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Water operator partnerships and institutional capacity development for urban water supply

Richenel Breeveld[a], Leon Hermans[a,*] and Siemen Veenstra[b]

[a]*Delft University of Technology, Faculty of Technology, Policy and Management, Multi-Actor Systems Department, P.O. Box 5015, 2600 Delft, The Netherlands*

**Corresponding author. E-mail: l.m.hermans@tudelft.nl*

[b]*Vitens-Evides International, P.O. Box 1205, 8001 BE Zwolle, The Netherlands*

Abstract

One way in which international water operator partnerships can contribute to capacity development is through the exchange of experiences with water institutions in different countries. This paper looks at a partnership between water operators in the Netherlands and Malawi to see to what extent institutional experiences in the Netherlands can contribute to capacity development of the Lilongwe Water Board in Malawi. For this, it combines insights from policy transfer, with a conceptual framework based on the Institutional Analysis and Development framework. Stylized game theoretic models are used to analyze in-depth the institutional (dis)incentives that contribute to improved performance for customers. Experiences in the Netherlands are analyzed by studying four specific action situations, such as asset management at drinking water company Vitens NV. Potential lessons are derived from this, which are evaluated for potential transfer to Malawi. The analysis suggests ways in which improved information gathering and data management can support allocation of investment and budgets for operation and maintenance. Furthermore, it suggests ways to increase the frequency of encounters between government and financing institutions and water utilities, as well as the use of a system of benchmarking to provide a platform for sharing best practices and to create competition.

Keywords: Game theory; Institutional analysis and development framework; Institutional capacity development; Policy transfer; Urban water supply; Water operator partnerships

1. Introduction

Malawi is among the poorest countries in the world. More than half of the population in 2005 lived below the poverty line (World Bank, 2006). In addition, the country faces a population growth of more than 2% per annum and increasing urbanization (World Bank, 2006). This presents urban water boards in Malawi with tremendous challenges to secure safe and affordable drinking water for the citizens in urban areas. One of those water boards is the Lilongwe Water Board (LWB), which is responsible for

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providing urban water services in the capital city of Lilongwe. The LWB needs to meet rising water demands, expand and improve the urban water infrastructure and reduce current water losses. Non-revenue water (NRW) estimates range from 24 to 40% (Ruijmschoot *et al.*, 2010) and drinking water production can hardly keep up with demands, resulting in rationing since August 2012.

The LWB is working hard to improve its water service delivery and in doing so, it is supported by an international water operator partnership with Vitens-Evidens International (VEI). VEI is a collaboration between two of the largest drinking water companies in the Netherlands, to share their knowledge and expertise internationally. A baseline assessment by Ruijmschoot *et al.* (2010) suggests that operational efficiency is a key area of attention. Although LWB reports a collection rate of customer bills of up to 95%, this collection rate is in contrast with the disappointing result on the operational aspects. Experiences from the field and information sources suggest that an improvement of operational efficiency could be served by a more enabling institutional set-up (Breeveld, 2013).

VEI draws on long-lasting experiences in the Netherlands. The drinking water companies in the Dutch water sector score well in international benchmarks on efficiency and are perceived to be operating in a relatively successful water governance structure (Dijkgraaf *et al.*, 2005; Ofwat, 2008; De Witte & Marques, 2010). This raises an interest in the extent to which the experiences with drinking water institutions in the Netherlands, available to this particular water operator partnership, can be used to improve the institutional capacity for urban water supply in Lilongwe in Malawi.

Within an overall framework of policy transfer and institutional transplantation, an institutional analysis was done for key aspects of the urban water supply sector in the Netherlands. Using the Institutional Analysis and Development (IAD) framework (Ostrom, 2005), insights were obtained in the institutional (dis)incentives that contribute to improved performance for customers in the Netherlands. Game theory was used to aid this analysis. The resulting promising institutional components from the Netherlands were evaluated for their possible transfer for application in Malawi. The resulting insights should allow for a better understanding of how international water operator partnerships can apply institutional practices from one country to improve operational process in the drinking water supply in another country.

Literature on policy transfer and institutions is reviewed in Section 2 of this article, based on which a framework for analysis is selected that is explained in Section 3. Section 4 presents the method for data collection and analysis. Section 5 discusses the results, reviewing key external conditions in both countries, a game theoretic analysis of four key areas of interest that were looked into and the applicability of the resulting lessons for Malawi. This is followed in Section 6 by discussion and conclusions.

2. Theory: policy transfer and institutions

This paper looks into the question how water operator partnerships can apply institutional practices from one country to improve the operational performance of water operators in another country. Two elements are central: policy transfer and institutions. Literature on both elements is addressed in this section, before moving towards the framework and methods adopted in this study.

2.1. Policy transfer and lesson-drawing

Capacity development in water operator partnerships rests on the (often implicit) assumption that partners can benefit from sharing their knowledge and experiences. However, the water supply sector in urban areas is complex and is intertwined with technical, socio-economic, ecological and political aspects. A change in one key aspect may affect and influence the behavior in other aspects. Consequently, it may not be readily visible which approach should be taken from one country that would result in benefits in another. Therefore a certain degree of understanding of the complexity of both countries is needed to secure success in a water operator partnership arrangement.

