

Experts and Expertise in the Governance of Infrastructures: Flood-Risk Management as an Example

*Bertien Broekhans and Tineke Ruijgh-van der Ploeg
Delft University of Technology, the Netherlands*

ABSTRACT

The current focus on risk-based approaches to the governance of technology poses new challenges to the combined effort of policymakers and experts since the current worlds of technology and governance are very different. We make use of two hegemonic perspectives in these worlds, i.e. the systems and the network perspective, to analyse the expected contributions from expertise and experts to policy-making about infrastructures. The first question we address is how these two perspectives shape the expectations of the contribution of experts and expertise to problem-solving and policy-making. Second, we explore how practitioners may deal with inevitable conflicting expectations. Based on documents and previous research and illustrated with examples of flood-defence projects from the Netherlands, this paper concludes that perspectives may be coupled or uncoupled in practices of collaboration, and that practitioners should reconsider the contingent room to manoeuvre in policy-making, and the role they may take.

Keywords: systems perspective; network perspective; expertise; experts; flood-risk management

1. Introduction

Policy-making about infrastructures typically depends on science, technology and engineering and builds on a long legacy of analytical approaches to policy-making and technocratic institutions. The current focus on risk in the governance of technology asks for technical and institutional changes with regard to planning and realising large infrastructures. This poses new challenges to the combined effort of policymakers and experts – among which are engineers. De Weck et al. (2011, xii) speak of a need for a “codesign of regulations and policy with new technological systems” and explain that this asks for engineers “who not only provide technical expertise but assume a leadership role in the overall design and development of complex systems”. Engineers are but one group of experts, or knowledge workers, that supply

expertise to such policy processes. Other groups of experts may be characterised as academic and non-academic researchers, consultants etc. The question that intrigued us is what codesign may look like in terms of collaboration between experts and policymakers and how they want their expertise to contribute to the governance of infrastructures.

From a long history of research, it is known that the relation between governance and technology is deeply ambivalent (Nahuis and van Lente 2008). The current worlds of technology and governance are like chalk and cheese – they employ different languages, they obey different rules, and their aims and objectives are poles apart. Two hegemonic perspectives in the worlds of technology and governance are the systems perspective and the network perspective (De Bruijn and Herder 2009). We use these perspectives to describe and analyse contributions from expertise and experts to policy-making. The two perspectives imply different expectations of the production, contribution and utilisation of expertise to problem-solving, design and policy-making. The first question we address is how these two perspectives shape these expectations. Policymakers and experts who seek collaboration reflexively plan their actions from the perspective they are accustomed to. The second question we explore is how experts and policymakers may deal with inevitable conflicts of expectations.

To answer these questions, we first counterpose the main characteristics of the two hegemonic perspectives with respect to design and policy-making (section 3). We then analyse two examples of collaboration between experts and policymakers aimed at rebuilding flood-defence systems in a (semi) urbanised setting (section 4). With these examples, we build on previous research on the interaction between technology and flood-risk-management policy (see footnote 1). Flood-risk management is a good example of the ambivalent relationship between the technology and governance of infrastructures in general (Bijker 2007). The examples are cases in which the tension between the proponents of both perspectives was evident and related to the challenge to redesign existing technology and institutions. Case descriptions are based on publicly available policy papers and documents, notes from earlier research interviews and various informal contacts with Dutch engineers, policy advisors and policymakers. We conclude that the scope for action of experts can be limited in practice by the perspectives at work in a particular setting, but that there is room to manoeuvre for experts and policymakers to develop contingent approaches to collaboration.

2. Governance and technology: Experts and expertise in policy-making

There is a lot of debate about the way to go forward with the relationship between policymakers and expertise.¹ Many scholars in science and technology studies take into account that governments are now adopting the relativist position that all expertise is biased and that, therefore, political considerations are important in the selection of experts (Jasanoff 2003). In public-administration studies, it is argued that

¹ (De Bruijn and Ten Heuvelhof 1999; Fischer 2009; Gibbons et al. 1994; Liberatore and Funtowicz 2003; Nowotny 2005; Rich 1991; Weiss 1991).

knowledge for policy is a negotiated construct of research and the policy community (De Bruijn and Ten Heuvelhof 2008; Van Buuren and Edelenbos 2004). Knowledge has acquired a very different meaning to policymakers, and, consequently, experts may reconsider their position and role in policy-making processes.

