructure networks: theoretical explanations

Inland waterway systems have been transformed into highly advanced systems as the outcome of the mutual interplay between technical advances and societal developments. The understanding of this interaction lies at the heart of socio-technical systems or large technical systems approaches. Such approaches are rooted in the idea of "the social shaping of technology" (Bolton & Foxon, 2015, p.539). Hughes (1987) emphasises that social elements – the beliefs of people, organisations and institutions reflected in policies – influence the development of technical systems. These approaches are concerned with unpacking the dynamics and evolution of systems (Arthur, 1994; Pierson, 2000).

2.1 Inland waterways as large technical systems

Large technical systems, such as inland waterway systems, are systems that are essential to everyday life serving multiple purposes (Jonsson, 2000; Kaijser, 2004; Hijdra et al., 2014). Inland waterways serve not only a communicative function (in particular freight transportation), but contribute as well to freshwater distribution and water safety. Because of this public interest, the state is often the main responsible actor, for instance reflected in public ownership or regulation. The success of large technical systems lies in their reliability, convenience and (financial) accessibility (Kaijser, 2004). Systems are usually capital-intensive and their assets have a long-term durability. These large-scale systems consist of many interrelated social and technical components that are in need to be aligned – or managed – for successful operation. Suitable institutional arrangements that coordinate public and private actors are required to achieve this.

2.2 The need for congruence between social and technical components

Therefore, as Finger et al. (2005) argue, a certain degree of congruence is required between the technical and institutional coordination of a system to ensure its well-functioning. If not, a 'mismatch' may occur, causing potential disruptions, inefficiencies and loss of important system components (Cumming et al., 2006). The degree of congruence can be operationalised as the extent to which the scale of social systems correspond with the scale of technical systems (cf. Cumming et al., 2006). After Cumming et al. (2006), we research if a mismatch exists between the scales of policies and the scales of the technical network being managed. There exists a wide variety of scales, spanning across for instance geographical, temporal, institutional or jurisdictional boundaries (see for an overview Gibson et al., 2000; Cash et al., 2006). Typically, a scale distinguishes several levels or degrees ranging from broad-scale to fine-scale (Cash et al., 2006). In this article, we follow Lee (1993) who introduces three types of scales: space, time and function. First, the spatial scale concerns the geographical boundaries of the infrastructure network, in which three levels could be distinguished: the component level, the node level, and the network level (Bollinger et al., 2014). Second, the temporal scale is operationalised into short-term versus long-term time horizons. Third, the functional scale puts central the dichotomy between sectoral versus comprehensive, integrative approaches. Table 1 provides an overview of the three scales, which need to be aligned between the technical and social part of a system.

Table 1: Three scales.

	Fine-scale		Broad-scale
Geography	Component	Node	Network
Time horizon	Short term	Medium term	Long term
Function	Sectoral		Integrative

2.3 The phased nature of large technical systems

The mutual relations between the social and the technical part are far from static. Rather, this interaction is continuously co-evolving, as both elements are reinforcing each other. Both sides co-evolve over time, and so does the congruence between the two. Co-evolution leads to a system that is becoming more advanced, yet also more reinforced in a certain trajectory (Pierson, 2000). The co-evolutionary process follows a phased nature, in which four stages can be distinguished (Hughes, 1987; Kaijser, 2004). Periods of turbulent change are interchanged with periods of slow, incremental change (Bolton & Foxon, 2015). These changes can be seen as the outcome of a combination of push and pull factors (Rauws & De Roo, 2011).

The first phase of network development is the establishment phase, in which typically many niches are competing with each other (Levinson, 2005). Kaijser (2004) argues that an institutional innovation is crucial to establish a new system, to enable use of the substantial investments by a wider audience. The second phase is characterised by heavily expansion, in which the system gains momentum and takes off, reflected in high growth rates. It becomes more interesting to invest in the network, since the marginal costs are relatively low to easily expand the network (Pierson, 2000; Kaijser, 2004). In addition, a dominant culture is likely to emerge, which comes with own routines and standards (Hughes, 1987; Unruh, 2000; Kaijser, 2004). The third phase is one of maturity, which is an outcome of the chosen trajectory. The high investments result in fixed assets and sunk costs, and make the system prone to inertia (Bolton & Foxon, 2015). The system becomes more rigid potentially leading to sub-optimal, 'locked in' outcomes (Bertolini, 2007). The fourth and final period is a phase of reconsideration (Frantzeskaki & Loorbach, 2010; Markard, 2010). The system is aging and in need to be replaced, while at the same time external developments such as climate change demand novel set-ups of the system. Hence, as also Markard (2010) concludes, a phase of renewal provides a window of opportunity to reconsider the system and explore new pathways.

