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Public values in infrastructures at risk?

Four strategies for the realization of public values
under conditions of fragmentation.

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Abstract

Although liberalization and privatization, and the resulting fragmentation brings about new risks for the realization of public values, at the same time, this fragmentation and splintering can be used to enable these public values. This paper starts with explaining why determining the effects of liberalization and privatization on public values is problematic and depends per infrastructure industry. Then, this paper analyses four risks stemming from liberalization and privatization that apply to infrastructures in general. Four strategies are designed to mitigate these risks by creating new connections in the splintered industries, while anticipating on the inherent ambiguity of public values. This shows how fragmentation and splintering can be turned into a fertile ground for the realization of public values.

Key words

Infrastructure- based industries; public values; regime change; risks; strategies

Public values in infrastructure-based sectors

What are public values in utility sectors? It is not so difficult to mention a number of these values: reliability of supply, quality, accessibility and affordability. In a simple pattern of thought, these public values should be protected in a context of privatization and liberalization. When private parties offer public utilities, the risk is that public values will be the losers in the struggle with private values. This is why these public values need protection.

In this introduction, we would like to problematize this pattern of thought briefly.

Public values tend to be ambiguous. At a certain level of abstraction, they can count on general approval, but as soon as a value has to be operationalized, for example reliability of supply or accessibility, a debate may arise between the actors concerned. Privatization and liberalization imply that the number of players involved in service provision increases. Consequently, the chance that these players disagree about a proposed operationalization also increases.

In addition, there may be tensions between public values. Complete reliability of supply may prejudice affordability (the costs of the low failure-tolerance are high) or prejudice quality (a redundant water network enhances the reliability of supply, but may prejudice quality). The more parties are involved in providing the service, the greater the risk of dissensus about the required trade-off.

Finally, operationalizations of public values may be subject to constant change. Its change may be due to a variety of factors – changing societal preferences, technological innovations or incidents. In a fragmented environment, the parties are unlikely to hold uniform views on this issue and this dynamic may be a source of dispute.

Public values are therefore highly ambiguous. The risk of protection of public values by a government is that this ambiguity is converted into non-ambiguous operationalizations. This is risky not only because it may generate conflicts. It is also risky because a non-ambiguous operationalization deprives the public values of all dynamics. It becomes more difficult to make new trade-offs between public values or to use new developments. In other words, public values are frozen. The ambiguity of public values is not only a given, but preserving this ambiguity is desirable from a normative perspective. There is a ‘constructive ambiguity’: public values are open to constant debate and so to constant change and innovation precisely because they are ambiguous. Elsewhere, two of us have set out how non-ambiguous operationalizations may cause perverse effects and eventually the opposite of what is intended (de Bruijn, de Bruijne and Steenhuisen 2008).

In conclusion, the above pattern of thought assumes that the impact of privatization and liberalization on public values can be established unambiguously. The question is whether that is so. Does an increase in the number of rail crashes after liberalization result from this liberalization? Or is it due to bad luck? Or is it the result of the increase in rail travel? It is all far less unambiguous than is often thought, which problematizes the

above reasoning even further. Public values are ambiguous, the relation between liberalization and privatization on the one hand and public values on the other has many unknowns and non-ambiguous safeguarding mechanisms are undesirable. We will continue our discourse with the help of these guiding principles.

Regime change in infrastructures: Fragmentation and Splintering

In the last two decades an ongoing process of regime change – a process which can broadly be described as the shift from reliance on a state owned and/or controlled public monopoly provider for these public services (i.e. responsible for the operational processes), to a new situation in which as a result of the introduction of market disciplines, multiple actors both public and private, share ownership and responsibility in various institutional arrangements or constellations for the delivery of services over the various infrastructures – has occurred in the majority of the Dutch infrastructures. This process has been described as institutional liberalization.