Many scholars reported on the contingency of scientific claims, the negotiated character of knowledge and the cultural and political character of (risk) management and policy.² They studied the conflicts about expertise and the roles of experts as an essential part of practices and processes of policy and management about environmental (and flood) risks. This implies that expertise-driven policy-making is inextricably intertwined with values, bias, trade-off and interests. That prompts us to consider the epistemological, institutional and normative implications of expertise and experts in policy-making. These studies brought a renewed understanding of attributes of experts, of the procedures through which experts – in the broadest sense – are mobilised and of the nature of the knowledge needed to deal with social problems. This resulted in a considerable amount of advice on how to manage a system or network, but most often in abstract accounts by scholars or experience-based ones by practitioners (Pahl-Wostl et al. 2007). Although these accounts reflect perspectives on policy and policy processes, they do not recognise the different rationales that drive action nor offer motives to practitioners to reconsider the way they act. However, less attention is paid to how experts can contribute their expertise to policy and decision-making. Literature about the roles and contributions of scientists in public policy assumes that scientists are able to freely act and make choices as to what role they want to play in a collaborative setting (Huiteima and Turnhout 2009; Jasanoff 1990; Ozawa 1996). Pielke (2007) identified four schematic roles for experts contributing to policy and decision-making: (1) the pure scientist, who only delivers knowledge and steers clear of policy, plans, measures etc.; (2) the arbiter, who makes sure that reliable knowledge is supplied and corrects errors, misinterpretations and misuses of knowledge in policy processes; (3) the advocate, who uses knowledge to argue for a preferred course of action; (4) the broker, who attempts to open up decision-making processes by exploring multiple perspectives and alternatives and by integrating societal or stakeholders' concerns with available knowledge. In principle, each of these roles can contribute effectively to policy-making.

In the next sections, we build on examples from the interaction between technology and flood-risk-management policy. Dutch water management used to be strictly informed by and solidly based on technical water expertise. The relationship between hydraulic engineers and their technical expertise on one hand and policymakers for flood-risk management on the other hand, was firmly secured, undisputed and self-evident. Hydraulic engineers prepared, developed and implemented laws and regulations with regard to flood defence (Disco 1990). Now, policymakers and engineers find their roles have changed due to recent Dutch and European developments in water governance (Van den Brink 2009). Flood-risk management still involves flood protection but also measures in spatial planning and crisis-management preparation.

² (Bäckstrand 2004; Barker and Peters 1993; De Bruijn and Ten Heuvelhof 1999; Fischer 1990, 2009; Jasanoff 2004, 2005; Limoges 1993; Lindblom and Cohen 1979; Lövbrand 2011).

For the policymakers and engineers, this shift has many implications in terms of the demand and supply of knowledge. This challenge associated with the paradigm shift from technocracy to governance has parallels in other infrastructure-related domains of public policy, from traffic safety to secure banking over the Internet.

Experts, like engineers, and policymakers cooperate in networks of interdependent actors but hold very different perspectives, due to their role, training, expertise and experience. The “systems perspective” of most engineers is rooted in the engineering sciences and builds on a technical-rational perspective on the complexity of systems, their elements and boundaries. The “network perspective” of many policy workers is rooted in social sciences and public administration, and it regards actors as intentional agents, interacting in networks of interdependencies and relationships. The systems and network perspectives can explain differences in ideas and preferences as to the organisation of system management, the roles of facts and figures, and the extent to which knowledge is negotiable (De Bruijn and Herder 2009). A better understanding of the nature of these differences may be a key to understanding the roles experts can take on in the governance of technology and infrastructures, such as flood-prevention measures and risk management.

3. Systems and network perspectives on policy-making for infrastructure

The realisation of adaptive policies for large infrastructures requires that engineers and policymakers cooperate to ensure that technology contributes to public values and to preventing failures of the technical aspects of the infrastructure system. From a systems perspective, the development and implementation of a new policy will be approached as a “solvable problem”, and policy-making as a complex assignment to be addressed with methods that reduce complexity. We explain this perspective in section 3.1 and relate this perspective to the different roles that engineers may have in a policy-making process in 3.2. Next, we characterise the network perspective, from which policy-making is seen as a capricious process that includes actors, knowledge, interests and strategic behaviour (3.3). We confront these two perspectives in the concluding section and discuss the implications for the role of engineers and the contribution of their expertise to policy-making (3.4). Examples in this section are taken from flood protection and flood-risk management.

3.1 The systems perspective: Honouring hierarchy to deal with technical complexity

The essence of the systems perspective is that infrastructures are considered to be elements of a system, as dikes and dams are part of a flood-defence system (De Bruijn and Herder 2009). Well-documented and structured systems engineering methods are employed when solving problems in design, construction or operations (Sage and Armstrong, Jr. 2000). These methods aim to reduce complexity and avoid ambiguity so that (1) the problem can be formulated, (2) the system’s performance can be optimised and the most cost-effective solution can be selected, (3) the design process can be organised in a structured and efficient manner, (4) safety and accountability can play a role in the design and management, and (5) the implemen-

tation of the project can be managed effectively. The methods structure problem-solving by creating a hierarchy in problem-solving activities. The rigour of this hierarchy allows experts – from this perspective – to deal with technical complexity as is explained in the following order.

