SUSTAINABILITY OF DUTCH WATER BOARDS:

appropriate design characteristics for self-governing water management organisations

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<u>ii</u>

PREFACE

When ILRI was established in 1955, its mission was to disseminate Dutch knowledge about reclamation of saline land and improvement of its agricultural production potential. This knowledge had been built up over centuries, as a consequence of inhabiting a country of which about 50% is below sea level.

The demand for this type of knowledge was not so much from other countries with a high percentage of their land below sea level; there are not many such countries. The demand came mostly from countries with large areas under irrigation.

Irrigated agriculture cannot be sustained if the salts that are dissolved in the irrigation water are allowed to accumulate near the surface. These salts need to be leached from the rootzone and the drainage effluent removed from the area. In irrigated areas without adequate natural drainage, this calls for the installation of a drainage system. Also, irrigation and drainage activities need to be well coordinated. This is especially true in arid and semi-arid regions. Natural rainfall in those regions is insufficient for leaching out the salt. This means that irrigation water, which is often scarce in these regions, has to be used for this purpose.

In order to apply Dutch knowledge about land reclamation and drainage in the arid and semi-arid regions, ILRI staff had to become familiar with irrigated agriculture. This condition determined the type of organisation ILRI wants to be: a knowledge-creating organisation.

Knowledge creation depends on forever re-investigating knowledge on its correctness and utility. In this publication, we have been exploring the relevance of another type of knowledge that was built up in the Netherlands over centuries: the Dutch water board as a model for the institutional design of sustainable water management organisations.

Due to ILRI's focus on land and water development *outside* The Netherlands, we required the temporary services of Birgitta Dolfing, whose PhD dissertation based on a historical and institutional analysis of the Dutch water boards will appear later this year. She worked together with one of ILRI's irrigation & drainage engineers, Bart Snellen. By this type of working arrangement, ILRI aims at acquiring new knowledge and making it readily accessible for those of our readership who are not experts on Dutch water boards or on institutional issues.

In making the experience of the Dutch water boards available to the international community, we hope to contribute to sustainable water management organisations elsewhere.

Ir A.W.H. van Weelderen Director ILRI

CONTENTS

PREFACE

1	INTRO	DUCTION		1		
2	OSTROM'S DESIGN CHARACTERISTICS 2.1 Introduction					
	2.2 Ostrom's design characteristics; comparison between irrigation systems					
	and water boards; the experiences of the Dutch water boards					
	2.2	.1 Design characteristic 1	5			
	2.2	.2 Design characteristic 2	12			
	2.2	.3 Design characteristic 3	15			
	2.2	.4 Design characteristic 4	19			
	2.2	.5 Design characteristic 5	26			
	2.2	.6 Design characteristic 6	29			
	2.2	.7 Design characteristic 7	31			
	2.2	.8 Design characteristic 8	35			
3	SUSTAINABILITY OF DUTCH WATER BOARDS: DESIGN CHARACTERISTICS 3.1 Introduction			37 37		
	3.2	Design characteristics: supplementing Ostrom's list on the issue of sustainability		37		
	3.3	Conclusions: the relevance of design characteristics for sustainable self-governing water management organisations elsewhere		40		
REI	-	CES		45		

۷

Page

1

INTRODUCTION

Reasons for this paper: focus on decentralisation

For some years now, many countries have been going through a process of changing institutional structure of water management or have been facing up to this challenge. Until recently, the dominating mode of irrigation and drainage management in Asia, Africa and Eastern Europe was a centralised one. For centuries, however, there have been small-scale hydraulic systems with accompanying local and regional decentralised administration for water management. Gradually, these systems have been either replaced by large-scale ones or, when remaining in existence, have lost most of their former independence to governmental authorities.

Since about a decade it has become more and more clear that the centralised systems are not performing optimally. Problems with maintenance and operation, caused by an inadequate financial basis and the absence of user control are manifold. These problems created an incentive for policy makers to look for alternative solutions and the best one seems to be decentralised water management. Although the name is similar to the one in use for the traditional systems, the content of the present newly decentralised systems does not coincide with the previously existing ones.¹ The new decentralisation includes a variety of options ranging from transfer of responsibility for maintenance activities up to complete management transfer. What all the options have in common is a shift in financial responsibility. The driving force behind management transfer is not inadequate maintenance and operation, but the lack of financial resources of the national government agencies. The idea behind the transfer operation is that it removes the financial burden of system operation and maintenance from the shoulders of the central authorities.

Improved irrigation and drainage management by means of non-technical solutions is still a largely unknown territory. The demand and need for knowledge are great and a large volume of literature has appeared over the past years. In spite of the many publications, the main question of how to identify and show the way towards creating sustainable institutions for decentralised water management remains.²

The present paper is an attempt to address the knowledge gap on institutional aspects of water management, using the experience of the water boards in The Netherlands. The first water boards were established more than a thousand years ago and the institution still exists today. This experience will provide insight in the factors determining the sustainability of the water boards by examining it from an institutional analysis' point of view. Institutions are more than organisations and to be regarded as working rules that guide and direct human activities. Our institutional analysis of the water boards will focus accordingly on the institutions as rules-in-use to organise repetitive activities of a group of individuals that provide better outcomes than activities that are not coordinated by rules. Although in the long run every individual will be better off in case of co-operation for proper water management, it is not in everyone's immediate interest to do so: it is tempting to 'free ride' on other people's efforts. Benefits can be obtained

1

^{1.} Robert C Hunt, 'Appropriate Social Organization? Water User Associations in Bureaucratic Canal Irrigation Sytems' in Human Organization, vol.48, no.1, spring 1989, 79-90.

See also R. Meinzen-Dick, et al. 'Sustainable water user associations. Lessons from a literature review' in A. Subramanian, N.V. Jagannathan and R. Meinzen-Dick (eds.) User organizations for sustainable water services. World Bank Technical Paper. Washington, DC: World Bank 1996 and R. Meinzen-Dick, Policy trends in farmer participation, Paper presented at the Workshop on Istitutional Reform in Indian Irrigation, National Council of Applied Economic Research, New Delhi 1996.

without proper maintenance at least for a certain period. Rules-in-use are the means and end to avoid such 'free riding' behaviour. The institutional analysis can serve as an appropriate framework for defining the necessary elements of sustainable institutions for decentralised water management. The Dutch example serves to improve the institutional analysis and to provide guidelines and warnings for the present process of implementing decentralisation.

Before examining the development of the Dutch water boards in the next chapter, the method chosen will be shortly explained below. Next, the phenomenon of the Dutch water boards will be introduced to the reader to get familiar with the origins and general characteristics in order to better comprehend the detailed analysis in later chapters.

Adequacy of Elinor Ostrom's design principles

Institutional Analysis is a mainstream method in public administration science. Some 25 years ago, a group of public administration scientists started research activities on the problematic use and sustainability of *collective goods*: man-made and natural resources that are sufficiently large as to make it costly but not fully impossible to exclude potential beneficiaries from obtaining benefits from its use. The reason for this interest was a growing concern about the actual degeneration of many of those resources. Meanwhile, the scientific work of Elinor Ostrom and others has resulted in the development of an institutional framework of analysis, the so-called Institutional Analysis and Development Framework (IAD).³

IAD is mainly directed towards user and management problems with goods of a collective nature. Field studies draw mostly on small-scale irrigation schemes in Southeast Asia. The problems signalled and investigated are in fact similar to the ones that the centralised water management systems in many countries are facing. Recently, IAD has also been applied to Dutch water boards.⁴ IAD is a tool that provides insight in the coming about of rules, their adaptation, improvement and sustenance over time. As people want to enjoy maximum benefit and benefit from collective goods without necessarily contributing inputs for maintenance and operation, it is necessary to guide and direct people's behaviour through rules that ensure the sustainability of the collective goods for future generations. Furthermore, it is especially designed to avoid the blueprint type of thinking in designing institutions for collective goods management that characterised many of the centralised systems.

In order to come to the core business it is not necessary to fully explain and follow IAD. It is enough to know that the point in creating institutions to sustain collective goods is: how to make people commit themselves to the agreements and to maintain and adapt the rules over time and to changing circumstances. Ostrom has come to a set of eight design principles that characterised the long-enduring institutions for collective goods that she investigated. By designprinciple she means 'an essential element or condition that helps to account for the success of these institutions in sustaining the collective goods and gaining the compliance of generation after generation of appropriators [users] to the rules in use¹⁵.

See E. Ostrom, Governing the Commons. The evolution of institutions for collective action, Cambridge University Press, Cambridge 1990; E. Ostrom, Crafting Institutions for Self-Governing Irrigation Systems, ICS Press, San Francisco 1992; S.Y. Tang, Institutions and Collective Action: Self-Governance in Irrigation, ICS Press, San Francisco 1992; W. Blomquist, Dividing the Waters. Governing groundwater in southern-California, ICS Press, San Francisco 1992.

B. Dolfing, Geregeld waterbeheer. Een historisch-bestuurskundige analyse van de institutionele ontwikkeling van de hoogheemraadschappen van Delfland en Rijnland 1600-1800. PhD dissertation (in Dutch). Leiden University, The Netherlands 1999 (to be published).