The primary objective of regime change throughout the infrastructures has been to introduce some form of competition as a means to ensure greater efficiency, as well as enhancing customer orientation and customer choice. But it has also been motivated by the desire to reduce political intervention and opportunism within infrastructures – by increasing the freedom of companies to ‘efficiently’ pursue commercial as opposed to political objectives.

The process of regime change for the organization of infrastructure provision is conceptualized in this paper to consist of five modes, namely liberalization, privatization, unbundling, corporatization and internationalization. In this paper these modes will not be discussed in detail, but it is important to stress that liberalization and privatization can mean very different things and that these modes can result in different and sometimes divergent challenges for the realization of public values. The five modes may be introduced in separate, sequential stages, but this is not necessarily the case. Regime change is an ongoing process.

In part, the mode of regime change is a political decision: the railways and the electricity sectors have been unbundled, whereas the sewage and drinking water companies have remained integrated. Although these sectors can, from a strictly technical view, be unbundled too, the negative governance implications (especially the increase of transaction cost) are thought to outweigh the supposed advantages of unbundling. But the chosen mode of regime change is also determined by the interplay with technical characteristics. Relevant elements are, for example the feasibility to construct a second, competing network. In other words: is the network a natural monopoly? The introduction of liberalization or privatization in case of a natural monopoly always requires independent regulation. In this way, technical characteristics directly influence the possibilities for institutional arrangements. Another relevant characteristic for the choice of the mode of regime change is the depreciation period of the infrastructure. For dikes,

the investment for extensions last for over 100 years. In the drinking water sector, infrastructure can easily last for 60 years whereas for the electronic communications sector this period is much shorter as new technology offers new possibilities. Shorter depreciation periods enable more modes of regime change since the investments are less lumpy and sunk.

The table below illustrates that the five modes of regime change have taken different shapes in ten infrastructures (see table 1) and this explains how and why we can expect different effects on the realization of public values.

Table 1 Modes of regime change in (all physical) Dutch infrastructures

Infrastructure	Liberalization	Privatization	Unbundling	Corporatization	Internationalization
Sewage					
Drinking water	√			√	
Waste		√		√	
Dikes	√			√	
Roads	√	√		√	
Railways	√		√	√	√
Airports	√			√	√
Electricity	√		√	√	√
Gas	√		√	√	√
Electronic Communications	√	√		√	√

Source: WRR Report 'Infrastructures. Time to invest' 2008

Three Outcomes of the regime change

The regime change, taking so many forms, has had different institutional outcomes in different sectors, but we can distinguish three general outcomes.

1. Change in actor constellation
2. Increase of levels of decision and policy making
3. Splintered arenas and transactions

1. *Change in actor constellation: more, heterogenous and rival actors, multiple principals*

There are various elements of importance in connection between regime change and the constellation of actors. The first, rivalry, originates from the fact that as a result of regime change, multiple actors were introduced in infrastructures, some public, some private and also hybrids. Most of them are new in the field, e.g. unbundled incumbents, new entrants, subcontractors and private financiers. Regime change fosters rivalry between these existing and 'new actors' – rivalry being the essence of a competition that was introduced intentionally with regime change. While it is true that most infrastructures themselves remain natural monopolies, there is competition between producers/service providers supplying into networks, and between rival wholesalers/traders taking goods and services from the networks to supply end users. In the initial phases of regime

change, the networks are supposed to facilitate these processes by facilitating access in an efficient way. Unbundling networks from other operational functions is designed to secure this. Separation of ownership and regulatory functions is also designed to prevent conflicts of interest between different actors and to facilitate competition. Regime change was meant to encourage new entrants with rival solutions. It is inevitable that this had consequences for the way the networks themselves have performed.

A second issue with regard to regime change is that instead of one principal, multiple principals have come into existence, mainly as a result of the shifts in ownership and the introduction of regulation. This has important implications for the implementation of public values– as this paper will show in the next section.

The result of all this is that there are multiple, heterogeneous and rival actors with divergent views of and claims on public values. The shifting constellation does not only refer to the actors, but also to the roles they perform within the institutional framework.