First, technical systems are understood in terms of nested subsystems and in terms of system functions. The hierarchies between subsystems and between functions play an important role in how complexity is understood and dealt with. For instance, the design of a storm surge barrier is to be embedded in a coastal defence system of dunes and dikes. Weak links in this chain of defence structures are to be avoided, and the pressure of water needs to be evenly distributed. The connectedness of these subsystems translates into specific requirements for the storm surge barrier.

Second, the hierarchy of functions can be translated into a programme of requirements for design. In the case of flood-defence systems, the primary function is to resist water, to keep water from overflowing land. Other functions are possible as long as they do not jeopardise the primary function, now or in the future. To protect the primary function, secondary functions can be accommodated only to a certain extent, and this is regulated in institutions.

Third, the sequence of steps in the design process also adheres to a hierarchy: first the system's requirements are formulated, then the design space is explored, alternative options for system design are conceptualised and tested, and finally the preferred design is selected. Different design methods, with expressive names like the waterfall method and the spiral method, have more or less flexibility for dealing with iterations during the design process (De Bruijn and Herder 2009). The hierarchy in the design process places dealing with complexity into the early phases of a policy-making process when the programme of requirements is formulated. Design optimisation methods can be used if the programme of requirements remains unchanged. This systems approach to design brings a logical order and rigour to a policy-making process and differs in this regard from the design approach of an artist or urban planner. To conclude, the systems approach is ruled by legal and otherwise formalised standards in many aspects of problem-solving and design. Responsibility for safety and accountability are very important elements of their professional attitude. This translates into adherence to even another hierarchy, namely the order that is created by standards, rules and regulations in the formulation of design requirements, in testing procedures and in the evaluation of test outcomes.

Hierarchy and order are qualities of systems engineering that are deeply engrained in the way engineers work, in their professional attitude and in the expectations that they project on their environment. The leader of the large Oosterscheldt Barrier project wrote of “turbulent times changing a well-ordered project” when he described the consequences of the government's decision to abandon a previous decision to build an earthen dam and to build a concrete-and-steel storm surge barrier instead (Rijkswaterstaat 1986: p.3). This statement was hardly an exaggeration, since the building of the earthen dam had already started and some work was well underway. From the systems perspective, the engineers charged with the building of this dam could not have counted on this change of events. It is interesting, therefore, that they used the same, rather rigid system-engineering methods to make amends

and incorporate the works that had been completed already into the entirely new design of the storm surge barrier (Rijkswaterstaat 1986). By doing so, the system's performance was optimised, the dam was as cost-effective and met the new safety standards, the design process was structured and effective, and the implementation effectively managed. In short, as little capital and time was being lost as possible, and safety was guaranteed.

3.2 The contribution of experts to policy from a systems perspective

Experts in infrastructure and technology often are engineers and educated and experienced to solve these technical problems in a structured manner. They may be employed by national government, regional (water) authorities, research institutes or consulting companies. These experts organise the processes of design, management and maintenance of technology to be as effective and efficient as possible. The systems perspective is deeply rooted within the practices and behaviour of such experts. It even brings hierarchy into the ways they organise their jobs, using project management methods to reduce the complexity of working with large teams on complex assignments. Moreover, the systems perspective also structures the ideas that engineers hold about how they may contribute to policy processes, as will be explained in this section.

Engineering experts expect policy processes to develop in a similar manner as problem-solving processes. At best, experts see a policy as the result of decision-making as an analytical process, structured in a series of sequential steps, in which data-gathering can be separated from the process of selecting the best solution to the problem at stake (Drucker 1967). They assume that a policy-making process starts with a problem definition and demarcation in order to reduce the debate about either the proper problem or the goal of the decision-making process. It is taken for granted that experts are asked and are able to collect all the data that is available on the problem and necessary for finding a range of alternative solutions. These data are considered facts obtained by standardised methodologies. Policymakers are expected to use these facts to assess the feasibility and efficiency of alternative options, and to select the best alternative. In this way, expert involvement in policy-making can contribute to truly, reliably and validly informed policies. Also, from the systems perspective, it is assumed that once the solution is implemented, it will be monitored and managed following a technological rationality.

Both (pure scientist and arbiter) are names of roles in this context, and introduced in the previous section as such. In both roles, the expert uses proven methodology, delivers numbers, facts and figures about the (future) state of the system, and leaves the interpretation to the policymakers. An arbiter – in contrast to the pure scientist – may offer expert judgments as well when invited to do so. For example, experts may act as arbiters when asked how to deal with societal and technical uncertainty associated with infrastructure decisions. Arbiters base their expert judgement on both objective standards and experience. Their aim is to inform but not to advise or to take a normative point of view about each of the policy options. The expert as arbiter is engaged with how knowledge is used in order to prevent incorrect knowledge or to be able to correct wrong uses or interpretations of knowledge. He (or she) is strong on

the idea that technical decisions are based on the best available, objective and authoritative knowledge and experience. If experts in the role of arbiter feel that their knowledge was not used correctly in a policy process, they may take the role of advocate.