Due to the process of co-evolution, the congruence between the social and technical side is challenged. In each phase, a (slightly) different institutional arrangement is required to adequately deal with the changed technical system and vice versa. This process of co-evolution challenges the scales in which systems are operating. Other scales might be more sufficient and, consequently, require an institutional arrangement adjusted to this new situation. The Dutch inland waterway network will be assessed that considers the three different scales in each phase, which will be explained in the next section.

3. Methodology

In this article, the case of the Dutch national inland waterway system is put central. Waterways are at the heart of the Netherlands and were one of the first transport modes, dating back already from the 14th and 15th Centuries. They encompass both natural rivers and man-made canals. Although the inland waterway system was challenged by novel systems such as railways and highways, it has evolved into an advanced system that continues to transport large amounts of goods (Hijdra et al., 2014). Due to its long-standing history, it provides an excellent research object to examine how the inland waterway network persisted its importance, next to railroads and highways, and has dealt with a state of maturity.

Our analysis centres on the period of 1878 until now. The inland waterway network underwent drastic changes in the 20th Century. At the end of the 19th Century, "public works engineers spoke of "a new-born country" and believed that the time was ripe for major undertakings to construct railways, improve rivers, excavate new canals, and close off the Zuider Zee" (Lintsen, 2002, p.558). Considering the total length of the waterway network, the growth might not look spectacular since many waterways were already established before 1800. Yet the difference in capacity was enormous (Groote, 1996). Also the navigability was increased, because the natural circumstances were increasingly managed.

To track this development, we gathered two sets of data. First, key policy documents of the inland waterway system are considered. The documents are gathered based on a systemic review of historical accounts of the Dutch waterways (Disco, 2002; Lintsen, 2002; Verbong & Van Vleuten, 2004; Filarski, 2014) and discussions with waterway experts in the Netherlands. These policies consist of strategic documents (drafted by the Ministry of Infrastracture & the Environment or its precursors) and advices from committees appointed by the state (table 2). As our prime concern is the inland waterway system as a transportation network, strategic plans with water management as a primary focus are left out, although they sometimes touch upon waterway issues. Second, an overview was created of when the physical assets are constructed, based on the amount of built hydraulic works (navigation locks) over the years. These data were derived from the statistical department of Rijkswaterstaat (DISK, 2014).

Table 2: Policy documents used for analysis. *V&W = Ministry of Traffic, Public Works & Water Management [Ministerie van Verkeer & Waterstaat] **I&M = Ministry of Infrastructure & the Environment [Ministerie van Infrastructuur & Milieu], the successor of the Ministry of V&W.

Key policy documents used for analysis	Year	Referred to as
Kanalenwet	1878	Canal Law
Verslag der staatscommissie ingesteld bij Koninklijk besluit van 4 Mei 1905, no. 51, tot het nagaan van den toestand waarin het binnenschipperijbedrijf verkeert	1911	Staatscommissie der Binnenschipperij, 1911
Commissie "Normalisatie van de Nederlandse vaarwegen in het algemeen en van die in de Hollandse laagvlakte in het bijzonder"	1932	
Vaarwegennota	1975	V&W*, 1975
Structuurschema Vaarwegen	1977	V&W, 1977
Tweede Struktuurschema Verkeer en Vervoer (SVV-II)	1988	V&W, 1988
Van A naar Beter: Nationaal Verkeers- en Vervoerplan 2001-2020 (NVVP)	2001	V&W, 2001
Nota Mobiliteit	2004	V&W, 2004
Structuurvisie Infrastructuur en Ruimte	2012	I&M**, 2012

Based on the primary and secondary data, the four subsequent phases of a large-scale technical system are defined. The analysis consisted of two main steps. First, a process of inductive coding of the documents mentioned was executed to review key terms and approaches in each phase. Particular attention was drawn to how these terms relate to the three types of scale: space, time and function. This analysis provided the foundation to define the scales in each phase. Second, the scale differences and similarities between phases were closer examined. The next section presents the transitions between the phases.