Essentially, institutional capacity development through water operator partnerships involves the question of what institutional or policy elements can be transplanted from one country to another. Literature on such policy transfer, institutional transplantation or lesson-drawing, suggests certain phases that one should go through when aiming for successful transfer of experiences of one country to another. Four essential phases can be distinguished, as summarized in Hermans (2011) based on a literature review:

1. Initiation: 'Do we need lessons? Where do we face problems in our country?'
2. Selecting promising source sites from which to use experiences.
3. Constructing lessons as 'policy models' that explain how certain mechanisms work to produce desirable effects in given conditions.
4. Evaluation of potential lessons for adoption/adaptation at the target site: 'Could we make it work here?'

These phases point out that, among others, policy transfer requires attention for important context factors that would determine whether or not a 'good practice' from one country could also be successfully applied in another (e.g. Evans, 2004; Rose, 2005). Also, policy transfer should, in many cases, be guided by the desire to solve problems and improve outcomes at the destination site. This requires that potential lessons are reviewed in light of the problems they may help solve (Hermans, 2011).

2.2. Institutions and capacity development

The institutional and organizational environments within which individuals operate are a key part of water sector capacity development (Alaerts & Kaspersma, 2009). This warrants a closer look at the institutional dimension in water operator partnerships. Different definitions exist of the term institutions. Broader definitions see institutions as the package of rules, beliefs, norms and organizations that together generate a regularity of social behavior (Greif, 2006: 30). This study follows scholars such as North and Ostrom who use a similar, but slightly stricter definition, that emphasizes the character of institutions as rules, both formal and informal. For instance: 'Institutions are the prescriptions that humans use to organize all forms of repetitive and structured interaction' (Ostrom, 2005: 3).

Because of their relative stability, institutions provide the context within which actors can interact. However, this does not mean that the stability of institutions is absolute. Institutions change over time and are themselves the result of (repeated) interactions among multiple actors (Greif, 2006). This becomes more clear when one realizes that institutions can be found at various levels, ranging from the (inter)national and constitutional level to the organizational and operational levels (Ostrom, 2005). Institutions that guide interactions at operational level are the outcome of actor interactions at collective choice and constitutional levels, and operational level institutions tend to change on a different (shorter) timescale than higher-level institutions.

New institutional elements may be introduced, such as privatization models or new contracting forms in urban water supply, but these do not necessarily deliver the results that water sector professionals expect. In general, scholars of institutional development argue that it is more likely that existing institutions are patched-up with new structures or transposed to perform new functions (Genschel, 1997). Often, new institutions are based on a recombination of existing institutional components, as a form of institutional 'bricolage' (Lanzara, 1998; Cleaver, 2000). This has important implications for water operator partnerships, as they need to build on existing local structures. This matches well with the previously discussed insights on policy transfer and lesson-drawing that stress the need to ensure that policy transfer connects well to the situation at a destination site.

Although different views and frameworks to study institutions are in use in the water sector (e.g. Cleaver, 2000; Saleth & Dinar, 2004), in this study the IAD framework (Ostrom, 2005) was adopted for use. This framework is widely acknowledged and accepted as a key representative of so-called institutional rational choice theories (see e.g. the volume of theories edited by Sabatier (2007)). In recent years, this framework has been further developed into the Social-ecological systems (SES) framework (Ostrom, 2010). We have not adopted this more recent framework because we found it somewhat less mature and less elaborate on the institutional components, making it more difficult to operationalize for our empirical study.

3. IAD framework

3.1. Studying institutions using the IAD framework

Institutional analysis focuses on incentives and disincentives by studying the behavior of individuals and organizations that interact with each other on a regular basis to provide services or produce goods (create an enabling environment to perform). Consequently, more knowledge and insights are obtained that explain the success of outcomes or the failure of producing successful outcomes. In this study, we have looked at institutions that govern interactions at a strategic level between managers and policy-makers (at provincial, national or international level) and at institutions that govern interactions at a more operational level between operators and engineers in water companies. Both can provide important clues towards the institutional (dis)incentives that co-determine operational efficiency.

Figure 1 shows the IAD framework which can be grouped into two main components, (1) exogenous variables and (2) action situations. The exogenous variables can be divided into three categories, namely: Biophysical and material conditions, Rules-in-use and Attributes of the community. The component 'Action Situation' in this framework is the core building block which shows that participants interact with each other and are affected by so-called exogenous variables. The action situation produces in turn outcomes that in turn may affect the participants' behavior in a subsequent action situation or may influence an action situation at a different governance level. This feature can be explained by the feedback mechanism illustrated in this framework, which may allow for changing patterns of outcome over time. Similarly, outcomes over time in a slower rate may affect the exogenous variables (Ostrom, 2010).