Experts in the role of advocate plead for a particular solution rather than the use of “just” knowledge. They translate scientific results and findings into statements and advice about what ought to be done. The choice to promote a single solution or a preferred course of action may be based on all kinds of arguments, like social responsibility, business, finance or politics. Also, perceived incompetent or uninformed policy-making may challenge experts to act as advocates. Frustrated about a lack of understanding or wrong use of their expertise, he may (consciously or unconsciously) try to make sure that – from his perspective – the best option, based on expert judgement, should prevail. Examples of such role perceptions are known from the case of flood-risk management; in newspaper articles, experts oppose policy choices and defend their preferred alternatives (Van der Most et al. 2010; Vissers and Van Deen 2008; Vrijling 2008).

Pielke (2007) also identified the role of broker. But, from a systems perspective, there is no natural need for brokerage between knowledge and knowledge claims since alternative solutions can be found by experts, once the problem has been defined. From this perspective, it makes no sense that values and interests, rather than factual knowledge, are allowed to inform the processes of problem definitions, knowledge production and policy-making. Experts and policymakers acting from a network perspective see this differently, as we will present in the next two sections.

3.3 The network perspective: Managing social complexity

Proponents of the network perspective view policies and decisions not as products of analysis or optimisation, but as casual results of on-going interaction between interested parties who aim to solve complex societal problems (De Bruijn and Ten Heuvelhof 2008). This implies that a policy is more than the result of the selection of the best alternative to solve a problem. It is also the result of collaboration and negotiation between mutually dependent parties that form a social network. To achieve such results, complexity is not to be reduced in a (public) debate but rather enlarged to allow that a range of public values, public and private interests is being served.

The search for agreement on acceptable solutions focuses not only on facts about a problem and its alternative solutions, but also on the context of that and interrelated problems and the many stakeholders with diverging values and interests. This may be illustrated from Dutch flood-risk management. In the 1970s, Dutch water managers came up against the limits of flood protection by means of reinforcement and expansion of the physical system of dikes and dams. Social protest was directed against the construction of higher and wider dikes along the rivers because of the negative impact on the quality of life. Moreover, in the political debate, protection against flooding often came second in political assessments, after other “pressing” issues, such as the development of the healthcare and education systems and national defence in the cold-war era. This led to sluggish and cumbersome dike-management practices and complicated relations between the parties that were needed to

realise flood-risk management (van Eeten 1999; Wolsink 2006). Since then policy-makers and water managers adopted the perspective that it is important to consider that in flood-risk management, many different parties are involved. Among them are a variety of authorities responsible for flood-risk management, with different tasks, resources and interests, all in their own public, political and physical environment. But also local interest groups of inhabitants, environmentalists and business participated. They agreed on flood prevention and on multiple related issues with regard to the cultural heritage, nature, environment, socio-economic development, housing etc. The result of their debate and policy-making process was a package of agreements and measurements dealing with multiple issues and satisfying as many parties. Parties reached agreement about such a package by negotiation instead of analysis; a process that often is less sequential, linear and straightforward than may be expected from a systems perspective, but capricious and unpredictable.

Although the network perspective may be instilled during education, many policymakers acquire this perspective from hands-on experience. They are engaged with managing relationships between multiple parties at a daily basis and involved in many issues and parallel policy processes. They experience that when many actors are negotiating about arguments, data, methods, research and system boundaries are continuously under discussion.

3.4 Different expectations about the contribution of expertise and experts

The systems perspective and the network perspective reflect different ideas, preferences and expectations about the organisation of system and infrastructure management, the contribution of facts and figures, and whether knowledge is related to values and interests. Table 1 summarises the schematic images of experts and expertise in policy-making from both perspectives.

Table 1: Schematic images of experts and expertise in policy-making

Systems perspective	Network perspective
Engineers are obvious knowledge suppliers	Engineers are one of the many expert groups among other actors
Facts are part of objective, neutral knowledge	Values shape subjective knowledge
Decisions (solutions) follow independent knowledge	Negotiated knowledge pre-sorts decisions
Standardised methodology	Capricious and unpredictable process
Engineers guarantee truth, reliability and validity	Expertise should contribute to trust, support and acceptance

It is self-evident what is relevant expertise and who is an expert from a strict systems perspective. According to the network perspective, who is an expert and what expertise is relevant ought to be agreed upon during the process of policy-making, given the wide range of parties involved. From a network perspective, policy-making is not only expert-driven but also interest-driven; and as a consequence, experts and exper-

tise will be of limited – or better of different – importance than from a systems perspective (De Bruijn and Ten Heuvelhof 1999; Fischer 2009; Jasanoff 1990). Engineers and other experts are employed by government agencies or hired from engineering consultancies or research institutes. These experts tend to have their own specialties, perspectives, fads and fancies, which they or their commissioners bring into the policy process to underpin their interests and values. The experts do not necessarily agree about knowledge and knowledge claims either; but bring this into the debate and negotiations.