2. Multiple levels in decision making: local, national, regional and European

Another impact of the regime change is the introduction of multiple levels. The local level has continued to be of importance, especially in the granting of permits, local regulation and, increasingly, local obstruction to national plans but increasingly other levels have gained importance. For most infrastructures, (supra national) regions form the relevant physical system level. Electricity for example, is traded within the north European Market. Furthermore, the European Union has gained importance in decision making in the last 15 years, both enabling and constraining national infrastructure policies (chapter 4 in WRR report, 2008)

3. Splintered arenas

The two former developments (change in actor constellation and introduction of multiple levels) taken together result in an important aspect for the realization of public values: the transactions needed for investment in infrastructure are increasingly discrete transactions, between two parties in isolation from other parties. Moreover, these transactions take place in splintered arenas. Let us explain how this happened and how this affects the realization of public values.

- *Separation of function and service.* The separation or splintering of the transactions manifests itself in various ways. The separation between infrastructure and service stems from the introduction and promotion of free competition. Establishing a situation of free competition for services that require infrastructures is only possible when service delivery companies have equal access to the network. This requires a clear split between service and infrastructure functions; otherwise those service companies with the closest ties with the network manager would be in more favourable positions. This rationale for so-called unbundling played a dominant role at the time of the introduction of competition in sectors with one or a few vertically integrated incumbents that were also active in the market of service provision.

Increasingly, however, the negative side effects of unbundling are highlighted. The case of the former incumbent Dutch Railways (NS) and the new infrastructure manager ProRail is exemplary in this respect. Bekkers (2008) observes that due to unbundling between infra and service, information from the end users does not reach the network manager. Consequently, investment decisions are taken on a too limited information basis. Larouche makes a similar argument with regard to electronic communications for those countries in which infrastructure and service have been separated – for example the United Kingdom (Larouche 2008).

-Separation of regulatory and operational functions. It was initially seen as a temporary task for a regulator to curtail the power of the incumbent during the early stages of liberalization. The introduction of regulation is in many sectors implemented in a separation between regulatory and operational functions (Larouche 2008). Larouche argues that in the field of electronic communications it appeared difficult to genuinely carry through this distinction. Whereas network managers, especially when it concerns incumbents, find it difficult to accept that they may (no longer) dictate regulatory choices, policy makers must learn in their turn to accept that they no longer engage in hands-on management (Larouche 2008: 11). Especially for policy makers this turn is difficult to take, as it requires them to be involved in a different fashion than before rather than withdrawing from the arena entirely. Rather, policy makers are required to “ensure that public policy objectives are fulfilled” without “superimposing a holistic vision (...) on the sector” (Larouche 2008: 13). Above all, attention will have to be shifted from the network itself to the behaviour of and the relations between the actors in the sector (this is what Larouche calls the ‘network of networks’).

-Separation between short term and long term transactions

The interests of actors for the short term are relatively well addressed in the current institutional or regulatory framework (service delivery). The introduction of free competition, embedded in a regulatory framework, guarantees and determines the relations between the actors. In various sectors, the results in terms of price and quality of services have improved. Much less attention is devoted to the situation with regard to the operation of networks. This questions the suitability of the institutional framework for long term transactions. Larouche (2008) analyses the electronic communications sector and argues that the institutional framework in that field fails to address long term interests. In particular, policy fails to provide the sector with adequate incentives to stimulate investments. A systematic approach to tackle this issue is not available and solutions to address this problem are therefore *ad hoc* and come with their own particular problems (e.g. regulatory holidays).