3.2. Operationalization of IAD-variables for water service institutions

3.2.1. Exogenous variables. The exogenous variables of the IAD framework are applied to the urban drinking water supply; the variables are selected and adapted from studies based upon rural drinking

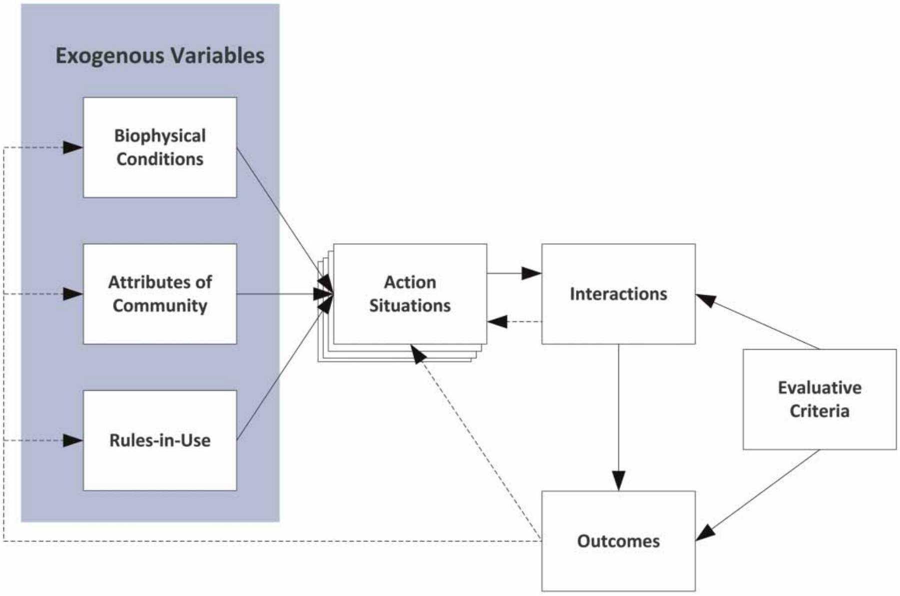

Fig. 1. Basic components of IAD framework. *Source:* Ostrom (2005, p. 15), with minor adaptations.

water supply, such as Ostrom *et al.* (1993) and Madrigal *et al.* (2011), that have applied the SES framework, which is essentially based upon the IAD framework. The selected variables are shown in Table 1 and are discussed below.

An important variable describing the biophysical and material condition in the drinking water supply sector is technology. Urban drinking water supply is linked with specific technology such as collective

Table 1. Exogenous variables in water service institutions.

Variable	Explanation/description
Biophysical and material conditions	
Geographical characteristics	Geographical distribution area and geographical attributes of distribution area such as soil composition, climate, ground water tables and elevations
Condition of infrastructure	Condition of the pipeline distribution system
Condition of technical equipment and installation	Condition of the equipment and installation
Socio-ecological conditions	Attributes of the water resources system by taking a macro view of other aspects related to the full water cycle
Attributes of community	
Historical characteristics	Historical development of country/drinking water sector
Degree of shared norms among users and customers	Degree to which individuals share values and norms related to drinking water supply and pursue same interests
Rules-in-use	
Legal structure	Procedures and practices to govern drinking water supply companies
Maintenance and investment decisions	Procedures and practices for maintenance and investment decisions

Sources: Ostrom *et al.* (1993); Madrigal *et al.* (2011).

distribution networks. Also, variables that are linked to the environment or the manner how goods, such as in this particular case, are distributed through a collective infrastructure. Attributes to the community can be divided into variables such as the degree to which norms are shared by the decision-makers in the community and the degree of homogeneity in the community on ethnicity and religion that may affect decision-making in the water supply sector. Rules-in-use are those rules that actors use in making decisions. They are linked for instance to norms in daily operations. Rules-in-use can derive from legal structures, but only if the laws and regulations are actually known to all participants, and if they influence behavior; rules-in-use are different from rules-in-form.

3.2.2. Action situations. Figure 2 shows a detailed picture of an action situation including the different variables. McGinnis (2011) explains briefly that an action situation consists of a situation in which individuals, on their own or as part of an organization:

1. observe information;
2. select actions;
3. engage in patterns of interactions; and
4. realize outcomes from their interactions.

For the drinking water supply sector this means that two or more actors with diverse preferences interact with each other to produce or provide a safe and affordable drinking water service in a certain distribution area. Also, it may happen that problematic dilemmas need to be solved between different actors. Problematic because of the diverse preferences of the actors and the constraints resulting from the exogenous variables, such as the natural resource or the collective infrastructure.

The central focus on action situations of this framework helps to explain or predict how and why actors behave in a certain situation. An analysis of key action situations can therefore help to find incentives and disincentives that explain operational performance of drinking water supply organizations. In addition, an analysis of action situations can also be used to predict outcomes of a designed incentive structure to assess whether changes will lead to an improvement in the situation and contribute to better outcomes.

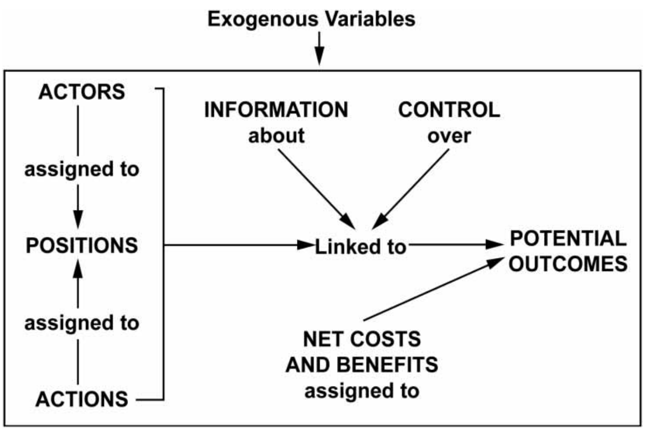

Fig. 2. Overview of variables in an action situation.