^{5.} E. Ostrom, Governing the Commons [...], p. 90.

These design principles will serve as the backbone of this paper when analysing the institutional development of the Dutch water boards. In examining this institution, another dimension is added to the works of Ostrom and others. So far, mainly small-scale systems have been investigated. Dutch water boards originally were small-scale organisations as well and continued to be so until the Second World War. After 1945, due to rapid and complex environmental changes, they had to merge into larger entities that lost part of their former autonomy. This change in the nature of the organisation will have consequences for the explanatory power of Ostroms' design principles. Based on empirical investigation, adaptations and supplements are necessary to fully explain the sustainability of the Dutch water boards until the present day.

Dutch water boards

In order to make the area inhabitable, the people living in the country that is now called The Netherlands had to protect themselves and their livelihood against floodings from the sea and from the rivers; they also needed to drain the lowland area. These are ongoing and self-reinforcing processes. The main objectives of the water boards were clear: they had to offer safety and dry feet⁶. These objectives, however, are not unambiguous. Even if all people involved have a vested interest in safe and dry lands, this does not mean they agree on how to achieve these aims.

About a thousand years ago, people in the Netherlands began to build flood protection works to defend themselves against the sea. Almost simultaneously, drainage activities were undertaken as well. Originally, the local communities in the countryside, which were in charge of all collective interests, took care of water management as well. After the year 1100, the inhabitants began to set up special institutions to offer safety and dry feet: the water boards. This phenomenon began in the delta region close to the North Sea and gradually spread out through the rest of the country. The process of establishing water boards did not happen from one day to the next. It took some hundreds of years before everywhere water boards took care of local and regional water management.⁷

The earliest history of the water boards is characterised by a lack of sources that makes it impossible to state with certainty how and why several processes have taken place. What is clear is that originally groups of individuals having an interest in a hydraulic structure agreed to build and maintain it in return for the benefit enjoyed. These groups were usually represented by the local communities. Although in the beginning such hydraulic structures could function autonomously, this was no longer feasible when more infrastructure was built. This process was in fact due to the nature of the hydraulic structures themselves. Small dams sufficed in the beginning to protect a small area, but the protection and subsequent drainage of a larger area required co-operation of several communities. Subsequently, flood protection of areas upstream caused higher water levels in the downstream part of the river. At the same time, within the established water boards the process of building new and replacing existing hydraulic structures went on as well. Progress in technology (e.g. windmills, steam engines) made it possible to improve drainage installations and flood protection works.

The water boards' right to organise not only had to be recognised by external governmental bodies but they had to recognise each other's right on existence as well. Individual interests that

^{6.} Drainage engineers wouldn't necessarily agree that the main purpose of agricultural drainage is to keep dry feet. Drainage, however, depended largely on windmills. Under unfavourable wind conditions, it was not uncommon that water accumulated at the surface, leaving the fields inundated for prolonged periods. Under these circumstances, 'dry feet' make sense as a service indicator for agricultural drainage.

^{7.} For more detailed information on the history of flood protection and drainage see Man-made Lowlands. History of water management and land reclamation in the Netherlands, ed. G.P. van de Ven, Matrijs, Utrecht 1993.

were taken care of by an institution now had to be balanced against the interests of individuals from another institution wishing to benefit from the same hydraulic infrastructure. Unrestricted use of this common infrastructure threatened its sustainability. Taking into account these problems, the sustainability of the Dutch water boards becomes almost paradoxical and therefore the more intriguing to analyse.

Structure of this paper

This paper is built up as follows. Following this introduction, chapter 2 presents an analysis of the institutional development of the Dutch water boards along the lines of Ostrom's design characteristics. Chapter 3 begins with an investigation into the adequacy of Ostroms design characteristics for the water boards' situation. This leads to an adapted and supplemented list of design characteristics. Finally, the relevance of the resulting design characteristics for decentralised water management organisations will be discussed.

2 OSTROM'S DESIGN CHARACTERISTICS

2.1 Introduction

This chapter will analyse the institutional development of the Dutch water boards, on the basis of Ostrom's eight design principles. Instead of design *principles*, we will use the term design *characteristics*. This is to avoid confusion with the term *water board principles* that will also be used in this paper. Moreover, Ostrom's design principles, in our opinion, are not principles in the true sense of the word but rather characteristics.

Each of the eight design characteristics will be dealt with in the same manner and under three headings:

A. Explanation of the characteristic;

- **B.** Comparing water boards and irrigation systems; as Ostrom's research was based on self-governing irrigation systems, this part will draw attention to differences between irrigation systems and water boards that are relevant for the design characteristic that is being discussed;
- C. Water boards experiences.

Although this report addresses institutional aspects of the water boards, the examples used sometimes contain technical descriptions. For easier understanding of such descriptions, Figure 1 presents the lay-out and some of the hydraulic infrastructure that are typical for the reclaimed areas found in the lower parts of the Netherlands.

2.2 Ostrom's design characteristics; comparison between irrigation systems and water boards; the experiences of the Dutch water boards

2.2.1 Design characteristic 1 Both the boundaries of the service area and the individuals or households with rights to make use of the facilities of a resource system are clearly defined

A. Explanation of the characteristic

Organised collective action requires a clear definition of the service area and of those who are entitled to make use of it. This will ensure that those who contribute to the collective action will not see their benefits shared or even reduced by others that do no contribute. Furthermore, the ensured sustainability of the services will stimulate people to create and sustain collective action. SUSTAINABILITY OF DUTCH WATER BOARDS: APPROPRIATE DESIGN CHARACTERISTICS FOR SELF-GOVERNING WATER MANAGEMENT ORGANISATIONS



Figure 1 Layout and hydraulic infrastructure of a reclaimed area in the lower parts of The Netherlands.

B. Comparing water boards and irrigation systems

In irrigation systems there are options to exclude individuals from irrigation services. A water board provides flood protection and drainage. A dike surrounding an area provides flood protection to every individual who is living, working or owning property within that area. It is very difficult, if not impossible, to exclude individuals from the service of flood protection.

Similarly, it is difficult to exclude individual farmers within the area from the benefits of drainage. In Dutch polders, the water level in the outlet drains is often higher than the groundwater level. If

6

the groundwater in the polders is above sea level, this problem can be overcome by building sluices that drain during low tide. In all other cases, the drainage water has to be lifted out of the area, using windmills or pumps. Once an area is provided with a system of drainage canals, sluices, windmills or pumps, it is practically impossible to withhold the service of drainage from an individual within that area.

In general, water boards are more dependent on the functioning of other water boards than irrigation systems. This is especially true when two or more neighbouring water boards make use of the same outlet drain. The users belonging to a water board want to maximise their benefits of the facilities without taking into account the needs of users belonging to another water board. In case of a common outlet drain, excessive disposal of drainage water into the common outlet drain by one water board inevitably reduces the opportunities for evacuating surplus water by the second water board. Even more so, when their lands are located on the lower grounds. Continued disposal into the outlet drain increases the pressure on the dikes, which increases the risk of dike failure. Because of the limited storage and discharge capacity of the common outlets system, simultaneous drainage has to be limited. This requires rules that restrict or even stop drainage activities once a certain water level has been attained.

As a result of the impossibility of excluding individuals from the system, the practise of free riding in water boards is different from that in irrigation systems. *Free riding* is the practice of benefiting from other peoples' efforts without having contributed to these efforts. Irrigators that have decided not to contribute to the implementation and/or operation of the system may be excluded. Free riding in water boards is more difficult to control. Exclusion cannot be used as a threat to free riding. It is necessary to develop mechanisms that correct free riding behaviour while maintaining the offenders as members of the group. Regular and strict monitoring with the prospect of high penalties exceeding the benefit of rule-breaking behaviour is required to discourage misuse.

In case of neglect of dike maintenance, the farmer was urged to fulfil his duties. The underlying idea was that if he was expelled, his land would be left behind unprotected and his share in maintenance would remain undone. If this happened on a large scale, the remaining farmers received a higher burden, as the financing and handwork of the maintenance activities would be repartitioned among a smaller group. This scenario would produce more harmful effects than keeping the tardy tenant within the organisation and forcing him into performing his obligations.

Limiting use and providing maintenance

Ostrom pointed out that in addition to the definition of the boundaries of a service area and the individuals or households with rights to make use from the facilities, the limits of use have to be defined and connected to the amount of input delivered in return. The situation in which everyone can make unlimited use of the services poses a threat to the sustainability of collective action. Not only the number of beneficiaries but also the amount of use and/or lack of adequate construction and maintenance activities can lead to the destruction of the service. Rules restricting use to certain conditions that prevent over-use or abuse as well as rules providing construction and maintenance are necessary.