-Separation between Technocratic and political arenas

Investment decisions in infrastructure require a great deal of technical expertise. At the same time, however, infrastructures serve to satisfy essential needs of the public and are used to realise public values of various kinds. As such, they require political involvement as well. A serious drawback of the political domain is (as was shown in chapter 2) political opportunism and a preference for short term over long term issues. The technical and the political arena must therefore be closely connected. This is, however, not always

the case. Especially at international levels of government, technical arenas of decision making have the upper hand at the expense of political decision making arenas. Even in the European Union this phenomenon is omnipresent (WRR 2007). As was indicated in the previous section, in the field of infrastructures various networks of experts, technical forums and similar informal organisations which can determine norms and standards and coordinate regulation have been introduced and/or strengthened. In many cases, these networks provide for new opportunities to connect national and European levels, but in general they do not succeed in reaching the political realm. The position of regulators fits in the technocratic arena as well, separated as they are from the political domain. In the Netherlands, therefore, politicians are scarcely inclined to entrust regulators with extra-statutory or only broadly defined powers. Decisions on 'technicalities' may however, have significant political implications as well.

-Splintered transaction chain

The role of the state seems to be more conveniently arranged in an unbundled setting. Market pressures can be introduced in the transaction chain where it is possible. Market pressures can be isolated from certain public values. For example, in the unbundled rail sector, short term market pressures trigger train companies without jeopardizing the long term perspective of the infrastructure manager. In the unbundled electricity industry, the state can pressurize the natural monopoly of network companies without harming the market for production and supply.

From the perspective of the state, infrastructure companies become less complex, more specialized, less diverse in their scope and, thus, more convenient to oversee. From an operational perspective, however, optimizing performance becomes more complex and less insightful.

At first, one infrastructure company could provide for telephony, electricity, water and gas. After unbundling, many separate companies are involved with the construction and rebuilding of these infrastructures underground. Now, multiple separate companies depend on each other in their performance. If one company defers certain activities, other companies have to re-plan accordingly. It becomes highly inefficient to do repair a disturbance in an underground network when telephony cables lay on top of the disturbed cables. Certain risks on the interface of separate companies may not be detected, such as a leaking drinking water cable lying against an electricity cable. Chances to profit from time reserves and flexibility at another company can be out of sight and out of reach.

In the rail sector, the infrastructure manager and the train companies each optimize their own product. The train company is held responsible for the punctuality of their trains. The infrastructure manager is held responsible for the continuous availability of rail tracks. Responsibilities have clearly been distinguished and formalized. Major parts of the output, however, only become visible from an integral perspective on the whole transaction chain. Implicit, shared responsibilities remain to prevent derailments, to ensure personal security, to maximize the use of capacity, to inform passengers and to minimize the time passengers need to reach their final destination.

For example, informing passengers is divided over the infrastructure manager and the train companies. Both have agreed on performance standards with the Ministry of Transport on this issue. The infrastructure manager informs passengers at stations. Train companies inform passengers in the trains. Both account for their performance, but 'the

informed passenger' is not an integral responsibility anymore. Contradictory information is not evidently perceived as bad performance.

Another example is that regional and local traffic control centers at the infrastructure manager co-operate with regional and local transport control centers at several train companies. This new division of tasks disperses highly complex operations over these many companies with hundreds controllers and hundreds of train staff. Each company constantly makes decisions on how to achieve train services. Each company has its own responsibility to optimize. But the train driver cannot optimize speed without information from the traffic controller at the infrastructure manager ProRail. In turn, controllers make many decisions deprived of information about the passengers in the system. Furthermore, as controllers at ProRail are assigned to treat different train companies 'equally', they need to apply uniform rules disregarding the particular interests of trains.