According to the network perspective, values shape subjective knowledge claims, and interests determine the demand for and use of expertise. This contrasts with a systems perspective that assumes that decisions can be based on objective and neutral knowledge. In a network setting, competing knowledge claims and competing designs are inherent to policy-making. Design requirements, suitability of designs and feasibility of implementation may all be negotiated among the parties involved. The result is that policies are based on “negotiated knowledge”. This negotiated and trusted knowledge pre-sorts the way the problem will be solved, supported and accepted by most of the parties.

The possible contribution of expertise to policy depends on the “type” of problem-solving (Rich 1991; Turnhout et al. 2007; Weiss 2002; Weiss 1991). In clearly defined problems and rule-driven problem-solving, policymakers that look for data and experts that offer solutions may act according to the systems perspective on policy-making. But in less structured policy problems, there may be a need for ideas, concepts and arguments rather than information, data and indicators. From a network perspective, such knowledge can be put forward by various actors and can serve different strategies in the course of a policy-making process. When the policy process is less rule-driven and characterised by learning, debating, negotiating and compromising, knowledge is used to strengthen one’s position, to underpin or undermine arguments, to create or to solve conflicts, to stretch problems and the debate etc. This not only implies that knowledge is inherently related to values and preferences, and that knowledge is negotiated, but also that expert status may be continuously redefined in a policy process (De Bruijn and Ten Heuvelhof 1999; Rifkin and Martin 1997).

Not surprisingly, the system perspective and the network perspective differ significantly and inspire people to various (inter)actions. The systems perspective offers order in work and helps to achieve goals, especially in terms of safety, cost-effectiveness, speed and technical problem-solving capacity. The hierarchy that creates this order and focus also, and unavoidably, creates rigour and a narrow view. The use of scientific predefined methods, as guarantors for objectiveness and quantification, is a core value for this perspective. Adherents of the system perspective assume that truth can be known and is the only conceivable basis for truth-worthy, valid policy. Adherents of the network perspective, on the other hand, consider trust indispensable but negotiable within a network of parties. Both policymakers and experts who act upon a system perspective and those who act upon a network perspective may have very different expectations about how changes in infrastructure (risk) management are brought about; the former plan their actions stepwise and expect for knowledge to be assigned overriding importance (decisively), while the latter aim to gain influence in nonlinear processes and may use knowledge in various ways.

The differences between the schematic images of experts and expertise from both perspectives have consequences for the different roles experts may fulfil in policy-making. From a systems perspective, the main objective of experts is to adequately deliver knowledge that can be the basis for the best decision. Ideally this knowledge will be supplied from a role as pure scientist and arbiter. But assuming that expertise is value-laden, an expert does take sides (advocate) and mediate between different knowledge claims or integrates them (broker). Knowledge and advice delivered by an advocate are geared towards a particular problem definition and preferred solution. An advocate takes responsibility for what happens with his knowledge and expertise by engaging in policy-making. He values a sound scientific underpinning of decisions even though he knows that most likely decisions will be based on both rational and political arguments. He is aware that his knowledge may be used to demonstrate flaws in the arguments used by other parties or to discredit people. Experts that chose the role of scientist or arbiter cannot always avoid becoming involved in an expertise-related controversy in a network setting. Willingly or unwillingly, an expert may become part of the debate and be pushed into the role of advocate when parties use the expert's knowledge in a strategic way to underpin their positions or undermine the other party. In contrast with a systems perspective, this means that, in the end, his knowledge will be negotiated, and not unilaterally or fully adopted by all parties. Thus, from a network perspective, decision makers see engineers as experts among others and as one group of many actors, and engineering expertise as one of the sources of information that can be used in policy-making about technological solutions for societal problems. In the next section, we will elucidate what may happen when both perspectives meet in practice.

4. Efforts for change by experts and policymakers

Experts reflexively plan their actions from a perspective that serves them well in dealing with the complexity of their task. Perspectives and schematic roles, as presented in the preceding sections, will not be practiced in their pure form, but they do play a role in reconsidering contributions to and shaping expectations about the process of collaboration. This becomes prominent in practices and projects where policymakers and experts are collaboratively looking for change. In this section, two projects from Dutch flood-risk management are analysed to explore the interaction between practitioners that act upon the systems and the network perspective. In both examples, the existing technology and current institutions were challenged. Experts – among which hydraulic engineers – were triggered to redesign existing infrastructure. The cases differ in the way that the systems and the network perspective were put into practice and how tensions between the perspectives were dealt with. In the first case, the initiative to redesign the dike was taken by municipal urban planners who invited a water board (i.e. regional water authority) to collaborate on waterfront development (Textbox 1). The urban planners acted from a network-like perspective whereas the engineers planned actions from a systems perspective when they were asked to supply expertise on hydraulic engineering and flood-protection law. In the second case, the water board took the initiative to redesign a dike ring – i.e. a small system of flood defences – in a semi-urban setting and started working from a sys-

tems perspective. But plan implementation foundered, and the water board restarted the project and explored how to increase the feasibility of a new design and implementation plan (Textbox 2). In our analyses, we focus on how the two perspectives were actively coupled or remained uncoupled when experts and policymakers acted upon their own perspective.