4. The development of the Dutch national inland waterway network

The current Dutch national inland waterway system consists of approximately 1500 kilometres of canals and rivers (RWS, 2009). Three main waterways can be considered within the Netherlands: the connection between the harbour of Amsterdam and Germany, the connection between the harbour of Rotterdam and Germany and the North-South connection, linking the regions across the Netherlands (Filarski, 2014). The natural circumstances influenced the state of the waterways to a great extent. Originally, waterways were constructed and maintained by regional authorities. At the end of the 18th Century, and concurrently with the Netherlands becoming a unitary state, the national water authority Rijkswaterstaat was founded, which became a powerful actor in Dutch water management. From the late 1800s until now, a large amount of hydraulic works has been built to increase the capacity. Figure 1 provides an overview of the total amount of navigation locks built (1890-2008).

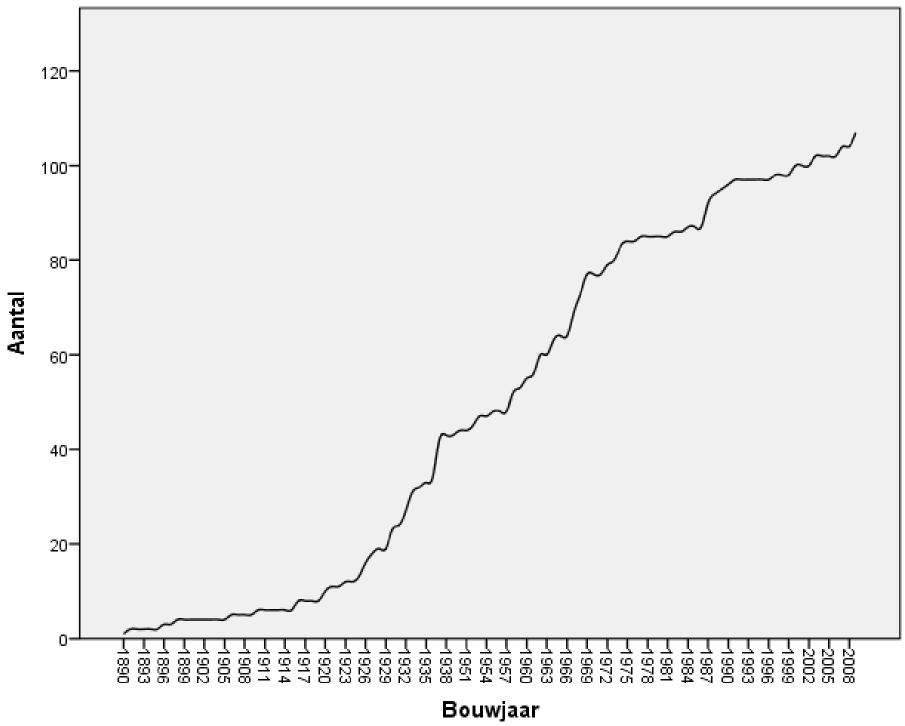

Figure 1: total amount of navigation locks built since 1890 (derived from DISK, 2014).

4.1 From phase 1 to phase 2: towards a standardised network

According to Fremdling (2000), in the 19th Century, the inland waterway network often encompassed "regional circuits without sufficient integration on a national scale" (p.527). As Disco & Van Vleuten (2002) argue, the institutional setting was scattered and contributed to the regional circuits, with powerful regional authorities (provinces, waterboards) and limited overarching, coordinating authority. Filarski (2014) states that policies from this time can be described as "ad hoc" and more regionally oriented. The construction of canals and river improvements aimed mainly to bring prosperity; plans therefore had a strong economic rationale. The state had two targets to reach this aim. On the one hand, the state aimed for linking the sea harbours of Amsterdam and Rotterdam with the European hinterland (in particular the Ruhr area in Germany). On the other hand, the state tried to connect the regions (e.g., Twente, Groningen, Noord-Brabant) to the main linkages, to bring prosperity across the Netherlands. The inland waterway system in phase 1 can therefore be characterised as regionally oriented and strongly sectoral. The congruence was strong: a focus on a regional geographical scale, strong economic motives and a relatively short time horizon (table 3).

The early 1900s saw voices coming up to consider the inland waterway from a national viewpoint. The regional diversity resulted in a wide variety of waterway dimensions – a nuisance for shippers. Also the differences in public works (bridges, navigation locks) were experienced as hindering smooth traffic. The Staatscommissie der Binnenschipperij (1911) attempted to inventory the grievances and concluded that a systematic overview of the Dutch inland waterways was lacking, which was disadvantageous for shippers. The committee recommended to establish standard dimensions for the waterways and to unify public works such as navigation locks. With novel, bigger types of ships, this issue was becoming more pregnant. Remarkably, another committee concluded in 1932 that "there is [still] no question of uniformity", because the dimensions of waterways diverge largely (Committee, 1932, p.5, own translation). Also shippers interfered in these debates, encouraging the state to centralise the network by drafting several proposals to do so (Filarski, 2014). These proposals pushed a development towards a nation-wide covering network, putting the regional, economic-driven congruence under pressure.