The impact of the separation of arenas together with a splintered transaction chain on the realization of public values cannot be underestimated:

- Short term public values are more heavily incentivized than long term public values
- Public values related to services are decided on in different transactions, in different arenas than the public values that concern the physical infrastructures.
- In various discrete transactions the end goal of the infrastructure service is not part of the equation. To illustrate this point: the end users (passengers on the train) are not part of the transaction between the ministry of public transport and the infrastructure manager.
- Social public values (e.g. affordability) are separated from the technical public values (e.g. norms for continuity of supply)
- Splintering the transaction chain results in many new dependencies and the possibilities to manage these dependencies are reduced. Optimizing the necessary trade-offs becomes more challenging and more strategically charged. For example, the possibility is created to blame other companies for disappointing performance. The impossibility to live up to responsibilities together with the possibility to transfer responsibilities takes away incentives to perform. While performance contracts may appear less complex from the state perspective, the performance of many public values simultaneously becomes more challenging in infrastructure operations.

Risks stemming from fragmentation for the realization of public values

The former section explained how the regime change has led to fragmentation and splintering. In this section, we discuss four risks stemming from fragmentation. In the next section, we will provide strategies to deal with each of the risks, still under conditions of splintering and fragmentation.

1. Risks for innovation and other values requiring system coordination
2. Risks for long term public values, requiring dynamic oversight and regulation
3. Risks for values that cannot be put into contracts
4. Risks for values that are dealt with in the domain of technical experts, not in political domain

1. Risks for values that require system coordination: innovation

Fragmentation engenders risks for innovation. But, perhaps counter intuitively, fragmentation can also contribute positively to the realization of public values. Research by Mark de Bruijne (2006) shows that fragmentation in the electricity sector, and the lack of coordination does not hamper the security of supply. Instead of vertical integration and coordination, the electricity sector relies increasingly on real time management in discrete transactions, resulting in more flexibility and resilience than in the case of the formerly vertically integrated businesses (de Bruijne, 2006).

Another illustration how the realization of public values benefits from fragmentation is small scale innovations: innovations tend to be developed and matured better in small, entrepreneurial circumstances than in large and bureaucratic institutionalized settings (WRR, 2008). This kind of innovation is especially fertile in innovations that can take place incrementally and where end users can choose between competing producers or providers so that the innovation will deliver competitive advantage, for example in telecoms.¹ Thus, in these cases where incremental development and innovation are possible, fragmentation may actually help the realization of public values.

But in infrastructures, incremental innovation is not always possible. After all, most infrastructures are characterized by (a) high sunk costs and (b) by the need of lumpy investments, the latter meaning that investments can not be carried out gradually, but huge sums in once are required in order to realize a scheme for a road, dike or pipeline. The sunk costs and the lumpy investments create conditions for discrete and leap innovations.

If system innovation is necessary in a sector that is characterized by high sunk costs and by lumpy investments, some degree of (horizontal or vertical) coordination is necessary. Illustrations may help to explain our point. If a transition towards the hydrogen economy

¹ In the telecom sector, the fragmentation is especially helpful for innovation, since the services actually create the network, called inverse networks. The networks thus rely on the service and on the users in order to be maintained and innovated. The small scale innovations that origin in isolated spots help the network to perform better.

is made, or if a transition towards zero carbon emission is set in motion, all stakeholders have to agree on new technologies and new standards. The ideas for such a new network can be developed in small, entrepreneurial circumstances, but in order to be implemented, agreement and commitment of the main players, including politics and administration, are necessary.

At present, several challenges, e.g. climate change, transition to a carbon free economy and the depletion of fossil resources, force system innovation in some sectors (energy, mobility, water management). It is a real issue how these system innovations can be stimulated under conditions of splintering and separation. The latest report by the ministry of Economic Affairs shows the urgency of this issue. If the current electricity networks are not replaced by new systems that can transmit renewable sources of energy, within 20 years there will be serious shortages in energy supply the Netherlands (EZ, 2008).

2. Risks for long term public values

In the first stage of regime change, the emphasis was on ‘trimming the fat’ of the former public monopolist as well as enhancing affordability and choice for the consumer (Larouche 2008; Van Dijk 2008). In the majority of sectors, regime change has been fairly successful in this respect. According to a recent report on liberalization (Ministry of Economic Affairs 2008), regime change has led to greater freedom of choice and lower prices for the consumer in electronic communications; in electricity and gas it has resulted in efficiency gains and lowering prices.