4. Methods: game theory and policy transfer

4.1. Game theory

The internal working parts of an action situation are compatible with the variables that are needed to perform a game theoretical analysis (Ostrom, 2010). Drinking water supply services are inherently linked with the concept of institutions due to the fact that multiple actors are involved in the services of drinking water production and services. It can be inferred that drinking water supply institutions regulate a 'game' that involves the distribution of outcomes which includes gains and losses to the various actors involved (Evans, 2004). Game theory is the study of how 'two or more entities – people, governments, organizations – make choices among actions in situations where the outcomes depend on the choices both or all of them make, where each has his or her or its own preferences among the possible outcomes – how they should (might) rationally make their interdependent choices' (Schelling, 2010: 28).

In line with the 'practitioner's approach' described by Schelling (2010), we have used game theory to exemplify situations in which interdependent decisions are somehow problematic. We have looked into typical dilemmas involving two archetypical entities with different interests, and have used game theory to formalize these situations in two-by-two matrices. The main advantage of this use of game theory is that it forces the analyst to strip a problematic situation down to its bare essentials, enabling a focus on the underlying misalignment of incentives that explain a conflict. Once this is done: 'The question is nicely formulated in the matrix, the answer is not' (Schelling, 2010: 33). Finding answers to such situations requires looking for clues in the situations, and often, solutions are provided by the rules-in-use. In this way, game theory helped our search for the key institutional structures that explain the outcomes of such dilemmas between multiple parties. This resulted in certain 'lessons' that could be drawn from each of the analyzed action situations in the Dutch water institutions.

4.2. Lesson-drawing and policy transfer

The reviewed literature on policy transfer and lesson-drawing suggests that successful policy transfer starts with a 'recognition' phase in which the problems that need to be solved at a destination site are carefully explored and that, in later phases, potential lessons are reviewed for their applicability at the target site (e.g. Hermans, 2011). Therefore, before analyzing the Dutch institutional set-up, an initial assessment of the main external conditions in both countries has been made, as well as an exploration of key institutional problems in Lilongwe. After the analysis of key components in the governance system in the Netherlands, for each of the lessons drawn from the Dutch experience, key conditions for successful transfer to Lilongwe have been identified. These are informed by looking especially at the exogenous variables for the situations in Malawi and the Netherlands.

4.3. Data collection methods

The institutional analysis of water service institutions in the Netherlands has been based on a game theoretic modeling of five selected action situations. These situations were identified, and modeled, based on information obtained from 22 semi-structured interviews. These interviews were conducted from the beginning of June until the end of September 2012. Respondents included officials and experts active at (semi-) government entities, such as the Ministry, Inspectorates and province. The majority of respondents, however, were affiliated with two of the main drinking water companies in the Netherlands, Vitens NV and Evides NV. The outcomes of the institutional analysis for the Dutch situation were evaluated for their usefulness for the case of Lilongwe, Malawi, using four e-mail and telephone interviews and available documentation. Further details about the results reported here can be found in Breeveld (2013).

5. Results

5.1. Comparing conditions in the Netherlands and Malawi

Policy transfer requires a feel for key conditions in the two countries that are involved. Hence, a scan of the exogenous variables in the IAD framework provides an insight into key commonalities and differences between the Netherlands and Malawi. For each country, the exogenous variables that seemed most important to co-determining the outcomes of interactions in the water service sector were mapped. The results are summarized in Table 2. They provide a background against which eventual 'lessons' from the Netherlands can be evaluated for their transferability to Malawi.

Table 2 highlights many conditions that make it difficult to directly transfer institutional practices from the Netherlands to LWB. For an institutional analysis, the rules-in-use are most pertinent. These 'rules-in-use' are generally the result of the patterns of interactions and the resulting (implicit)

Table 2. Important exogenous variables for water service institutions in Malawi and the Netherlands.

Category:	Key exogenous conditions, Lilongwe Water Board	Key exogenous conditions, The Netherlands
Material and biophysical nature	• Lack of information on actual condition of physical components at an operational level and collective choice level • Lack of fail-safe design in distribution network at operational level • Insufficient water production to meet water demand	• Substantial parts of the distribution infrastructure are old and are expected to fail in the near future
• Attributes of the community	• High unemployment rate, affecting company culture	• Economies of scale, can enlarge investment capacity, knowledge and expertise at drinking water companies
	• HIV/AIDS epidemic, constraints on technical expertise	• Risk-averse attitude towards investments and maintenance issues that may affect public health
	• Strict hierarchal culture	• High trust of public in drinking water supply system provides incentive to various actors involved in the water supply cycle
• Rules-in-use	• Donor providing funding for investment	• Strong monitoring and enforcement of rules to detect rule-breaking
	• Lacking a closed financial cycle	• Shareholders likely to be driven by political values
	• Corrective maintenance crowds out capacity for preventive maintenance	• Asset management provides incentive to make investment and maintenance decisions based upon analyzed information
		• Asset management provides incentive to improve data management

understandings at higher levels. Important rules-in-use that affect the activities of LWB stem from the presence and role of international donors providing investment funds. Therefore, this key variable has been studied in some more detail.

5.1.1. Institutional constraints to capacity development in LWB: the Samaritan dilemma. It has been observed that the multiple projects carried out at LWB are mainly financed by donor investments and this is also mentioned on LWB's website. In popular literature the concept of donor–recipient relationships is frequently mentioned (e.g. Moyo, 2009). From the literature it can be noted that in the water irrigation sector similar patterns are observed. Bruns (2008) and Ostrom *et al.* (2001) studied these patterns and captured this particular behavior in the archetype 'the Samaritan dilemma' to explain this social dilemma.