There are two main pull factors why a nation-wide network did not yet emerge. First, the regional division hindered the development of a nation-wide network. Regional authorities tried to remain their power by resisting transferring responsibilities to the national level. Provinces and waterboards managed most of the waterways, leaving limited space for the state to execute plans. The foundation of Rijkswaterstaat in 1798 challenged that to a certain extent; yet, Rijkswaterstaat was organised in several powerful regional districts. In addition, the Canal Law of 1878 considered for the first time the inland waterway network from a systemic, countrywide viewpoint and emphasised the region-transcending interests (Filarski, 2014). However, the Law was never approved by parliament because not all regions felt heard. Second, the state was busy with carrying out the construction of a national railway network, which left fewer resources available for inland waterways. As a result, only limited hydraulic works have been built in these years (figure 1). In sum, there were several constraints for moving towards a nation-covering network.

Things started to change from the 1920s. New design practices emerged as the result of modernisation processes, which made Rijkswaterstaat enter its technocratic-scientific period (Lintsen, 2002). More formalised, standardised and quantified forms of knowledge came up, together with novel modelling and simulations. Previously, knowledge was strongly people-based and place-based (Disco, 2002). In addition, new techniques such as reinforced concrete supported larger types of constructions. Whereas the natural circumstances used to be an important component to damage or disrupt waterways, these new techniques gave rise to a period of social engineering: nature was finally tamed. It enabled Rijkswaterstaat to execute major works, such as the normalisation of the Meuse River by constructing large weirs. Although the Canal Law of 1878 was never officially approved by parliament, it functioned as a blueprint for the following years to reach these aims (Filarski, 2014). Rijkswaterstaat reorganised its decentralised structure into a centralised one. Instead of regional districts, one functional organisation was created with specialised offices, such as 'Navigation Locks & Weirs' and 'Bridges' (Disco, 2002). This further increased the standardisation of the network and pushed the network beyond the regional circuits.

The underlying rationale remained largely the same, i.e. transportation as a means for bringing prosperity, although there was still no official national inland waterway policy (Filarski, 2014). Social engineering helped to bring prosperity more easily. In addition to the two aims formulated in phase 1, the state decided to enlarge canals similar to international standards. Therefore, the base of the state was to construct and manage all major waterways, to which regional authorities would contribute. Simultaneously, the state would contribute to regional waterways. Hence, the period between 1926 and 1938 was one of rapid growth (figure 1).

After World War II, the dominant discourse of social engineering was increasingly put forward with the Delta Works as prime example. The state had to repair the network and seized the opportunity to enlarge capacity and modernise hydraulic works. By doing so, the inland waterway network was better able to compete with other networks, in particular that of highways. The discourse of social engineering was further optimised and a common culture existed, making Rijkswaterstaat an influential actor in the Netherlands (Van den Brink, 2009). This resulted in a second growth wave (1957-1970) (figure 1). Table 3 provides a summary of the change in congruence.

Table 3: The shift in congruence from phase 1 to phase 2.

	Phase 1 (<1920)	**Phase 2 (1920-1970)**
Geography	*Linkage* Canals	*Network* Standardised network
Time horizon	*Short term*	*Mid term*
Function	*Sectoral* Transport, economic-driven	*Sectoral* Transport, economic-driven
	Push ↑ - Proposals by state committees and shippers to overcome the limitations of regional differences - Technical advances (bigger ships, novel	**Pull ↓** - Regional powers: next to influential provinces and waterboards - Limited financial funds, focus on railways

	construction techniques): 'social engineering' - Centralisation of Rijkswaterstaat; the Netherlands becoming an unitary state	

4.2 From phase 2 to phase 3: waterway policies beyond pure transportation aims

The period 1920-1970 (phase 2) drastically changed the Dutch waterway network, with a break during World War II. The majority of the public works were constructed in this period, based on a technocratic-scientific approach. As Van den Brink (2009) shows, Rijkswaterstaat was a powerful actor, fully pursuing 'social engineering', and perceived by outsiders as a 'state within a state'. The first national white paper on waterways ("Nota Vaarwegen"; V&W, 1975) takes stock of this period of rapid growth and concludes that the existing inland waterway network has become mature. This is further underpinned by later policy documents: "the emphasis is not put on the construction of new linkages. More attention is paid to the improvements of existing linkages and advanced traffic management" (V&W, 1988, p.6). Since new linkages are less needed, more attention is paid to the quality of the network (e.g., to ensure smooth traffic flows). The Ministry of Transport & Public Works (1977) states that both capacity expansions are needed, due to larger ships, and capacity improvements, related to traffic management. Hence, the existing network needed to be improved: it concerns modernisation, improvements (removing obstacles) and up scaling of public works (V&W, 1988).