At the same time, however, the limitations of this stage of regime change have also manifested themselves (see also Ministry of Economic Affairs 2008: 27). The focus on efficiency has dominated the institutional and regulatory framework that has been primarily aimed at the realization of static efficiencies that are visible, measurable and made operational on the short term.

Whereas the current processes of regime change appear to adequately address what this paper labels as ‘Type I market failures’ (i.e. improper market functioning, low efficiency), the potential for Type II market failures remains neglected. The latter category consists of market failures, which indicate the inability to address wider societal concerns (Van Dijk 2008) that lead to the failure to realize public values that are relevant for the long term, often requiring dynamic institutional arrangements, not least because these values are neither easily defined or measurable, nor indeed as visible in comparison to the efficiency issues typical of Type I.

Prime examples of Type II values that may not be realized in the case of Type II market failures are: the long term reliability of networks; long term security of supply; long term accessibility of networks; innovation; mobility and sustainability. These values have in common that they are hard to put into contracts since their definition and operationalization is contested. They comprise many dimensions and are open to many interpretations. Sustainability, to provide an illustration, is not just an item in the contract

that can be ticked. Instead, there are many and often qualitative parameters necessary that indicate whether innovation or sustainability is indeed realized.

3. Risks for values that cannot be put into contracts or concessions

Since the state shifted from operational to strategic involvement, public values are being put in performance contracts and concessions. New challenges constantly appear to plainly assess public values in performance standards. Moreover, as the state does not fully overcome these challenges, the state finds ways to adapt to them.

The main adaptation is that the strategically involved state prefers agreements on input to output. Input offers operational rules to follow. Train staff, for example, should go through their train every half an hour at least to keep an eye on the personal security of train passengers. Output describes the result of operations. For example, passengers should be transported from A to B in a satisfactory way. Output is often less tangible.

Agreements on input compete in practice with attention to output. For example, traffic controllers are mainly instructed to respond in time. The output of their work, however, is to maximize rail capacity in real-time and prevent delays among many other things. Moreover, their output is a collective effort of many controllers and train staff. The contribution of individual controllers to this output is often impossible to instruct.

In the electricity industry, surprisingly, network companies have to comply with input rules for when to send letters, how to pick up the phone and what type of information to provide on websites. These rules address how to be responsive to customers. In contrast, the continuity of electricity supply is a highly critical output but deprived of a straight conditional performance standard. The presence of an explicit contract items does not necessarily reflect the criticality of performance aspects.

The adaptation of the new role of the state to formulate performance agreements in terms of input is attractive. It sets up conditions for achieving public values. These conditions are tangible, enforceable and suitable to monitor. These conditions do not have to address a myriad of trade-offs between other public values. By formulating performance in terms of input, the state does not have to regard operational complexity.

The emphasis on input, however, may lead to non-priorities. Efficiency standards can be reached by postponing investments for reliability. Detailed safety rules can result in trade-offs with a marginal safety improvement but a major burden for efficiency. Some public values do not lend themselves to be described in terms of input. Particularly safety and reliability highly depend on operational complexity more than other public values. As such, the adaptation to put emphasis on input biases priorities among public values unintended.

After this main adaptation towards input, other adaptations follow. Performance agreements are not stable but grow, since compliance with input agreements does not prevent unsatisfactory performance for either one or another public value. New input rules are triggered. For example,, despite sophisticated decision rules, a network company may suddenly face the complete prohibition to cut off customers from electricity during wintertime. A major black-out leads to a new definition of redundancy. A safety incident results in a new compulsory security system. An inspectorate division compels companies to spend their scarce time on education of their operational personnel. A Ministry introduces extra right-of-way rules for customers with political

importance. The eagerness of the state to fix requirements to guarantee public values puts a constant stream of interventions into action, undermining temporarily under-articulated values and, again, triggering new input rules in the future.