Rights and duties for use and maintenance

Use

In irrigation systems, it is often necessary to restrict water applications in times of water scarcity. Furthermore, based upon an individual's past or current contribution to the construction and maintenance of the irrigation system, it is possible to differentiate between users in terms of service provision. The individual's contribution to investments or maintenance can thus be

7

rewarded. Similarly, the insufficiency or lack of input can be punished. Depending on adequate infrastructure and management the timing, volume and flow size of irrigation applications to individual farmers may also be varied according to soil type, cropping pattern, and water availability.

Differentiation between users' needs within a water board based on past or current contribution to the O & M activities cannot be realised. Regardless of deficiencies in input, each individual is served with the same level of drainage service from a sluice or pumping installation or with the same level of flood protection service from a dike. It is possible to limit the amount of drainage for a collective group of users but not for an individual farmer. With dikes, it is only possible to restrict the amount of use for other purposes than the provision of safety. Permits for construction of houses on or adjacent to the dikes and cattle grazing on the dike were granted to individuals provided that this did not affect the safety provision function.

Maintenance

The main reason for maintenance is to compensate for the diminishment of the capacity for service provision of the infrastructure. Financial and other resources, like labour in kind, serve as input to keep up the net benefits of the system.

Irrigators as well as water board farmers periodically need to clean their ditches. They both have to pay for construction and maintenance of the systems. In the old days, water board farmers also used to work on the dike for repair activities. Gradually, labour in kind was replaced by a financial contribution to the water board for the officials doing the O & M job. In addition, the water board users have to pay for the drainage facilities as well. This is similar to paying irrigation fees.

C. Water boards experiences

Boundary setting

In the 10th and 11th century, people in the Netherlands began to build local dikes for flood protection. Farmers whose lands bordered directly on the proposed dikes agreed to commit themselves to the construction work and maintenance activities afterwards. As these activities concerned more than one individual, the decision was taken and recognised by the communal public authority. The community was the smallest and lowest level of public authority. The local community meeting that was composed of all farmers having a farm of a certain size within the community would sanction the agreement. This initial agreement contained a definition of the dike with regard to place, height and width, its physical boundaries and the boundaries of the area protected by the flood protection system and a list of the households that were obliged to deliver input. During the earliest years, contributions for maintenance were not based on the use of the dike for other purposes than safety, such as transport or cattle grazing. Even though the entire community enjoyed the same benefits of flood protection, initially only those farmers whose land bordered directly on the dike were obliged to maintain the dikes. Membership of the interest community on the other hand included every individual that enjoyed the protection of the dike.

Almost at the same time with the construction of dikes, drainage activities were developed as well. To make the lowland area inhabitable, it was necessary to get rid of excess water. Small dams and sluices were built and maintained, based on similar agreements between direct beneficiaries as for the flood protection systems. The agreement specified the hydraulic structure concerned, the boundaries of the area affected by it and the names of the people that were obliged to give input for maintenance activities. The noticeable difference with regard to input for dike maintenance was the fact that from the beginning all beneficiaries had to pay for the benefits received.

Originally, the local communities in the rural areas were in charge of all general collective interests and took responsibility for water management as well. Around 1100, however, a new development set in when water management tasks gradually began to be separated from the general public tasks. The reason is likely the increase in frequency and severity of floods and also the increased interdependence and complexity of the hydraulic works that began to stretch out beyond the local scale. Since the end of the 11th and the beginning of the 12th century the first public bodies for local and regional water management appeared on the scene and the phenomenon of the water board was born. Their establishment was recognised by the higher, regional public authorities who still considered themselves responsible for adequate water management but resigned from the administrative duties.

The definition of the boundaries of the first water boards was still based on those of the political entities but the changes in the physical situation due to drainage and reclamation activities led to a new criterion for boundary setting. The principle of 'boundaries are tied to benefit from object' was born. Henceforth, the official documents recognising the establishment of a water board defined its boundaries on the basis of the area affected and/or protected by the hydraulic structures. The 'benefit boundaries' defined interest communities. These were no longer limited to beneficiaries living on or along the dikes but depended on any interest and thus implicitly any flood protection benefit. A water board system comprised several and different hydraulic structures, which effects stretched out beyond more than one political community.

9

Box 1 Threat to effective use because of in-congruency between the legal definition of a drainage and flood protection system and its physical borders

A major constraint in defining clear boundaries is the in-congruency between the legal definition of a drainage and flood protection system and its physical boundaries. The following case demonstrates that to achieve congruency a change in peoples' incentives has to take place. This change in turn depends on a change in the value attached to the illegal activity. If the benefit from illegal pumping water into drainage canals is heavily and regularly punished, the costs of the punishment will outweigh the rule-breaking benefit and bring about a change in rule ordered behaviour.

In case of a common outlet between two neighbouring water boards there was usually one that always benefited at the expense of the other one. The principal water boards of Delfland and Schieland in the western part of the country provide a notorious example. Since the end of the 16th century with the invention of windmill technique, Schieland millers were able to drain substantially more water to the outlet than before. Especially in springtime, this created great problems for Delfland millers as the outlet was a common facility and they were living on the lower grounds west of the Schieland territory. As long as Schieland millers could mill unlimitedly, the water table had already reached a dangerously high level before Delfland millers had had the opportunity of draining. The number of complaints rose in proportion to the force of the disadvantageous easterly wind blowing in springtime.

Delfland administrators were unable to remove the constraints for their inhabitants, because they had no legal powers to force the Schieland millers into limiting their milling activities. The Schieland administrators failed to take action, in spite of the fact that the Schieland millers not only created problems for Delfland, but for Schieland as well. The largest town in the territory of Schieland was situated in the lower area and its inhabitants were frequently confronted with inundated cellars. Apart from that, the polder dikes suffered severely from the rising volume of the water and collapses or near-collapses were a common feature.

Looking from these perspectives Delfland was not the only interested party in the conflict. As long as external authorities remained inactive, no matter how much their activity was needed, a situation of non-decision making continued. There were no institutional arrangements that could smooth out boundary conflicts between water boards. It would take centuries before the provincial authorities declared to be stakeholder as well and provided the necessary support to the Delfland governors. Until then, a resolution depended on an individual's willingness and courage.

Source: Principal water board of Delfland, Old Archive Delfland (OAD), minutes from the college of chairman and assistants, numerous inventory numbers 17th and 18th century.

Rules for use and input in general

The original agreement defining the issue of boundary setting also specified what, how, when and where use was allowed for the object concerned. The conditions for maintenance were specified as well. These comprised the amount of labour in kind, the quantity and quality of the materials to deliver and/or the money to pay at what time and which place. Such agreements were continuously drawn up for every newly constructed object in a water board. In addition, conditions for the use of objects belonging to a community, entering another system, were reconsidered to harmonise with those of the facilities already in use in the existing water board.

Rules for use in particular

Rules for use were based on the water boards' guiding principle that 'collective interest has priority over individual interest'. If every interested inhabitant would be allowed to use full capacity of windmills for pumping or to use the dikes for other purposes without limits, the institution of the water boards would have been short-lived. The water board officials were able to turn short-term benefits into long-term ones. Members accepted the resulting rules limiting individual use as it reduced the risk of harmful future events. Apart from saving private lives, the prevention of floodings from dike collapses implied more benefits in terms of higher yields from harvests and lower costs for maintenance and construction activities.

For drainage management the instrument of draining through pumping 'on the water level' was invented (Box 2). Once the water in a drainage canal had reached a fixed level, pumping was not allowed. In practice this meant that all user groups within a water board were subject to the same water level. This fixed level is higher in summer than in winter.

For dike management, rules for the use of dikes specified which animals in which months were permitted to pasture along the slopes of the dikes. Also, rules defining use of the dikes for the construction of buildings were developed. In drawing up these rules, items such as the planting distance of trees or the time of the year to allow traffic were considered against the safety purpose that had precedence over all other purposes.

Box 2 Rules ordering pumping 'on the water level'

Towards the end of the 16th century windmill technology had reached a level that made it possible to regulate windmill activities for pumping the water out of the lowland polders, through small ditches and drainage canals into the main outlets. The increase in pumping capacity was however not matched by an increase in drainage or storage capacity. Dependence on the direction of the wind remained an additional uncertainty factor. Pumping through windmills was henceforth tied to many regulations involving time, place and weather conditions. The restrictions were not set up all at once. It was not possible to foresee each possible offence. It depended on particular circumstances whether people would be tempted to fully use the pumping capacity of the mills thereby overusing the storage capacity of the drainage system. At first, in the beginning of the 17th century, water board laws were promulgated in which a chain of windmills was outlined and the order by which each of them had to follow the water level. In case the water level reached the critical point at the indicative windmill, all pumping activities had to be stopped until the water level dropped again. The warning was visible by the position of the vanes of the indicative mill. In addition, the wind millers were obliged to place a mark inside one of the walls of the mill indicating the water level so that they did not depend solely on the vane position of the indicative mill. Pumping at night was strictly prohibited, as it was very difficult to check whether or not the water level would be exceeded. In case of emergency situations, it was not unusual to stop pumping because of the growing pressure on the polder dikes that might collapse. This measure is still in operation today.

Source: Principal Water Board of Delfland, Old Archive of Delfland, minutes from the college of chairman and assistants, several inventory numbers 17th and 18th century.