Textbox 1: **Traditional dike or superlevee?**

Dikes – or levees – form barriers against flooding and, to the regret of urban planners, also function as barriers against waterfront development. Japanese-style superlevees incorporate the flood barrier in a wide earthen levee that supports urban housing and other urban functions. Such superlevees can overflow but are resistant to breeches, therewith limiting the potential impact of flooding waters.

The Dutch city of Almere would like to develop its waterfront, but currently flood-defence regulations impede this initiative. The concept of superlevee inspired the municipal urban planners to seek cooperation with the water board to build a superlevee. Building a superlevee would meet multiple interests: expand housing development, develop highly valued waterfront property and improve flood protection in anticipation of the impact of climate change.

The urban planners invited the water board to co-invest in building the superlevee, assuming that the potential increase of flood protection would help achieve its goal of expanding the city in an attractive and climate-proof manner. It needed the water board because of its formal task to approve of any developments in the vicinity of flood defences. At first, the water board hesitated to participate in a superlevee design because, in the case of Almere, a superlevee would lower the risk of flooding more than required by current legal standards. Future standards were deeply uncertain, and therefore the cost-effectiveness of investing in a superlevee could not be estimated. A second hurdle in the process of collaboration was the lack of (legal) standards needed to indicate requirements and constraints for the dimensions of the superlevee and construction on or in the levee. Without such standards, the water board could not calculate what housing development could be permitted. Consequently, the water board concluded that it could not cooperate in the design of a superlevee despite its “breech-proof” qualities. The urban planners needed the expert knowledge and formal authority from the water board to make a business case for the waterfront development. Both parties made serious efforts in finding a common ground for designing a superlevee in the city of Almere, but the idea has been stalled for now.

Sources:

(in English) (Van der Sande 2009)

(in Dutch) www.innoverenmetwater.nl/project.asp?id=2312&L=2 (last accessed 12 July 2011).

4.1 Reconsidering dike design: Decoupling perspectives

The urban planners of the city of Almere took the initiative to build a “superlevee” – a levee that can resist every conceivable flood. This may have surprised the water board since the latter is responsible for the management and design of flood defences. The water board is the central actor in the decision-making process about levee design and the likely initiator when flood protection is to be improved. Moreover, the water board employs the obvious knowledge suppliers, i.e. engineering experts that can define and judge the design of such a levee. They are familiar with rules, standards and laws that define the possible alternatives and should guarantee reliable flood defence and legitimate decisions. Based on the letter of the law and their standard method of working, a superlevee in the specific situation of Almere was not needed, and was out of scope and budget.

In this case, the water board’s experts claimed total responsibility for flood-risk management, innovative design and authoritative expertise. They may not have appreciated that other experts stepped into their domain of expertise by proposing a new concept for dike design. In this collaboration, engineers positioned themselves as arbiters of the law and used their expertise and expert status to guide policy and decision-making according to current standards and regulation. The urban planners, on the other hand, were looking for innovative solutions to achieve both safety from flooding as well as other public values and interests. They challenged the authority and professional expertise of the water board to accommodate innovative technology that better match urban waterfront development than a traditional flood-defence system. Accordingly, they thought about involving other expertise in reconsidering the existing dike design. Their attempt to broker between interests and expertise remained without success: the approaches of both parties remained uncoupled in this case, and the attempt for codesign stranded. Despite the efforts made by both parties, the superlevee concept was neither elaborated upon nor replaced by another approach that could serve the dual objective of urban development and flood defence. This objective could not be achieved because of the conflicting ways both parties put their perspectives into practice.

Textbox 2: **An alternative dike design that serves both safety and landscape values**

A safety assessment of the dike ring “Commandeurspolder” was reason for the responsible water board to start a redesign project in 2005. A plan was developed based on existing standards and resulted in an overdimensioned, robust design for earthen dikes. In 2007, it became apparent that these plans met with much resistance of the landowners and other stakeholders. The plans for dike reinforcement were expected to reduce the economic value of property on or near the dike, and to impair the historic landscape associated with the dike itself. The citizens and municipal council made an appeal to the water board to apply another, innovative and less impactful design. Even though the water board was entitled to enforce its plans, it abandoned the standardised approach and decided to start the project all over, although this would delay the reinforcement of the dikes by three years or more.