4. *Risks for values that are dealt with in domain of technical experts, not in democratically legitimated arenas*

The trade, exchange and cooperation over ‘hard’ networks increases: energy networks are genuinely international, the international mobility in air, roads and railways increases, new gas pipelines between Russia and Europe are constructed. The functional internationalization of networks has progressed substantially in the last decades. In this fourth risk, we express our concern that the internationalization at the level of governance has not kept pace with the functional internationalization (see also chapter 4 of the WRR report, 2008)

Chapter 4 of the WRR report on infrastructures (2008) describes that in the functional internationalization of infrastructures, many groups, committees and networks have come into existence, e.g. the the Council of European Energy Regulators European Gas Regulatory Forum of Madrid (‘the Madrid forum’); Electricity Regulatory Forum of Florence (‘the Florence forum’), of National Independent Regulatory Agencies (nira’s); Federal European Regulatory Agencies (fera’s) and many more.

Both public and private actors from the EU and national levels may be represented in such forums. Policy learning through peer review or setting benchmarks and norms may be the most concrete results of such mechanisms. All this resulted in a rise in informal networks and forum governance. In the practice of many network industries, the option often chosen involved a “double delegation” of functions and powers from the Commission and national ira’s. The hybrid (neither national nor European) entities resulting from these double delegations thus manifested themselves increasingly in an autonomous way (Lavrijssen-Heijmans and Hancher 2008: 2). It allowed them to operate in a position moved away from the political realm.

Remedies and Strategies to deal with the risks

These four risks to public values, discussed above, as a result of liberalization and privatization do not have straightforward remedies to them. Given the ambiguous nature of the troubled public values, unambiguous operationalizations are likely to cause perverse effects and raise fundamental dispute. Quarrelling about operationalizing public values is not a sin, on the contrary, but we argue for certain process arrangements that enable to interact tactfully in the splintered arenas.

Our approach moves away from the current governmental reflex to define troubled values and then establish rules to safeguard them. Instead, our approach creates new connections in the splintered industries, anticipating that, even without unambiguous

operationalizations of public values, trade-offs still take place. Four strategies have been designed to mitigate the risks discussed above (see table 2).

Table 2 Remedies and strategies to deal with the risks

Risk	Strategy
Innovation	Joint Risk Mapping Process: Design process in which commitment is created about the direction of the innovation and the way it is implemented
Long term public values	Meta process: Do we measure what we want to measure. Design process to ensure negotiation about the way and the things we measure
Non-contract values	Q&Q process: Measure Quality and Quantity and design process to achieve and deal with negotiated knowledge
Technical instead of political trade offs and decision making	Reconnect politics and experts: Design processes to help national governments to use competing bodies and areas of expertise

1. System Innovation: Joint Risk Mapping Process

How to obtain some degree of coordination and commitment, which is necessary for the implementation of system innovations? We follow Ten Heuvelhof (2008) and the WRR report (2008) in which a joint mapping approach is suggested, in which the parties involved (ministries, regulator and service providers, system users and organizations representing final customers) together map the uncertainties and risks, for example by outlining scenarios that all parties regard as possible and realistic. The process in which parties map uncertainties and risks could be moulded in the form of a joint and widely supported real-option, accompanied by a robust cost-benefit analysis. This type of approach ensures continuity as opposed to ‘one shot’ future perspectives that are liable to frequent change at every occasion. The parties should negotiate about the various parameters and links in such an analysis. In parallel with this, analyses of the positive and negative external effects should be conducted, both qualitatively and quantitatively. These effects, with the corresponding uncertainties, risks and opportunities, should also be identified and, where possible, quantified in a process in which these stakeholders are actively involved. This would reduce the over-dependence on the current planning bureau structure. In this way, a negotiated environment creates commitment to the system innovation and ensures that the solutions proposed are feasible and desirable.