12 SUSTAINABILITY OF DUTCH WATER BOARDS: APPROPRIATE DESIGN CHARACTERISTICS FOR SELF-GOVERNING WATER MANAGEMENT ORGANISATIONS

Rules for input in particular

For dikes and drainage management, the water boards distinguished two types of input:

- Regular input for the daily operation and maintenance
- . Emergency input for preventing collapses or repair activities afterwards. Emergency activities were labours in kind along the dikes.

Regular input also consisted of two categories:

- . Labour in kind and materials
- . Financial contributions.

Labour in kind for regular maintenance comprised dredging ditches, strengthening dike sections and delivering materials for new constructions or for regular repair activities. In addition to this type of input the farmers had to make financial contributions. There was an annual taxation for regular operation and maintenance activities on dikes and drainage structures. Dike management was covered in two ways. Most local dikes were still in communal possession. Maintenance was initially divided over the individual farmers who maintained their share of the dike. Towards the end of the medieval ages, the communities handed over the larger boundary dikes to the water board. Henceforth, these dikes were a collective responsibility like mills and sluices. Each farmer paid a fee to the water board whose officials did the O & M job. Sluices, windmills and pumping installations were too large objects to be constructed or maintained on an individual basis, so each farmer paid a fee in addition to the one for the larger dikes.

Further considerations

It was stated earlier that to regulate people's activities, agreements have to be made about who may use and maintain which amount of the goods and services provided by the water board and under which conditions. The rules for using and maintaining flood protection and drainage facilities contain specified conditions as to how, when and where use and maintenance is to take place. Such agreements will provide co-ordination between the various activities of the users at present and have to ensure future ones as well. What is more, the implementation of specific conditions will enlarge people's willingness to contribute to the water board agreements. Therefore, rules for use and maintenance have to be characterised by the following design characteristic.

2.2.2 Design characteristic 2 Proportional equivalence between benefits and costs

A. Explanation of the characteristic

An individual's share of use of the collective facilities must be proportional to the share of inputs provided by that individual. Furthermore, rules for establishing this proportional equivalence must reflect the locally perceived values of benefit and cost items.

B. Comparing irrigation systems and water boards

In irrigation systems that are constructed and maintained by the users themselves the water rights of an irrigator may be based on the inputs provided. In the water board, each farmer basically receives the same level of service. It is not possible to vary the amount of flood protection or drainage service provided to an individual farmer. Benefits and costs were therefore taken to be directly proportional to the area of land owned.

C. Water boards experiences

In the old days, the total costs were first divided over the number of communities in the water board. Next, the communities divided their share over the individual farmers according to the size of their land. Those who possessed more land were required to pay more for drainage and flood protection. The wishes and needs of the users were taken into account when the members of the board made the annual estimates for maintenance or repair as well as the ability of the users to meet obligations.

The governors to a certain extent showed flexibility when taking into consideration local circumstances. In case of extremely bad weather conditions or dike collapses that caused bad harvests the farmers were granted exemption from their annual taxes. The same happened with cattle farmers when their livestock was affected by cattle plague. For many centuries this was in fact the only example of differential treatment of members within a water board.

Every land measure the same amount of taxation

The amount of taxation every farmer had to pay was based upon the water board's principle 'every land measure the same amount of taxation'. The execution required an entire measurement and registration system of all the land within a water board. First the land area of all individual farms in a community had to be known. Next, each year the total costs for operation, maintenance and construction for the coming year had to be estimated. The share of contribution of each community was based upon its total area of land. The community sum was then divided in shares over all the farms.

The very principle of every piece of land the same amount of taxation did not imply equality for all farmers. This was due to the fact that the land measure was not the same as the taxation measure. The share in costs was the outcome of the land that all farmers within a community possessed. This total land acreage did not take into account the number of farms within a community. This approach achieved proportional equivalence between benefits and costs within one and the same community. Between communities, the amount paid per unit of land for the services of its water board could vary considerably.

Congruency between input rules and local conditions necessitate regular updating of the information on land ownership. Apart from changes in ownership, the size of the total area could change over time due to reclamation activities that turned water into land or peat digging which turned land into water. Re-measurement of land was supposed to provide the mechanism for maintaining congruency. Farmers had the right to request re-measuring. However, in case of substantial decrease in the land-water ratio, the water board governors were reluctant to remeasure, as this would decrease the regular income of the water board, which was based on total land size.

Developments in differentiation

It proved to be difficult in practice to relate payment to benefits. Efforts have been undertaken to calculate the value of each benefit. In the old days, an effort towards differentiation in user needs was made. Deep drainage was necessary for people and farmland on the lower grounds whereas a shallow level was sufficient on the higher grounds. However, this distinction could not be put into practice for technical reasons and hence a differentiation in taxation did not come about. Recently, with the introduction of more and different groups of interest, the need to differentiate in contributions for input was required. Both developments are discussed in more detail below.

Differentiation in physical conditions

Some lands were situated lower due to natural conditions and some lands had sunk as a result of soil subsidence caused by drainage. When reclamation developments set in, the old lands were in a less advantageous position compared to the new lands that had not yet been subject to subsidence and could benefit from advanced windmill technique for pumping activities. It was common for farmers from the lower grounds to complain about the level of pumping being not sufficiently deep. The lowland farmers became more persistent in their demand for deep pumping as their productivity decreased. The resulting decline in income would threaten their ability to pay the water board taxation. Farmers located on the lower grounds in general were a minority group within a water board. As rules for use were based on the guiding principle 'collective interest has priority over individual interest' this minority group was often overruled.

Differentiation in beneficiaries, tasks and financial contribution

The exact valuation of benefits was a problem of the old days, which continues until today. As long as the group of beneficiaries was composed of farmers this problem could be dealt with by treating them as a homogeneous group. Toward the end of the 19th century this began to change as a result of growing urbanisation and citizens were considered as another group of beneficiaries. After the Second World War there were further changes related to a diversification in the tasks of the water boards. As a consequence of the extension of tasks, the financial contribution was diversified as well, Both developments will be discussed below.

For centuries the members of the water boards were composed of farmers. The growing urbanisation opened the door to the recognition of other inhabitants as an interest group. The water board governors in the coastal areas in the urbanising western part of the country raised this point as a result of rapidly growing costs for flood protection. Since the beginning of the 20th century two categories of beneficiaries were officially recognised. The category of built upon representing the interests of people owning real property in the sense of house(s) was introduced as a complement to the traditional category of unbuilt representing real property as land possession.

The growing concern for water pollution put the item of wastewater treatment and purification of surface waters on the political agenda in the 1950's and 60's. The question which public body should take charge of water quality management gave rise to a grave discussion in which the water boards received the benefit of the doubt. These doubts were raised as the rising costs for flood protection and drainage management had severely undermined the water board's effectiveness and financial autonomy. They had tried to combat these effects by consolidating small water boards into larger entities to create a better financial basis. The new task of water guality management created an opportunity to continue this process. A third interest group was introduced: companies and households.

In the seventies, a growing interest and concern for environmental matters affecting the condition of water resources implied a gradual broadening of the concept of water management. So far the objective of water management had been the provision of flood protection and drainage; these were regarded, as services required for making the territory inhabitable. Now it came to comprise the service of making the territory liveable and sustainable. The concept of water management was defined as 'the public responsibility directed toward the water present on and in the soil, in view of the interests involved'.

The new concept resulted in a distinction in tasks: general, specific and related tasks. The general tasks are the traditional water management tasks and the specific tasks are a subcategory of tasks that are required for the benefit of a special group of members, for instance the greenhouse horticulturists. The related tasks are those for which a water board is not established but which it nonetheless has to take into account when performing the main tasks. They express the concept of the above-defined integral water management, as the water boards have to consider the interests of nature conservation, fishing, recreation and spatial planning.

The definition implies that every inhabitant of the Netherlands has an interest in the performance of tasks by the water boards and not only the people living, working and owning property in the rural areas or the polluters of the wastewater and the surface water. This meant that the last category of the Dutch population entered the water board system as benefiting from its performance as well. They represent the fourth category, of *citizens*.

The new tasks and concept had to be financed. The traditional water board tasks are still financed through the taxes on the inhabitants. In the case of landowners and users (tenants of land) the rate is based on the amount of land i.e. those with more land pay more. This also applies to property owners; those with a more expensive house pay more. The contribution for water quality management is based on the principle 'the polluter pays'. Households pay an annual contribution that is based on the size of the household. Single households pay for 1, households composed of 1+n persons pay for 3. Companies and organisations pay according to the volume and composition of their wastewater.