This shift in attention has altered the congruence of the system. The main driver behind waterways – bringing prosperity – did not change. Still, the national inland waterway network should connect the most important economic regions of the country as well as ensure good linkages between the sea harbours of Rotterdam and Amsterdam with the neighbouring countries. The Nota Vaarwegen (1975), though, reconsiders the network and redefined the waterways of national interest, which the state would take care of. How these aims should be achieved was differently interpreted in this phase.

First, while the focus was put on the network in phase 2, it changed in phase 3 towards specific components that hindered a smooth operation of the network. The waterway budget diminishes heavily in the 1980s; the deferred maintenance is addressed in the 1990s with new policies. The SVV-II (1988) presents the inland waterway network as an interesting alternative for the packed highways. The waterways are pictured as reliable, quick and environmental friendly. Advances in electro mechanics make that the network can be used more efficiently and predict the traffic times for vessels; policies become more user-oriented. Simultaneously, infrastructure construction became more project-based (Busscher, 2014). The geographical scale thus becomes more local.

Second, the functional scale became more integrative than the purely sectoral, transport-focused aims. Ecological and spatial implications are increasingly questioned by amongst others environmentalists and local residents. The on-going growth of ships, such as container shipping, required widening of canals and rivers. According to Filarski (2014), the year 1970 marks a true turning point. New types of ships, i.e. container shipping, created several bottlenecks, as some river bends were too sharp. Rijkswaterstaat planned to broaden these places, but was rebuffed by the public. The example of the sharp river bend near Nijmegen illustrates this nicely. Rijkswaterstaat proposed to cut off the sharp bend through a polder landscape. Local protests prevented this from happing and challenged the prevalent approach. Policy documents emphasise the importance of incorporating ecological values as well as establishing linkages with other fields such as spatial planning. As the Nota Vaarwegen (V&W, 1975) already states, "the increase of new vessel dimensions will not be plainly directive for the state's waterway policies" (p.2-4). More comprehensive forms of planning ("facet planologie") gain attraction, as it is recognised by parliament that "a better alignment and consideration, both within waterway policies and in relation with other societal sectors" is needed (V&W, 1975, p.1-3).

To conclude, the congruence has shifted from a network-focused, sectoral approach towards a locally integrative, object-focused approach (table 4). The quality of the network became the key focus, requiring alterations at the component level. The prevalent way of working – sectoral and 'social engineering'-driven – has been increasingly contested by residents and environmentalists.

Table 4: The shift in congruence from phase 2 to phase 3.

	Phase 2 (1920-1970)	**Phase 3 (1970-2010)**
Geography	*Network* Standardised network	*Components* Specific projects to keep the network up to date
Time horizon	*Mid term*	*Short term*
Function	*Sectoral* Transport, economic-driven	*Integrative* Combining transport aims with ecology and spatial planning
	Push ↑ - Focus on the <u>quality</u> of the network: reliability, accessibility - Upgrading (local) "weak links" - Environmentalist movement	**Pull ↓** - Limited attention for waterways; diminishing budgets

4.3 From phase 3 to phase 4: renewing instead of constructing

As the network became saturated, policies in phase 3 focused on maintaining the current network and an improved use of the network. By upgrading objects, taking into account its locality, a smoothly run network is ensured. However, the network is currently moving towards a new phase, with the state of the network receiving increasingly attention. The network components built in the early 20th Century are in need to be replaced soon. This is also reflected in the latest policy document (I&M, 2012), which aims "to maintain the national networks of highways, railways and waterways to guarantee the well-functioning of the mobility system" (p.41). To this end, it will report on the "factual condition of networks and functioning of network parts for the purpose of a cost-effective maintenance" (I&M, 2012, p.100). As a result, it seems that the state continues its policy focus on reliability and the presentation of inland waterways as an efficient alternative to the congested highway (I&M, 2012).