2. Long term public values: meta process

Do we measure what we want to measure? Do we proceed in the direction we aimed to go? Every now and then, stakeholders have to confer with each other about the big issues. These meetings can be organized sector wise, but also be gathered around a specific issue or problem, that might be transsectoral of nature.

In this process, special attention should be devoted to the following issues

- What direction do we want to go with our system/ our sector
- Which innovations are necessary and at what scale?
- How the deal with the unknowns (both the known unknowns and the unknown unknowns).
- How to deal with the tensions between the short term interests and long term
- How to design incentives that serve both the short term and the long term

3. *Public values that cannot be put into measures: Quality and Quantity*

Measurement of public values in quantitative terms can be very useful. Many water quality aspects cannot be measured otherwise. However, sometimes, values you really want to realize are not measured or indicated remotely correct with the quantitative operationalization, as many scholars have indicated (e.g. Scott, de Bruijn).

Our remedy is to develop monitoring and measurement of public values in which the realization of public values is monitored both qualitatively and quantitatively. The qualitative operationalization will help the ‘soft’ values to gain weight in the trade off with ‘hard’ public values.

But immediately, we have to add a step to this process, since the qualitative scores will sometime conflict with the quantitative scores, as table 3 shows.

Table 3 Combining quantitative and qualitative scores to monitor public values

	Quantity score +	Quantity score -
Quality score +		Disputed outcomes
Quality score -	Disputed outcomes	

For the disputed outcomes, a process should be designed in which agreement is reached how this conflicting information will be used for the complete picture.

4. *Technical trade offs: Reconnect technical experts with governance & secure national interests of strategic importance*

There are two separate concerns with the fact that hybrid entities increasingly operate in a position moved away from the political realm. First, in the domains of experts decisions are made on seemingly technical issues, but in fact, these trade offs and decisions have real consequences for the realization of public values. At present, these decisions are increasingly made among experts, which are not democratically legitimated to make decisions with such consequences for society as a whole.

How to bridge the gap between (national) governance that are formally legitimated to make decisions on public values on the one hand, and (European) technical experts that make the decisions in practice?

National governance could make use of the lively competition between expertise groups at the European level. Consumer groups, ombudsmen, regulators and net managers all hold different views to major issues such as innovations that are needed, the current state of the infrastructures, the direction it should go and the investments that are needed. A process should be designed to help national governments to gain access to and to make fertile use of these competing views.

A separate though important problem is that there are specific interests of national strategic importance, which are not treated in that way if only negotiated and perceived from the European dimensions. Shuttleworth (2008) argues that in the sectors of energy and gas such mismatches may occur as a result of the EU's focus on non-discriminatory market access and transparency and national governments' inclinations to be led by national interests. Thus, regional optimization may be impaired, especially security of investments, as investors are confronted with a high degree of regulatory uncertainty and are ill-protected against national regulatory decisions that impair investors' rights to recover the costs of investments and a normal rate of return.

How to defend or realize national public values in an increasingly European context? It seems to us that only supranational regional authorities (i.e. the EU) with the power to override national governments or regulators who continue to exercise their powers in a purely national interest could be a sufficient remedy.

Concluding remarks: risks and power of fragmentation

The splintering of infrastructure industries has put long term public values, non-measurable values, technical values and innovation at a systemic level increasingly at risk since privatization and liberalization. Despite we emphasize that the risks particularly hold for the more ambiguous public values, we argue that unambiguously operationalizing public values is often not the desirable remedy. Instead, we designed four strategies that create new connections in the splintered industries, taking into account that the meaning of public values might remain highly contested while major trade-offs take place.

Alternatively, we, too, showed that fragmentation does not merely engender risks but contribute positively to the realization of public values as well. Fragmentation, for example, triggered small scale innovations in the telecom industry and enhanced real time management in the electricity industry. Although liberalization and privatization, and the resulting fragmentation brings about new risks for the realization of public values, at the same time, this fragmentation and splintering can be used to enable these public values.

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