Table 1The different categories having interest(s) in the water board tasks since the
coming into force of the Law on the Water Boards, January 1, 1995

Category versus task	Dikes Management	Water Quantity	Water Quality	Roads	Waterways
Built-upon	*	*	-	*	-
Unbuilt	*	*	-	*	-
Agric. Tenants	-	*	•	*	-
Citizens	*	*	*	*	-
Companies	•	*	*	• •	. •

2.2.3 Design characteristic 3 Most individuals affected by the rules on boundaries, use and input can participate in modifying these rules

A. Explanation of the design characteristic

The majority of the users should be able to participate in the decision-making process to adapt the rules with regard to boundaries, use and input. This allows self-governing organisations to gradually develop rules that are well adapted to the local conditions by making use of the collective experience of the individual users who directly interact with one another and with the physical world. If they can provide knowledge on the patterns of use and the possibilities for maintenance and construction, then acceptable rules can be designed that will increase the level of compliance. Users can thus adapt rules to fit the conditions of their setting and help produce effective rules for boundaries, allocation and use.

Ostrom has pointed out that the realisation of this design characteristic requires the setting up of a regular system of information and communication.⁸ Farmers, who engage in a collective effort, draw up an initial agreement. They, as well as the next generations, should have the possibility to launch objections and ideas for improvement to the governors on existing rules or on new

^{8.} Ostrom, E. Crafting Institutions for Self-Governing Irrigation Systems, Institute for Contemporary Studies Press, San Francisco, Calif., U.S.A., 1992.

rules as proposed by the governors. In turn, the governors have to inform the farmers about propositions on new rules and to regularly update information about existing rules. As a followup, they then have to receive and elaborate the farmers' information before proposed changes or new rules can get into operation.

A system of mutual information and communication depends on a transparent system of procedures in which the rights and duties of both users and governors with regard to information and communication are well defined and observed. This calls into being rules defining what information will be provided, by who and how.

Information and communication rules are not isolated phenomena but are linked to accountability or legitimacy. It is very important that both users and governors can trust the other party to do what is expected of them: to act according to the rules that are drawn up to sustain the system that provides services. In order to check the governors' behaviour the users need direct or indirect access to the decision making fore. In this way information and communication rules serve the purpose of accountability.

B. Comparing water boards and irrigation systems

In irrigation systems that were built by farmers themselves, the majority of the farmers will participate in the modification process. They designed the initial agreement and later generations of users have the possibility to modify the original rules and propose new ones according to changed circumstances. The information and communication process will facilitate the commitment of the local farmers. At the same time, information and communication provide legitimacy and accountability of the governors representing the users.

In public irrigation systems, the majority of the farmers are usually not involved in the modification process. External authorities established these schemes and often there is even no initial agreement. As a result, there is a lack of commitment, which is upheld by absence of information, and communication channels that allow the farmers to send objections or proposals for improvement to the external governing agency. By consequence, large-scale irrigation is often not characterised by legitimacy or accountability from the governing body to the users but rather from the governing body to the external authorities.⁹ In the water boards, we find both an inward and outward type of accountability.

C. Water boards experiences

In the medieval ages, when water management was still a task of the local community meeting, the farmers participated in the general modification of rules. Starting around 1100, when separate water boards originated it was logical to expect that this tradition would be continued and this indeed happened. User-members were still represented on the board and as such they designed the rules that affected them and other user-members. The others, when not being board members, were able to make themselves heard in order to be able to modify the rules.

The local meeting and later the meeting of the chairman and assistants of the water board was more than a forum for information and communication. The governors were chosen out of and by the local population. In those days society considered it a matter of course that such governors were accountable to the population.

^{9.} Compare Merrey's 'outward accountability' versus 'inward accountability'. Merrey, D.J., *Institutional Design Principles for Accountability in Large Irrigation Systems*, Research Report 8, IIMI, Sri Lanka, 1996.

The nomination procedure was a form of *inward* accountability. Moreover, it was an expression of equality and fairness that not only users had obligations to fulfil but governors just the same.

Until today, the users are represented on the board. Although the governors in the old days had the duty to inform the users on all issues concerning water management, this did not mean that they had to present and justify all the arguments in favour or against certain options and the reasons for selecting one. Matters of nomination of board members, appointment of civil servants and their instructions as well as the decision-making procedures in board meetings were equally regarded to be none of the users business. The recent Law on the Water Boards, dating from 1995, has put an end to this lack of openness, following the way other public bodies like municipalities perform. The only field of policy the governors were always obliged to give public account of was the spending of the financial contributions. They needed the users' approval of the budget and this duty never disappeared.

Information and communication

The water boards have a long tradition of a two-way traffic system of information and communication. Top-down, the governors have to inform the users about every planned policy measure in every field: taxation, use, maintenance and construction. They used four methods for informing the users. The first was the 'church order': For three weeks in a row, rules for use and input or for the collection of fees were announced after the religious service. The second was the announcement at market places where people would usually gather once a week. The third method was to place placards on the trees along the dike roads. This was only effective if people could read. The fourth method was to announce matters at the local water boards or polders meeting.

By the end of the 18th century when the reformed church was no more the dominant religion in the country, the announcements through church order went out of practice. With other business of farmers and other members entering the water board, the market place announcements were no more fully effective either. With the appearance of newspapers and local magazines informing people about activities from municipalities, the water boards found other ways to reach their inhabitants. The measure to inform the farmers through the polder meeting is still in practice today. People also receive water board mailings at regular intervals.

Bottom-up, farmers could launch objections against new water board laws or against proposed adaptations and against monitors or water board officials who had apparently misbehaved. They could not object to the imposed fees. In case of disagreement with the laws, verbal protest had to be delivered at the secretary's office of the water board. The governors were obliged to consider these protests during the next board meeting. The outcome had to be presented to the individual(s) concerned. If the problem could not be settled, the protester could take the matter to a court of law.

Today every user still has the right to lodge objections. Water board laws announced in the newspapers are subject to a six weeks term for possible reactions. The objections are prepared by the civil servants of the water board but the board meeting still has the last word. In case of persistent disagreement, the users have the possibility to begin a legal procedure in court.

Legitimacy/Accountability

Originally, functionaries belonging to the general administrative bodies, like the communities in the countryside, performed financial functions for the water board as well. They were chosen out of and by the local population. It was their duty to collect the fees and to monitor the maintenance activities as they also did the contracting out. They checked the annual budgets of the water board governors and reported back to the local meeting.

Accountability for financial matters was first strengthened in the 16th century when after a series of severe floodings the boards raised the taxes. The increased burden did not reassure the inhabitants as the floodings continued to cause material damage. The inhabitants accused the governors of incompetence and turned to external authorities. These established and recognised colleges of principal landowners representing the users with a further mandate than to check the annual budget. They had to approve of newly planned large construction activities as well and approve of reclamation activities. This institution was to offer a better guarantee for accountability.

For centuries the water boards preserved the division of the board in a governing body for financial affairs and the traditional governing body of chairman and assistants that was in charge of all other policy issues. A further division in general and daily administration was first made in the second half of the 19th century. The meeting of chairman and assistants turned into the daily board and the general board was the extended meeting when consultations took place together with the principal landowners. With the coming into force of the Law on the Water Boards in 1995 every water board has a general council, an executive body and a chairman. The general council is made up of an amalgamation of the two former separate colleges. They choose the members of the executive board out of their ranks. The Crown (queen/king and Dutch cabinet) appoints the chairman as being the only administrator with a full-time job. Financial matters are now the concern and responsibility of every board member of the general council.

The triplet benefit-pay-say

The foregoing three design characteristics were expressed through the water board triplet benefit-pay-say:

- The boundaries of a service area were determined by the *benefits or gains* of the hydraulic structure(s);
- The contribution to maintenance or *pay* was specified and in proportion to these benefits;
- The users had say in drawing up and modification of the rules for use and maintenance.

The design characteristics were translated for the water boards situation into a number of rules that expressed the underlying basic principle of *benefit-pay-say*. Whoever had an interest in the benefits of a water board had to pay a share of the costs for use and maintenance and received a share in say in return for this effort. In this way, the water board inextricably linked interest and payment to voice in matters and to accountability of the governors to the users. The water board situation emphasised the implicit links between the design characteristics: the first and second design characteristic lead inevitably to the third one.

The realisation of share-in-say is not a matter of course that flows naturally from the first and second design characteristic. Legitimacy or accountability is heavily dependent on the presence of a norm of legitimacy and accountability in society in general. If the governmental bodies do not recognise or practise these kind of principles it is extremely difficult to realise them within a single body of public administration like an irrigation or drainage system.

Ideally, the triplet resembles a triangle with three equal sides. The amount of benefit is in line with the payment and the amount of payment is again in line with the voice in matters. As in the case of proportional equivalence between benefits and costs here a critical note has to be placed as well. The relationships are ideal ones. In practice deviations occur as a result of power

games that even the most ingenious accounting methods for connecting benefit to payment cannot prevent. People are inclined to maintain the status quo of their share in say and even more so when their share in benefit or pay for some reason declines and would therefore also reduce their share in say. The following examples will clarify this.

Benefit and pay are assumed to be proportionally equivalent. This assumption holds only as long as physical circumstances (like improved drainage or peat digging resulting in lakes) and economic circumstances (growth in trade or decline of agricultural prices) do not change. If they do change, the valuation of benefits for certain users has to be adjusted. However, a new division of payment would affect the share in say; this could harm vested interests and benefit new interests. Farmers having had a share in say for may generations and losing income will be unwilling to give up their share in favour of other interests like those of cities. As the farmers are in possession of the seats in the board they can prolong the status quo although their financial contribution decreases.