Bruns (2008) explains that the Samaritan dilemma occurs in the following circumstances. First of all two streams are considered, namely, water to generate funds and a flow of funds to allow investments. The main problem occurs when government funding or donor funding is used for investments. This displaces local efforts to generate funding that can be used for maintenance investments. The presence of a donor organization creates a disincentive to active engagement in maintaining infrastructure and production facilities. Second, the donor organization or government institution, although aware of such a behavior, finds itself unable to alter this behavior. It is difficult for a donor to withhold financial funding for fears that this might only lead to a further deterioration of water service levels in target areas.

A solution, suggested by Bruns (2008), is to invoke the recipient organization to put efforts in to preventive maintenance which will result in a favorable outcome for both. The solution may be found to increase the frequency of encounters between a donor organization and a recipient organization. As this would invoke the recipient organization to build a long-term relationship (with the donor organization), it would therefore be more inclined to put effort into preventive maintenance. Second, a method to invoke preventive maintenance by the recipient organization is to distribute funding over multiple recipients (Bruns, 2008). Supporting this approach with institutional measures, such as transparency through a benchmarking method, would create a form of competition and provide a platform for participants to learn from the best performer. This could lead to an improvement in operational performance. Last, ownership by the recipient organization or country can also be seen as an approach to overcome this dilemma. However, in practice it seems difficult to make the necessary arrangements to accommodate a sufficient level of ownership in aid projects (Ostrom *et al.*, 2001).

5.2. Institutional analysis for selected action situations in the Netherlands

Four action situations have been studied in more detail for the drinking water sector in the Netherlands:

- Asset management dilemma between engineers and asset managers in water companies.
- Economies of scale, looking into past mergers of drinking water companies.
- Collaboration in road construction projects.
- Aged infrastructure dilemma between national government and water service providers.

For each action situation, a game theory model has been made, capturing the essence of the dilemmas in two-by-two matrices. Here, we will illustrate the use of game theory for only the first of these four dilemmas. Elaborations of the other dilemmas can be found in Breeveld (2013).

5.2.1. Asset management dilemma in the Netherlands. The asset management philosophy aims to take an integrated approach to the physical and human assets of a drinking water supply organization. By considering the complete production chain, distribution chain and entire asset life cycle, decisions on preventive asset maintenance and investments can be made more effectively. The key for success is the collection of information in central database systems that can support decision-making within the drinking water supply organization. In addition, allocation of ownership in the production and distribution chain is both inherent with the asset management philosophy and essential: the reason being that ownership ensures commitment and accountability. In practice it means that in the Dutch drinking water supply sector a substantial effort is made in data management by having maintenance and investment plans in place. Also, much effort is placed in the analytical step through data analysis of asset performance and condition to predict the expected lifetime of the particular asset. By exploring the operator's dilemma through the institutional framework useful insights can be obtained.

Game theoretical explanation of the operator's dilemma. Consider the case of an operator observing a failing filtering system of a pumping installation. According to the operator's expert judgment the filter needs to be replaced. The asset management department concludes, based upon historical information and process analysis, that the item is non-critical and does not need immediate replacement. Instead, more frequent inspections are prescribed in the maintenance plan. However, maintenance engineers and operators control small maintenance and repair activities. Expenses that stay below a certain threshold do not need approval from the asset management department. By ordering items separately over a period, the filtering system can be replaced without the intervention of asset management procedures. However, by ordering the different sub-parts separately the total cost of the filter system may end up to be much higher than the cost of replacing the system at once. Hence, if the two parties do not reach an agreement, the outcome will harm the efficiency of this particular water service provider.

This action situation can also be illustrated in game theoretical language. Table 3 presents a game theoretical notation which depicts actors A and B, each of whom can choose between two moves. The outcomes are shown in the table respectively (A, B) and are ranked in qualitative manner from 1 to 4, according to each of the participant preferences, whereby 4 is most preferred and 1 least preferred. Player A can 'move' between rows in the matrix, player B moves between columns. Both will move from less to more preferred outcomes if they can, which is illustrated by the arrows.

The dilemma occurs when both players have opposite interests which means that incentives are not aligned which can be seen in the quadrants I and IV. In this particular case actor A represents the Operators and actor B represents the Asset Management department. Move 1 means Replacing the filter installation at the pump station, whereas Move 2 means Maintaining the filter system.

Table 3. Asset management dilemma.

			B
		1	2
		Replace	Maintain
	1	I	II
A	Replace	(4,1) →	**(3,3)**
	2	III ↑	IV ↑
	Maintain	(2,2) →	(1,4)
Cell content A's payoff, B's payoff			

In this setting the asset manager has a higher preference to maintain the particular filter system to keep the total cost of ownership low. Additionally, according to a process analysis the particular asset is rated as non-critical and is safe to fail. Consequently, immediate replacement can be delayed. In contrast, the operator has an interest to work with reliable assets and therefore an incentive to bargain to replace the filter system which will minimize the risk of failure. In this situation where incentives of both departments are misaligned it is plausible to assume that strategic behavior will occur by operators. Consequently, the outcomes would be suboptimal which is represented in quadrant II (see the direction of the arrows).