The water board invited the local municipality to collaborate in activating a network of stakeholders, including property owners, other inhabitants and non-governmental organisations. These parties were given specific tasks in support of the new design process and operated according to “game rules” that were accepted by all. An interactive design process was set up by a team consisting of a landscape designer, a hydraulic engineer and a communications specialist. The first phase of this design process was “solidified” in a formalised start document, stating requirements for flood risk reduction and spatial quality and promising design solutions. Also, the water board replaced the formalised standards for dike design with a functional design process and so created possibilities to tailor dike design to local area-specific characteristics and yet meet safety specifications within the available budget. The power to approve the final design and make funds available remained with the water board; the municipality was a partner in this decision to the extent of granting the necessary building permits. In 2011, the water board started the necessary construction works.

Sources (in Dutch)

www.hhdelfland.nl gives access to the formal decisions to start with the improvement of the Commandeurspolder dike ring by the water board council in February 2005 and to restart the project anew in July 2007. All documents, presentations and films that were published by the water board on this project starting January 2008 are made available to the public on www.hhdelfland.nl/projecten/commandeurspolder/documenten-en-films/ (last accessed 11 January 2012), including the Startdocument Kadverbetering Commandeurspolder “Veilig & Mooi” that was approved by both the municipal council and the water board council.

4.2 An alternative approach to system design: Coupling perspectives

In the second case, the water board’s engineers – as the responsible authority – initially developed a plan to rebuild the existing dike ring to be able to meet safety requirements. A systems perspective was dominant in this design approach and standard engineering methods were applied. The engineering experts evaluated the

current situation using required methods and designed measures to meet institutionalised criteria for dike dimensions. To obtain the necessary support and permits to execute their plans, the water board advocated that its plan was needed for safety. The costs to landscape and property values were said to be unavoidable. Apparently their plea was not convincing, and opponents to the plan promised to hinder its implementation.

The water board then adapted its procedure, and together with the main stakeholder, the municipality, it sought a new approach to policy-making. The approach offered room to manoeuvre for engineers, experts on landscape and historic quality, and other stakeholders (such as the landowners, inhabitants and local politicians). That implied that the final design for the dike reinforcement was emergently formulated and negotiated in a process that was managed by the water board. Nevertheless, it followed a step-by-step approach, similar to the typical, and more or less hierarchical, design processes which include setting requirements, developing design options, selection and implementation.

First, all experts – both engineers and architects – were involved in formulating functional rather than standard design requirements, based on the shared knowledge about safety, landscape values, and costs to society. That formulation needed a reinterpretation of legal standards. Together they assembled knowledge about the problem and possible solutions, taking into account different perspectives, values and interests of parties involved. In this role, we see elements of what is called a “broker”. They now agitated for the improvement of policy-making and, in doing so, aimed to be less (politically) biased than an advocate towards a specific problem definition or solution.

Second, different experts took different roles: engineers started designing, and the architects discussed with the stakeholders about the selection of the design options. The approach elicited the engineering experts to take an arbiter-like role again since in this setting, there was room to redesign the regional system of dikes and levees according to their way of working, by sharing knowledge, formulating constraints and coming up with alternative options for traditional dike reinforcements. The engineers regained a role from which they could generate ingenious solutions based on engineering experience, facts and methodologies. The landscape architects were concerned – like a broker – with linking engineering knowledge and knowledge of historic landscape values and inhabitants’ land use practices. Thus, the structured approach to policy-making played together the systems and the network perspective and resulted in an alternative design of the dike ring that was safe, reliable, acceptable and yet feasible. The outcome was to some extent negotiated and tailor-made but the result of a stepwise approach with room for the standardised design methods of engineers. The water board’s policymakers thus balanced both perspectives in this case, and the engineers adapted their previous course of actions. The engineers and other experts felt that their expertise had been fully used in the course of the design process.

4.3 Coupling or decoupling perspectives

We have presented two examples of infrastructure projects in which supporters of systems and network perspectives interact. In the first example of the “superlevee”, the water board followed the system perspective quite strictly, from which the urban planners act unexpectedly. This case in essence shows us that a strict implementation of both perspectives did not give enough room for a collaborative search for the development of new technologies and institutions in the implementation of Dutch flood-risk management. Both the urban planners and the water experts chose a role that apparently did not match the expectations of the other party and the policy setting. The perspectives remain uncoupled and the interaction results in a stalemate between them.

The second case shows that finding such a way to cope with confronted perspectives is an emergent search rather than a predefined method. In this case, the experts had different roles and even switched roles in the course of the process. The decision to abandon standardised requirements but to reinterpret legal standards and formulate functional requirements was a pivotal choice: the experts no longer had grounds to advocate but did contribute to the boundaries that alternative designs ought to meet. The broker-like role was appointed to the landscape architect, the expert that was able to visualise alternative design ideas and so to make expertise from different sources available to all. Both experts in this case – the engineers and the architects – succeeded to develop a role that combined their professional methods of working with the diverging process of (re)design. The roles in practice were a mix of the schematic ones.

Now the water board managed to emergently develop an approach to couple the two perspectives that gave room to experts to take appropriate roles. It could steer a middle course that connected both perspectives and successfully steered away from a conflict.