The Dutch political system in the 17th and 18th century was characterised by an in-congruency between the federal governors, being the governors from the old days (share in say), and the 'newly rich': people who had made money as a result of the growth in trading and commerce but who had no access to the public offices. This created dissatisfaction as the 'newly rich' provided the biggest part of the taxes but were nevertheless excluded from the public seats. A similar tendency could be observed in the water boards where the cities' interests were hardly heard.

2.2.4 Design characteristic 4 Monitors who actively audit physical conditions and users behaviour are accountable to users and/or are the users themselves

A. Explanation of the characteristic

In self-governing systems, agreements concerning the provision, operation and maintenance of goods and services are made in mutual consultation between users. These agreements need to ensure that monitors will sanction free riding behaviour of users running counter to the agreements. In self-governing organisations the monitors are accountable to the users or are the users themselves. Monitoring has to take place for specified objects at regular intervals. The objects and the dates as well as the activities considered to be subject to penalties are known in advance to limit free riding behaviour of users as they can anticipate monitoring and adjust their behaviour. The penalty for repeated free riding must be known in advance, to serve as an additional threat. The standards for the performance of monitoring will prevent arbitrariness on the part of the monitors.

B. Comparing water boards and irrigation systems

The service provided by an irrigation system - irrigation water delivered to the farm - is more easily visible than the services of a water board:

- Flood protection only becomes visible when the service is **not** delivered;
- Agricultural drainage is essentially the control of the groundwater table, which is also not visible.

In addition, it is very difficult to withhold the service of flood protection and drainage from an individual user within the system. Monitoring to control free riding in an irrigation system, therefore, will focus on prevention or restriction of **use** by suspected free riders. In water boards, the emphasis will be on monitoring **contributions to maintenance**, because restriction of use is hardly an option.

C. Water boards experiences

Monitoring at regular intervals

Monitoring was done by means of the 'survey on the spot'. As a rule the survey took place three times a year. The first survey was at the end of wintertime, usually end of March or beginning of April. This survey was to determine the necessary maintenance and repair activities for the users or those who did the contracting out after the winter season. The second survey took place in June or July and was a first opportunity to see whether the users had undertaken some action. If not, they would receive a warning. The third and last survey was fixed for the end of October before the winter season. The exact days and hours were announced at the fixed places for communication.

Water board monitors

The very first official monitors of the water board were chosen by and out of the local population. They were the assistants of the chairman of the water board. Together they performed the survey on the spot at regular intervals. In addition to the water board officials, functionaries from the local communities came to perform monitoring tasks as well. This position originated in the 12th century when the hydraulic works that the water boards had to administer grew rapidly in number and complexity. The duty of collecting fees for drainage structures - that were subject to collective instead of individual maintenance – was given to one community member in particular, the local sheriff. Next to his responsibility for the water boards flow of income he did the contracting out of construction and maintenance works as sanctioned before by the local meeting. As a result of these activities he represented the local community during the surveys of the assistants.

Water board laws versus permits

The basic documents of the water boards for monitoring activities were called *water board laws*. Originally, the water board laws related to one or a few hydraulic structures within the service area of a water board. Later, additional documents had to drawn up for newly constructed hydraulic structures and documents were revised for existing structures in response to changing circumstances.

Almost from the very beginning, water boards had the right to design water board laws. This indicates that the general public authorities recognised them to be the competent actors in the field of local and regional water management with the exclusion of other public bodies like cities or provinces. This special type of laws or regulations has grown into a body that comprises all specific regulations with regard to water board law. More precisely: a water board law connects a sanction to a certain action or non-action. Initially, the laws related to one special case or object but of late, since the 19th century, they developed into general binding rules. The laws contained the definitions on use and maintenance of the hydraulic structures that have been discussed before. In addition the conditions for monitoring were specified, like the intervals of monitoring, the persons who had to monitor, the required and forbidden activities with additional conditions and the penalties for rule breaking.

Users had the possibility to request individual exemption from the collective rule. People could obtain permits for peat digging, for cattle grazing during the spring season or for lifting of taxes after a poor harvest. The history of the water boards reveals the inextricable bound between laws and permits. Permits were issued for the construction and repair of small constructions on the slope of a dike like a barn or a fence on the dike separating parcels of land. In times of threat of a dike collapse people needed unhampered access to the dike for strengthening activities. For that reason, the keys for the fence locks had to be common property before such a construction

would be permitted. Similarly, the construction and maintenance of small dams separating ditches between plots of a farmer required a permit.

The system of granting permits was developed and refined over the years. Permits had to be asked for verbally at the board. After consideration a decision was taken that was final. In case of a positive decision, the user had to pick up his permit at the secretary's office of the water board upon payment of a registration fee. The simultaneous registration in the water boards records served as a legitimate basis for monitoring the conditions specified in the permits during the surveys. At the same time surveys were meant to check whether or not constructions were built or repaired without permit.

Objects and activities subject to monitoring

Every hydraulic structure from the smallest ditch to the largest dike was subject to monitoring. The water board laws laid down the specific conditions for use and maintenance. In case of flood protection like dunes and dikes the quantity and quality of strengthening materials was prescribed beforehand and inspected afterwards. Constructions like barns and fences or planting and growth of vegetation were inspected. For drainage structures, the conditions specified in the contracts for repair activities were carefully examined, for instance with regard to costs and materials. The dredging of ditches was examined as prescribed with regard to depth and width or to see if the slurry was deposited at the place allocated for that purpose and not left behind on the banks. Individual constructions were monitored according to the conditions specified in the permits.

Further considerations

Information, communication and accountability regarding monitoring

Like observed before, the majority of the users affected by the rules for boundaries, use and input can participate in modifying these rules. As these rules are part of the water board laws, the users have the right to put forward suggestions for improved surveying. For example, in large systems it was common practice not to survey each and every individual ditch but to survey every fourth ditch. Depending on changes in drainage conditions, the users might suggest to extend the survey to every third ditch.

The users who did not agree to the punishment for a certain act or non-act could send in a complaint to the local meeting that was authorised to deal with complaints about the monitor's performance. The board meeting would then hear both sides before deciding who was right. The users could also criticise the nomination of a monitor as for instance not representing the majority of the users or not being chosen on a legitimate basis as agreed to beforehand. In these ways monitors were accountable to the users.

Too many exemptions from the rule reduce effectiveness

As shown in the following examples, users were inclined to ask exemption from the rule, whenever this would increase their benefits or reduce their obligations.

In an attempt to increase their benefits, Delfland millers continuously asked to be permitted to exceed the agreed water level in pumping whenever Schielands millers had fully used their pumping capacities thereby limiting those of Delfland. Delflands chairman and assistants understood the needs of the farmers but at the same time realised that by giving in they would seriously reduce the effectiveness of the policy instrument of pumping to the water level when nobody felt committed to sustain it.

In The Netherlands farmers were often tempted to continue peat-digging activities, which provided a source of additional income. Until approximately 1530 only the part of the peat layer

above the ground water level was dug out. When in the 16th century the high moor peat was getting exhausted more radical methods were put into practice. Especially in the fenlands of the western part of the country this practice became widespread. The entire peat layer, reaching out several meters below the ground water level was dredged away with a peat-brace (Figure 2). In the case of the traditional peat soil method at least some more or less stable subsoil was left behind but the new method created uneconomic ponds and lakes (Figure 3).



Figure 2 'The peat-digger'. Copper etching made in 1694 by Johannes or Caspar Luyken. The peat-brace was a hand instrument that enabled deep cutting of peat. After compaction and drying, the peat was cut into slices and sold as fuel. Photograph made available by Hoogheemraadschap Rijnland.



Figure 3 Lake produced as a result of uncontrolled peat-digging. The narrow strips of land were used for depositing and compacting the peat before it was cut and sold as fuel. Photograph made available by Hoogheemraadschap Rijnland.