The outcome could result in higher operation costs and ineffective decisions on maintenance and investments by the asset management department. Also, due to a lack of commitment by operators and maintenance engineers to maintain the data records in the central databases, insufficient information is available to the asset management department to make effective decisions.

Given the exogenous variables and the action situation variables, an information asymmetry exists between the two departments. Information on the physical condition of the filter system is available to the operator, including his expert judgment. On the other side, the asset management department has historical information on the filters' performance and results from analysis that predict the expected lifetime.

Asset management dilemma with aligned incentives. Based upon the analysis explained in the paragraphs above it can be inferred that the outcomes resulting from this particular setting are suboptimal. Considering the various institutional components, the structure of the game can be altered to align the incentives that could lead to a situation in which the incentives for both participants are aligned.

The key to solving the dilemma is to overcome the information asymmetry between the two departments. First, communication between the two parties to improve the information between them is typically proposed to get the incentives aligned (Bruns, 2008). This will improve decision-making in the asset department and cooperation among operators and maintenance engineers as they are confronted and experience the likely outcomes that result from decisions made by the asset management department. Second, transparency in the decision-making process could also help to create the support of operators and maintenance engineers to accept decisions made by the asset management department and consequently align the incentives.

The next question then is: how to improve this communication and transparency? Useful insights can be obtained from the information that is collected for this research on the strategy used within Vitens to create support for asset management procedures among operators and maintenance engineers. First, the asset management philosophy is introduced by providing training and information sessions emphasizing the multiple advantages of the method. Second, management and team leaders have selected motivated entrepreneurs among the various maintenance teams and operators who were positive about the asset management philosophy. These entrepreneurs acted as 'champions' for the asset management philosophy within the operational levels of the company. They were given the responsibility to link the physical infrastructure with the central registration system. The institutional mechanism is that the selected entrepreneur creates a sense of ownership of the central database system. In addition, transparency is introduced through this process, which makes clear for operators and maintenance engineers how decisions are being made and on which grounds, and encourages commitment to maintain data records.

Lessons from the asset management dilemma. The institutional lessons that can be drawn from this situation is that between departments at an operational level accurate and timely information is essential to support decision-making on investment and maintenance issues. Data management is therefore an important attribute. In addition, transparency in the decision-making process encourages cooperative behavior and commitment to decisions made by other departments, as it creates an understanding of the impacts. Involving motivated entrepreneurs in the implementation of the system creates ownership and commitment on data management.

5.2.2. Drawing lessons from three other dilemmas

Dilemma 1: economies of scale. This dilemma concerns the past mergers of smaller drinking water companies into the current set-up of a limited number of large drinking water companies in the Netherlands. In this historic case, national government favored the formation of larger drinking water companies based on the expectation that these could reap benefits from economies of scale. Initially, the municipalities that then owned the smaller water companies were not supportive. They feared, among other things, a loss of employment and a loss of income from dividend payments when selling their shares. Initially, the incentives of both key players were such that the situation ended in a gridlock.

However, due to technological advances, new information became available regarding ground water quality. This quality was worse than expected, and it was also clear that municipalities lacked the funds and expertise to upgrade their treatment technology to treat contaminated ground water effectively. This would mean a serious public health risk. This changed the preferences of municipalities. They now realized they did not have the resources necessary to sustain provision of good quality drinking water, and that the huge investments necessitated the formation of larger drinking water companies. Thus, improved information about the condition of the biophysical system, in this case ground water quality, helped to align the incentives for both players.

Dilemma 2: collaboration in road construction projects. In many municipalities in the Netherlands, it is now a good practice to coordinate upgrading and maintenance of underground and road infrastructures. Drinking water companies collaborate with other utility companies and municipalities in the maintenance and upgrading of water infrastructure. Of course, all parties involved would like *their* concerns to be leading in the scheduling of these collaborative maintenance activities. Otherwise, drinking water companies may be 'forced' to work on their distribution networks earlier than they judge economically most efficient. And the same applies to other parties like the municipalities that maintain the sewerage and roads, gas and telecom providers. Collaboration invokes costs to each of the parties, for coordination and setting up contractual obligations and for early replacement of infrastructure. Collaboration also has obvious benefits: costs for maintenance works may be shared, and there is less damage to assets due to less frequent meddling in the underground infrastructure. However, these costs and benefits are not necessarily shared equally among participants. Furthermore, uncertainty is involved as it is difficult to determine the actual condition of the underground infrastructure.

One of the key mechanisms that is likely to avoid free-riding behavior and keep these games balanced is their repeated character. When a participant free rides on the other participants' efforts by choosing its own preferred higher outcome, it will be unlikely that collaboration will occur in the future. Moreover, all parties will profit in repeated play by choosing active cooperation, as in the long term it is likely to assume that coordination costs will decrease for all parties. This requires, however, that long-term investment and maintenance plans are communicated to all parties, and that they are developed jointly to allow for shared ownership and commitment to these plans.

Dilemma 3: aged infrastructure dilemma. In the Netherlands, the replacement of aged drinking water infrastructure by drinking water companies is not specifically regulated. A key issue in this situation is uncertainty about the actual condition and expected lifetime of the underground pipeline infrastructure, which is difficult to determine. The different players in this case respond differently to this uncertainty.