Thus, these stories might indicate that confrontations between perspectives can have many faces that ask for a wide range of roles of experts to deal with them. In practice, roles are contingently developed in the unique policy setting that practitioners face. In that setting, an approach to introduce technological or institutional change may be developed. Based on only these two examples, we expect that to be successful, any approach should be respectful and leave room for practitioners of both perspectives; for engineers to develop new inventive and ingenious designs using their own methods; for policymakers to guarantee public values and to find designs acceptable for all parties involved. Recognising the perspectives at work might offer an understanding of why policymakers and experts act and have expectations about the (re)actions of others as they do. In different contexts, different approaches are possible to deal with tensions between adherents of both perspectives.

Based on only these two examples, we expect that successful approaches are respectful of and honour both perspectives. Practitioners may want to reflect on their actions from both network and systems perspectives to be able to understand how their actions may be perceived by others. Then engineers will be able to develop new inventive and ingenious solutions, and policymakers can guarantee

public values and create effective policies and feasible designs. In different contexts, different approaches may be needed to give room to manoeuvre to experts in various roles.

5. Conclusions

In this paper, we discussed two different perspectives that people may act upon to design and implement new technologies and institutions. In contrasting the systems perspective and the network perspective, we have explained that these perspectives nourish different prospects of the roles that experts see for themselves and the contribution they can make to policy (table 1). The two concepts of systems perspective and network perspective are helpful to understand the potential problems of codesign but fall short in offering a frame of reference to reconsider the role of experts or their contribution to expertise. We therefore used the four roles presented by Pielke (2007) to describe how policymakers and experts may act and take their expertise to the policy-making process. From a systems perspective – looking for truth – it is expected that authoritative experts supply neutral knowledge in the role of “pure scientist” or “arbiter”. Conversely, from a network perspective, it is expected that experts are but actors and that their expertise is one of the different sources of subjective knowledge to be included in policy-making: knowledge that needs negotiation and brokerage. Although in a network setting, there may be room for scientists, arbiters and advocates of expertise, policy is assumed to be based on negotiated knowledge that is trusted, supported and accepted in the network of actors.

We analysed two examples of collaboration between experts and policymakers from Dutch flood-risk management (section 4) that aimed to codesign flood defence systems in a (semi) urbanised setting. The confrontations between adherents of both perspectives were approached differently in these cases. This indicates that the confrontation and subsequent approach of collaboration can have different faces: the two perspectives can become coupled – as in the dike-ring design – or uncoupled – as in the superlevee case, in an emergent or deliberate way. The room to manoeuvre for experts in both cases varied. In the superlevee case, the urban planners sought room to manoeuvre, but from a systems perspective, the regional water policy and the water-board experts hardly perceived any room to allow others to bring in new values or expertise. In the second case, experts were given ample room by the development of a new way of collaborating, and the creation and acceptance of adapted roles for experts. The approach gave rise to hybrid roles that were more or less variations of the schematic, theoretical ones. So contingent, suitable roles are filtered by the particular policy setting and the room to manoeuvre it offers to experts and policymakers.

The challenge to practitioners, both experts and policymakers, is to continuously reflect on their actions and to adapt their roles if recommended. The success of design and implementation of new technologies and institutions depends on the collaboration of these professionals. Public-administration studies address the exact ways how individual policymakers and project managers think and act, which relations are formed, what is negotiated and how, how to cope with the perspectives in

a unique situation. This elucidates how the management of collaboration may be improved, but does not consider what it takes to give meaning to expertise in a policy-making process and to be engaged in a process consistent with a specific expert-driven role. Therefore, we plea for research that traces in what policy settings perspectives may compete, what approaches of collaboration are developed, how individuals cope and 'how institutions and technologies mean' (Yanow 1996). Such research may contribute to reflection on collaboration of experts and policymakers as adherents from different perspectives, and offer insights into how the tensions can be dealt with that come with the relationship between technology and governance. We should search for (new) roles for experts in managing supply and demand of expertise and in bringing about innovation. We plan to contribute to this search by investigating promising new arrangements for governance of technology that offer perspectives for action to practitioners.

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BERTIEN BROEKHANS, PhD, is an assistant professor at the Section of Policy, Organisation, Law & Serious Gaming, Faculty of Technology, Policy & Management, Delft University of Technology, the Netherlands. Her research deals with issues of expertise and governance, and management of uncertainties. **TINEKE RUIJGH-VAN DER PLOEG**, PhD, is an assistant professor at the Policy Analysis group of the Faculty of Technology, Policy and Management, Delft University of Technology, the Netherlands. She is engaged with water management and flood protection from the perspectives of design, implementation and operation. Correspondence: Bertien Broekhans, Delft University of Technology, Faculty of Technology, Policy and Management, PO Box 5015, 2600 GA Delft, The Netherlands; E-mail: b.broekhans@tudelft.nl; M.P.M.Ruijgh-vanderPloeg@tudelft.nl.