When allowed on a large scale and an extended period of time, this negative side effect was much more harmful and dangerous to the living conditions of the inhabitants than the additional source of income in the short run. Many land surfaces were turned into water bodies that could only be reclaimed with great difficulty and expenditure. This was realised many decades and sometimes even centuries later. Until then the hydraulic consequences were far-reaching and alarming. Unprotected land was washed away turning ponds into lakes. Strong winds on these large water surfaces produced large waves, which threatened the dikes.¹⁰

^{10.} Sources: Principal water boards of Delfland and Rijnland, Old Archive of Delfland and Rijnland, several volumes of the minutes of the meeting of chairman and assistants from the 17th and 18th century. Additional sources: W.J. Diepeveen, De vervening in Delfland en Schieland tot het einde der zestiende eeuw, (Ph.D. Leiden), Eduard IJbo, Leiden 1950 and P van Schaik, 'De economische betekenis van de turfwinning' in Economisch en Sociaal Historisch Jaarboek, jaargang 32, 1969, 144-205; jaargang 33, 1970, 186-235

Box 3 An example of unlimited peat digging in the principal water board of Rijnland

The principal water board of Rijnland provides an example of unlimited peat digging. Already in the late middle ages, regional authorities recognised the danger of this activity and insisted on moderation. In the 16th century the federal authorities issued decrees in which peat digging was permitted if carefully observed by the water boards. They refrained from outright forbidding but charged other public bodies with the implementation of its policy. Rijnland soon experienced great trouble in following the decrees. Its governors granted permits without exception. The next generations had to pay the bill for this policy. Mid-17th century, spatial restrictions were set, based on existing and future danger especially in the areas directly bordering on the lakes. As the local inhabitants of this area were living on poorer soils, they asked to be exempted from the rule. Unfortunately, the governors gave in to the pleas. Here, governors who were supposed to act like monitors did not perform their duty. Within a few decades the governors had to admit that the preventive measures had failed. They proclaimed retroactive measures to facilitate reclamation of the smaller and greater lakes that had resulted from the peat digging. The users had to pay an annual contribution in return for the permit. The collection of the fees had to be checked and here again problems

Source: Principal Water Board or Rijnland, Old Archive Rijnland, several volumes of the Minutes of the Meeting of Chairman and Assistants, 17th and 18th century.

appeared. Not only were the local sheriffs unwilling to give insight into the accounts, the

governors also failed to act rigorously after unlawful behaviour had been detected.

Frequency and objects of monitoring

Monitoring cannot prevent every rule-breaking activity. Like legislation is generally a reaction to developments taking place in society, the rules respond only to what has taken place and not toward different activities that may possibly occur. Hence, only the daily practice will reveal if legislative measures are fool proof. The body of water board rules increased and improved over the centuries in response to changes in people's practices.

These changes came about as a result of socio-economic progress and/or decline like rise or fall of prices of agricultural products and improved or deteriorated physical conditions after reclamation or peat digging. The progress in 16th and 17th century windmill technology made it possible to substantially increase drainage capacity. It was difficult to withstand the temptation to make full use of the opportunity although the activities of one community might hamper other communities in undertaking the same activity at the same time. Such kind of activities had to be discouraged by rules that would keep people from pursuing individual benefit that harmed the collective benefit.

Designing and issuing rules was the governors' responsibility but in order to design adequate rules they depended on and benefited from the local inhabitants' experiences to an important degree. Adaptations and improvements of rules was a process of mutual consultation. The *effectiveness* of this mode of operation was enlarged as not only the governors tried to set up rules to prevent users from misbehaviour but the users themselves also did much to achieve this aim.

Users might put forward ideas with regard to the objects under survey or to the frequency of monitoring. For example, in Delfland the users put forward the suggestion to intensify the duckweed survey, in view of maintaining discharge capacity of the drains. The increase in pumping activities coincided with another development in society, that of growing trading and commercial activities of the cities. Both developments in drainage as well as in infrastructure

emphasised the importance of deep and clean waterways. Dredging activities were a prerequisite to achieve this. Initially, a system was developed in which only one out of five or ten (or any other convenient number) ditches and drainage canals was surveyed. (With the exception of the common outlet that was considered to be too important and subject to survey anyway.) In response to requests from the users for adaptation, the governors extended the number of ditches and drainage canals subject to monitoring.

Apart from increasing the number of surveyed objects the frequency increased over the years as well. Most noticeably since the 17th century - in addition to the three-times-a-year general survey for each and every object - surveys directed to special objects came into being. The survey of windmills to prevent excess pumping is a first example. Another example is the survey of dike roads that was probably the result of increased use for transportation purposes. This undermined the dikes condition more rapidly than if used for safety purposes only. Special surveys for dikes and dunes followed in the 18th century. The dunes survey was likely a result of deteriorating conditions of the coastal area. The condition of the river dikes in the western part of the country became precarious after streamlining of the river course in the upstream part. This led to accelerated drainage and increased water levels in the downstream western part of the country.

Effectiveness and efficiency of monitoring

The increases in the number of objects and in the frequency of monitoring resulted in more monitoring work. The chairman and assistants could not perform more than three surveys per year in addition to the administrative tasks, so they had to find alternative solutions.

Initially, the board made use of officials from the local community administration. The competence for the surveys of the local objects was delegated to the local judge and aldermen (bailiff and assistants) who can be considered as mayor and council of the local countryside villages. They were held responsible for the condition of the hydraulic works in their territory and the chairman and assistants of the water board performed an after-survey. Soon afterwards the larger water boards that disposed of a small technical staff, usually a land surveyor and a few assistants found an additional source of monitors. The water board officials were sent on duty with a special commission of the board members. This type of monitoring was not standard or regular: the technical staff was mostly active in times of danger or after a collapse to find out the causes.

The technical staff acting as monitors were members of the water boards organisation and received a salary that could be supplemented with income from fines that were imposed on users after rule-breaking activities. The officials from the local public authorities were not members of the water board organisation and their regular salary came from the first organisation. Consequently, it was difficult for the water board governors to stimulate and to supervise this type of monitors.

The water board governors held out the perspective of one third of the fines to the monitors. The local officials however did not depend on the water boards fines as a main source of income. The efforts of monitoring they were willing to undertake depended on the attractiveness of the reward. Judging from the frequency and intensity of the supervisions undertaken by the water boards governors and their almost proportional amount of complaints about deficiencies in monitoring, the *effectiveness* of this type of monitoring was not high.

Local monitoring was also characterised by a low degree of *efficiency*. Efficiency depends on the instruments or costs for monitoring that had to be offset by the income or benefits. Ostrom's implicit theoretical assumption that monitors who are accountable to the users will provide a

deterrence from rule breaking as well as an advantageous monitoring system in terms of costs and benefits is not supported by the water boards' past experiences. The local monitors were chosen out of and by the local population. They felt more akin to the inhabitants' individual needs and wishes than to the collective objectives of the water board. Although the users were competent to lodge objections about the monitors and the monitoring job, their remarks had no bearing on the intrinsic aspects of the fulfilment of tasks. Thus the mechanism of accountability bottom-up did not prevent insufficient monitoring. Prevention had to come from accountability top-down. This mechanism was much more costly; it was a correction afterwards and demanded more input of man-hours.

The efficiency and effectiveness of monitoring could be questioned as the net costs only marginally exceeded the net benefits. For better efficiency, the costs first would have to be compensated by higher revenues from fines (more activities were subject to fines and the size of the fines steadily rose). As a proof of greater effectiveness, the revenues should decline as a result of fewer rule-breaking activities by the users. In reality, the revenues did not rise and year after year the same rule-breaking activities continued. This also proves the inadequacy of the sixth characteristic that refers to the size of the fines. Monitoring and graduated sanctions are interconnected as the effectiveness of fines depends on effective monitoring.

2.2.5 Design characteristic 5 Users who violate the rules receive graduated sanctions, depending on the seriousness and context of the offence, from other users, from officials accountable to the users or from both.

A. Explanation of the characteristic

Users undertaking rule-breaking activities are subject to graduated sanctions. The height of the sanctions depends on the seriousness of the rule-breaking activity in question and on the number of times the offender has been sanctioned for the same activity before. The sanctions have to be part of the by-laws that are drawn up for the hydraulic structures and also specify the conditions for use, maintenance and monitoring.

B. Comparing water boards and irrigation systems

In irrigation systems users can monitor each other's behaviour, especially in case of water rotation systems. In case of neglect of maintenance activities or of taking too much water, the offender may be excluded from receiving irrigation water for a certain period of time depending on the situation and the frequency of the offence.

The users in the water boards are subject to monitoring from other users but historical evidence showed that it was more common practice that communities monitored other communities instead of individuals monitoring individuals. Next, officials from the local communities act as monitors as well as water board officials and governors. Rules for imposing sanctions were carefully laid down in the water board laws. Financial sanctions could be considered as relatively low for the first time of rule breaking. There were however some important exceptions. Gradually even the lower fines were steadily increased in order to be more effective.

C. Water boards experiences

In the old days, for each hydraulic structure within a water board territory the activities subject to monitoring and sanctioning were part of the relevant water board law. In general, a three-stepway of sanctioning was implemented on rule breaking. A first-time offence would usually only lead to a warning or a very small fine that could be considered to be more or less symbolic. A second offence would result in actual fining or a doubling of the first fine. A third time meant a doubling or a tripling of the fine. In case of refusal of payment of taxes, confiscation of estate property could take place.

Moreover, in the old days, when neglect was discovered on the third general survey, the chairman and his assistants performed the 'digestion survey'. This meant that they remained eating and drinking in the nearest inn until the tardy tenant had fulfilled his obligations. All the food and drink they consumed were charged to the account of the offender.

The prospected fines further differed according to the nature of the hydraulic structure: condition and strength and to the position: local circumstances like the vicinity of peat lakes or boundary dikes. In such cases rule-breaking activities created relatively more dangerous situations than in the middle of a polder. To make the users aware of this distinction, the sanctions were adapted to the situation. Neglect of the conditions for maintenance of local dikes was subject to lower sanctions than neglect of maintenance of boundary dikes. Similarly, insufficient dredging of a small ditch was a less costly omission than insufficient dredging of the common outlet. Overpumping in times of bad weather or at night was much more serious than at daylight.