The Ministry of Infrastructure and Environment has a risk-averse attitude and wants to minimize the risk of system failure as much as possible. Drinking water companies want to know more to deal with this matter more effectively. This could lead drinking water companies to favor a lower replacement rate of their aged infrastructure than the Ministry, thereby reducing costs for investments in new infrastructure. The Ministry of Infrastructure and Environment, when aware of this behavior, could respond by increasing the supervision by their Inspectorate, and/or by setting a legally required minimum replacement rate. Both actions would increase the burden on water companies, but also the administrative costs for the Ministry. Also, although some level of external monitoring and enforcement is necessary, increasing the level of external monitoring and setting external norms, such as minimum replacement rates, can also erode internal monitoring and responsible behavior (Falk *et al.*, 2012).

There are at least two ways to respond to this dilemma. The first is for both parties to collaborate in obtaining more information about ways to predict the expected (remaining) lifetime of the pipe systems. The second is for the Ministry to create incentives that are linked to internal norms within water companies. This could be done by introducing an indicator on infrastructure reliability on the national benchmark that exists for drinking water companies in the Netherlands. This gives drinking water companies an incentive to improve system reliability because of the competition that is invoked by the benchmarking method. In addition, it may also provide an incentive to learn from the best performer in the national benchmark ranking.

5.2.3. Summary of institutional components drawn from action situations. A summary of the elements resulting from each particular action situation is provided in Table 4.

5.3. Applicability of selected institutional components to Malawi

The analysis of key action situations in the Dutch drinking water sector suggests different lessons; institutional components that help to overcome situations that might otherwise lead to suboptimal outcomes because the incentives of the different players are not well-aligned initially. It is also possible to identify some of the conditions that need to be met in order for these institutional mechanisms to 'work'. Reviewing these conditions with the situation that exists in Malawi allows for an evaluation of the potential transferability of these institutional components. A summary of these elements is provided in Table 5 for each promising institutional component.

Table 4. Action situations and resulting institutional components from the Netherlands.

Action situations	Institutional components
Asset management dilemma	• Improved information about material conditions • In-company entrepreneurs and champions for participation of operators and engineers in asset management decisions
Economies of scale	• Improved information about material conditions and environmental conditions
Collaboration in road construction projects	• Early communication and joint elaboration of plans between parties • Repeated interactions between parties
Aged infrastructure dilemma	• Collaboration in research on expected lifetime infrastructure • Monitoring and enforcement • Public benchmarking and indicators

The information contained in Table 5 suggests that certain institutional mechanisms could also be useful to improve the operational efficiency for the LWB. Not all mechanisms are directly applicable, and some are already being put in place. For instance, a starting point for some of those mechanisms is already being implemented through the use of so-called 'caretaker teams'. This strategy has been introduced recently. It divides the LWB's distribution area into hydraulic zones which are being managed and put under the responsibility of a group of maintenance engineers. The intention of this approach is that it creates local ownership and therefore provides an incentive to improve maintenance activities at an operational level. Also, by dividing the distribution area into different zones and allocating equally sized groups to such an area linked with water supply and administrative billing, it is expected that groups may compete against each other and will affect NRW levels in a positive way (Ruijmschoot *et al.*, 2010). In addition, this strategy could promote a learning platform for operators and management to make effective decisions that may, consequently, improve continuity of supply.

Other institutional components may be useful, are but still difficult to transfer effectively. Changing the relationship between LWB and external parties such as ministries and donors is quite difficult. Also here, some of the key mechanisms have been suggested earlier – for instance in response to the Samaritan dilemma (Bruns, 2008). Also, repeated interactions on smaller loans and grants may not fundamentally alter the nature of the dilemma; it just cuts it into smaller pieces, hoping that this will introduce more discipline into the relationship.

Public pressure could help counteract the limits in independent Inspection capacity within the government. In addition, it also creates accountability of decision-makers involved in the production and distribution of drinking water. These mechanisms are already visible in the public pressure resulting from rationing of water supply in recent months. Use of the public does require that trustworthy data are being made available to them, in a timely manner.

6. Discussion and conclusions

In this paper, we have focused on the role of institutions in capacity development. Existing institutions provide the structure and prescriptions that organizations and individuals use to organize their interactions. These existing institutions provide rules and pay-offs to guide these interactions, which means that institutions can both enable or hinder the realization of improved water services. As such, appropriate and well-functioning institutions are a necessary part of water sector capacity development.

In water operator partnerships, institutional experiences are often shared and used to improve water services. However, best practices and good institutional formats cannot be standardized. There is no 'one size fits all', as is for instance clear from the debate about the role of privatization. Even fine-grained and sophisticated international comparative studies on water institutions do not yield straightforward conclusions (e.g. Saleth & Dinar, 2004). Still, one can learn from abroad. Water operator partnerships can add value here, sharing and comparing experiences within different institutional settings.

Locating potentially useful institutional elements and evaluating their transferability from one country to another requires a structured approach. In this research, we have shown that the IAD framework, in combination with basic insights on policy transfer and lesson-drawing, can provide this structure. Game theory offers a method to formalize specific action situations. This helps to analyze interactions as (potential) dilemmas. Using such crisp models of interactions is valuable as a thinking aid that helps

Table 5. Institutional components from the Netherlands reviewed for use in Malawi.