It can be questioned, though, if the focus on objects is a suitable approach for a phase of renewal, as a few 'niches' within Rijkswaterstaat argue. To illustrate, the project Replacement Task Hydraulic Works (VONK; Vervangingsopgave Natte Kunstwerken), affiliated with the Dutch Delta programme, brings up the more fundamental question which role the waterway network should play in the following decades and which measures needs to be taken now to achieve that role. As such, it does not only attempt to integrate the time scale, but also the geographical scale: it pleas for considering hydraulic works within a network or a region. To summarise, instead of taking a short term, object-focused angle, VONK argues for a perspective that considers both the upcoming decades and the wider area. In a similar vein, the project MultiWaterWerk considers a smarter approach of connecting hydraulic work projects in the future. Since a large amount of hydraulic works needs to be upgraded, MultiWaterWerk explores approaches that point towards standardisation between objects. Both examples plea for more programmatic (integral) approaches that consider specific corridors or even the complete network.

Table 5: The shift in congruence from phase 3 to phase 4.

	Phase 3 (1970-2010)	**Phase 4 (2010>)**
Geography	*Components* Specific projects to keep the network up to date	*Linkages* Reconsidering waterways and their role in the network
Time horizon	*Short term*	*Long term* Lifecycle thinking, asset management
Function	*Integrative* Combining transport aims with ecology and spatial planning	*Integrative* Combining transport aims with ecology and spatial planning
	Push ↑ - Aging assets: increasing urgency - Long-term thinking: lifecycle	**Pull ↓** - Limited attention for waterways; diminishing budgets - Continuation of the dominant approach in phase 3

In these 'niches', especially the time horizon is changing. Previously, the time horizon was devoted to the short or mid-term by contributing to regional economic interests. Now infrastructure assets are aging, the lifecycle of these assets receives considerable attention. On the one hand, this mainly comes down to the object-level, which suits well with the already increased attention for maintenance of phase 3 and its focus on performance levels – i.e. a strong pull factor. On the other hand, the 'niches' are developing policies to tackle the issue of aging assets in a more integrative manner, with longer time horizons. The next step is to connect these initiatives with current policies (e.g., I&M, 2012) that can be considered as logical extensions of policies developed in phase 3, in which maintaining the current network and an improved use of the network are put central. Accordingly, there exists a risk that the dominant approach as developed in previous stages is further optimised, which could lead to a lock-in (cf. Frantzeskaki & Loorbach, 2010).

To summarise, the waterway system is moving towards a phase of renewal, but the institutional setting seems to remain relatively stable (table 5). Consequently, the scale connections between the social and technical part seem to diverge. In other words, incongruence is likely to occur with its according potential mismatches. Novel policy initiatives hint upon more life cycle oriented approaches that integrate corridors or even networks.

5. Conclusions and discussion

The historical overview in the previous chapter demonstrates that the congruence of inland waterway as Large Technical System has changed considerably. Originally a regional, sectoral approach, the policy focus altered towards a nation-wide perspective during the first half of the 20th Century. The transformation towards this subsequent phase took a while; it required several decades and advises before the system really started to take off in the 1920s. From the 1970s, a more integrative focus came up which included also ecological and spatial concerns. A mature inland waterway was created, making the network become saturated: there was a considerable drop in projects from the 1990s onwards. Phase 3 – a phase of maturity – can be characterised as a phase that tried to maintain the network as best as possible, further refining the network. It concerned predominantly maintenance works and only a few projects executed each year. These projects were executed in an integrative manner, a transformation that was pushed by environmentalists and residents.

Now that a new change in phases can be regarded, from a phase of maturity towards a phase of renewal, the congruence is again altering. The physical network is aging and needs a well-suited policy 'response'. There are, though, strong pull factors hindering this transformation. In particular, the current dominant, object-focused approach, reflected in a project-based way of working, limits the integral consideration of the complete network. At the same time, there are some small-scale niches that consider long-term time horizons and relate objects to nodes or networks, such as the Replacement Task Hydraulic Works (*Vervangingsopgave Natte Kunstwerken*) and MultiWaterWerk. Additionally, initiatives in the related field of water management explore comparable policy directions, such as 'Space for the River' (*Ruimte voor de Rivier*). These promising attempts can push the system towards a phase of renewal, with its according congruence. This involves an exploration of novel pathways, which has to become familiar on the institutional side. It might as well contest the dominant path. To conclude, although there is not yet congruence in this emerging phase of renewal, the first attempts to move to this phase look hopeful.

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