Institutional components	Mechanism (how it works)	Conditions in the Netherlands (what makes it work?)	Conditions in Lilongwe Water Board (could it work?)	Recommendations for Malawi
Improved information about material conditions	Reduces uncertainty about cost and benefits for participants involved	Measurement equipment; knowledge and expertise to estimate effects on other variables	Measuring equipment often defective or inadequate; staff capacity limited as employees heavily occupied with acute problems	Set up a team committed to analyze data and estimate effects on drinking water production and maintenance
In-company entrepreneurs and champions for participation of operators and engineers in asset management decisions	Provides incentive for commitment to management decisions; sharing plans with employees can create more transparency and justification for decisions	Central databases for information exchange; entrepreneurs willing to cooperate in data collection and planning; rewards for consistency in data collection and preventive maintenance; expertise to translate information into decision support information	Operators and maintenance engineers primarily busy with corrective maintenance, limited data collection capacity; no centralized information systems and only 25% of staff has access to computers; absence of maintenance plans and investments programs	Improve data management and analyses, as above; link data management reward system to caretaker strategy
Early communication and joint elaboration of plans between parties	By aligning plans opportunities can be created to engage in collective action in public works	Possibility to share collective project costs proportionally; long-term agreements between parties; flexible contracts to absorb surprises	Collaboration of external parties mainly between LWB, ministries and donors; costs and benefits currently unequally distributed (Samaritan dilemma)	Share plans and results, not only with donors but also with the general public
Repeated interactions between parties	Supports collaborative attitudes among parties, as free-riders can be more credibly punished and cooperation rewarded	Long-term presence of same parties in interactions; possibility to link interactions	Important parties are donors and ministries; repeated interactions but threats not credible (Samaritan dilemma)	Link smaller projects with budget constrains
Collaboration in research on expected lifetime infrastructure	Helps share ownership of problem situation and incentive to align preferences	Funds and resources available to collaborate in joint research	Not an urgent problem for LWB; limited funds for research	Not (yet) recommended, not the main problem area

(*Continued.*)

Table 5. (*Continued.*)

Institutional components	Mechanism (how it works)	Conditions in the Netherlands (what makes it work?)	Conditions in Lilongwe Water Board (could it work?)	Recommendations for Malawi
Monitoring and enforcement	External monitoring and enforcement provides threat to drinking water companies to be detected for non-compliance	Independent inspectorate with expertise; sanctioning instruments; internal monitoring and enforcement, possibly linked to a reward system	Government has shortage of inspectors who carry out monitoring and enforcement; insufficient production capacity has led to rationing and critical customers	Channel performance outcomes through media to public to increase the effect
Public benchmarking and indicators	Incentive for learning and performance; smart selection of indicators helps align incentives, water service providers and external actors	Trustworthy data for benchmarking; sufficient participants in benchmark; sufficient importance attached to benchmarks by water service providers	Conditions for effective benchmarking not yet in place, but ‘caretaker’ strategy that creates local ownership in organization provides starting point	Publish benchmarking results for different zones in LWB area (link to ‘caretaker strategy’)

identify mechanisms that turn potential conflicts into situations offering room for cooperative solutions, realizing 'system efficiency' by aligning the incentives of participants in a game.

One of the practical implications of the approach presented in this paper is that more attention is required for a careful exploration of local needs and conditions, to identify key areas where improvements, based on international models and experiences, are feasible. This helps to focus efforts on areas with a higher chance of success. It implies a choice for a focus on a limited number of areas for improvement, rather than an ambitious overhaul of the complete drinking water sector. In the case presented here, we looked into a limited number of action situations, excluding for instance other areas such as tariff structures or gender equality. In many cases, such a pragmatic approach is to be preferred for water operator partnerships with a limited scope and time-span; one can only change the world one step at the time. However, if one is on a track that is fundamentally wrong, even many steps will not lead to an acceptable level of (drinking) water sector performance. Sometimes a fundamental overhaul of existing systems and institutions *is* required. A fairly detailed analysis of specific action situations in the way suggested here, will not suffice in those cases.

The approach suggests that analysis should not be limited to the mainstream indicators for water operators' performance, but should also include attention for the actor interactions within organizational departments and with external actors. This resonates with the findings of Pascual Sanz *et al.* (2013) and Mvulirwenande *et al.* (2013). This requires another perspective, in addition to that of the traditional water engineer or economist. This in itself may require some capacity development with national and international water sector experts.

In the case of the LWB in Malawi and Vitens-Evides International from the Netherlands, an institutional analysis of the situation in the Netherlands does not so much produce ready-made institutional components that can be transplanted with little or no adaptations to improve the situation in Malawi, but it provides insights in how dilemmas can be overcome. For instance, insights from the Netherlands do not directly help to tackle the Samaritan dilemma between donors and local beneficiaries, but it does suggest that changing the dynamics to use smaller and more repetitive interactions may help to better align incentives.

These results are not the 'golden bullets' or definitive statements that some may hope for. Also, many of the institutional components that are suggested as promising for transfer are not unique, but echo suggestions made elsewhere by other scholars and experts. However, our results confirm that the structured approach in this paper helps to identify institutional lessons that can be shared within specific partnerships. Such lessons are likely to help water operator partnerships make better informed decisions about which, and how, institutional experiences can be shared fruitfully. Finally, this papers highlights the dynamic environment of capacity development for the water sector. It requires one to rethink critically what is needed, for each new place and time; do not just go with the flow.

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