In addition to activities that were subject to graduated sanctioning there were other rule-breaking activities that were sanctioned right away with a large fine. Peat digging without permits or not according to the terms of the permit was subject to the highest fine. Most fines would be in the same order as the annual taxation and vary from ten or twenty to fifty cents; unlicensed peat digging, however, would cost twenty guilders! (1 guilder = 100 cents). Tearing off placards announcing surveys or water board laws from the trees and showing a lack of respect for the water board authority also resulted in a twenty-guilders fine.

Apart from activities against the rules (water board laws), activities against the peace (stealing, quarrels and public violence), against hydraulic constructions (deliberately cutting a dike to diminish the floodings of one's own lands) or against the water board governors or officials (scolding or molestation) were subject to heavier punishments. The water board governors of the principal water boards even possessed the highest legal competence, which gave them the right to impose the highest sanctions including the death penalty. Less final but most severely as well were the corporal punishments like whipping or 'brandmerken': to put a scar of fire on a part of the human body of the offender thereby literally stigmatising the person in question (Figure 4). Although this hardly ever happened, the possibility was visualised by the symbols of the juridical power: the whipping post and the pillory on the town square in front of the water board office. Present day offences and sanctions are presented in box 4. The overview shows how things have changed: offenders are no longer digging peat but are polluting the surface waters, jail sentences have replaced corporal punishment and the maximum fine is fourthousand times as much.

28 SUSTAINABILITY OF DUTCH WATER BOARDS: APPROPRIATE DESIGN CHARACTERISTICS FOR SELF-GOVERNING WATER MANAGEMENT ORGANISATIONS



Figure 4 Iron with the mark of the water board, used for branding ('brandmerken') severe offenders of water board rules. Photograph made available by Hoogheemraadschap Leiden.

Further considerations

In general, sanctions were low but not effective. Over the centuries a rise in the amount of sanctions can be observed. More then once, governors stated that the fines were not high enough to prevent people from breaking the rules. The theoretical assumption by Ostrom that self-governing organisations can impose surprisingly low fines and yet be effective does not hold for the water boards. The low effectiveness of sanctions is likely a result of the small chance of being caught on the spot. There is a large time span between committing the (non-) act and being found out during the survey or otherwise. The chances of being caught on the spot were supposed to increase by a higher frequency of monitoring from the local administrators but it did not work out that way. The recognition of the problem prompted the water boards in some instances to punish the neglect of the monitors as well. In case of pumping above level the Delfland governors in the 18th century decided not only to punish the miller but also the local administrator who was in charge of monitoring the miller. The effect was expected to be even greater as the administrator had to pay the fine out of his own pocket.

Box 4 Relation between seriousness of the offence and the sanction in today's water quality management of the water boards

In the 1970's, the growing concern for water pollution as a result of urbanisation and industrialisation resulted in an extension of tasks for the water boards. In addition to flood protection and drainage management they were charged with water quality management of surface water bodies. This was a result of the Law on the Pollution of Surface Waters. The cost recovery system of the implementation of this task was 'the polluter pays'. Both households and companies from then on had to pay a levy based upon the amount and/or quality of waste products or polluting materials brought in or onto the surface water. Polluting materials were categorised and some categories could be released if a permit had been obtained in advance from the water quality administrator. The water boards were thus obliged to set up an entire registration and monitoring system.

This led to an increase in tasks and staff. The technical service had to handle the granting of permits and the administrative service had to monitor the activities from the companies. Criminal investigators and superintendents were appointed to perform the second type of tasks. A standardisation of steps was developed to check a company. This may be compared with the traditional survey system for flood protection and drainage that existed for centuries. The sanctioning of rule breaking had to be adequate in order to prevent ongoing pollution. The awareness of the need for raising fines led to the following reinforcement of fines on breaking the Law on the Pollution of Surface Waters (LPSW).

- 1970-1975 Law-breaking activity LPSW = Peace Court (lowest court) Maximum fine = fl.1,500 and 1 year jail sentence
- 1975 Law-breaking LPSW considered to be breaking the Law on Economic Offences. This allowed a considerable extension of the criminal instruments since deliberate law breaking was now a crime
- 1975-1994 Law-breaking = Court of Justice Maximum fine = fl.10,000 and 2 years jail sentence
- 1994 Reconsideration of seriousness of offences and punishments
- 1994- today Maximum fine = fl.100,000 and 6 years jail sentence with the advantage of preventive custody and maximum fine for each day of prolonged crime.

Source: A.P. van der Berge et al. Bestrijding van de watervervuiling: 25 jaar WVO. Unie van Waterschappen. Den Haag 1995.

2.2.6 Design characteristic 6 Users and their officials have rapid access to low cost local arenas to resolve conflict between users or between users and officials

A. Explanation of the characteristic

Rules are susceptible to many interpretations and if people are to follow rules over a long period of time, a mechanism for resolving differences in the interpretation of rules between users or between users and their officials is necessary. Individuals who interpret the rules as a passport to free riding behaviour will induce other people to adopt a similar strategy. Apart from ill will, people can also make non-deliberate mistakes. In both cases there has to be a mechanism for establishing what is rule breaking and what is not. This is necessary to make the rules being perceived as fair and to ensure future rule conformance.

As rules have to ensure effective operations of resource use and maintenance it is important that in case of conflict the parties involved have rapid access to nearby - which is mostly local arenas for conflict-resolution. Rapid access is needed as ongoing rule infraction deteriorates the resource system. Access is facilitated by low entry costs. A conflict-resolution mechanism may be built on the same system of information and communication that allows most users to participate in the modification of the rules or to voice objections about monitors. This enables the governors to deal with the matter of rule interpretation in the same arena as the one for designing and modifying rules.

B. Comparing water boards and irrigation systems

In self-governing irrigation systems, the majority of the users as well as their officials have access to a low-cost local arena for conflict resolution. In public irrigation systems, the majority of the farmers at tertiary level usually have no access to the conflict resolution arenas as these are not present at the local level nor are these low-cost arenas if present. Very often, external authorities designed and established these schemes without consultation of the users beforehand and afterwards they continued the process of closing off the way for communication and conflict-resolution in mutual co-operation.¹¹

In the traditional water boards every user had access to a local and low-cost arena to resolve conflict. In the smaller water boards and polders they had direct access to the local meeting that also dealt with the modification of the rules. In the case of the larger regional or principal water boards the users had *in*direct access to the meeting of the board. This means that a group of individuals represented by one or more local governors could present written or verbal comments to the board meeting on the interpretation of the water board laws by other users or the water board officials. The water board had the obligation to consider the case during the next board meeting after having read or heard the information of both parties.

C. Water boards experiences

The mechanism for conflict-resolution had the same stepwise approach that was used for communication and information as well as for monitoring and sanctioning. The users first had to address the administration of the water board to which they belonged. They had to give a verbal explanation of the conflict. The board would invite the accused party to provide a verbal defence as well. Sometimes the board considered it necessary to invite either party to appear in the meeting or to send out the technical staff to verify matters. If the verdict was unsatisfactory to one of the parties, the second option was to consult a water board that was higher in the hierarchy as to keep matters indoors. If the outcome was still unacceptable the way to the courts of justice was open. It could happen however that the users bypassed the higher water board court and brought matters outdoors in an earlier stage.

Further considerations

Limits to conflict-resolution

Unsatisfactory outcomes for one of the parties were common. Unlike today it was not clearly defined how often complaints on the same case could be brought before the board or the court. In addition, the board had the duty to *consider* the case during the next meeting but this did not

^{11.} Compare situation with collective choice arrangements, discussed under Design characteristic 3.

mean they were obliged to *decide* upon it in that same meeting. This meant that procedures could drag on for months if not for several years.

A different aspect to conflict-resolution was its being limited to conflicts between users and between users and officials. The possibility of conflicts and the need for resolution between officials and governors within a water board or between two or more water boards was not foreseen. Ostrom did not take this into consideration either. This is probably due to the fact that her experience was mainly based on small-scale irrigation systems. The interdependency of such systems is less than that of water boards so that there is less chance for conflicts between irrigation systems.

2.2.7 Design characteristic 7 *Recognition of rights to organise*

A. Explanation of the characteristic

Self-governing cannot take place in isolation. People in most societies are faced with governing bodies that exert administrative competencies and may not be willing to allow certain groups to take up the responsibility to manage natural resources themselves. Therefore, a prerequisite for any self-governing organisation is that external governmental authorities do not challenge the rights of users to devise their own organisations and rules.

The practical recognition of the organisational charter and subsequent by-laws has to follow from support in court in case of conflict between users and their officials and from the right to raise taxes to mobilise the financial resources for supporting the organisation.

B. Comparing water boards and irrigation systems

Many water-users' groups (for irrigation as well as for drainage) today, both existing and planned ones, are not recognised by national governments as legitimate forms of organisation. Consequently, the acts and decisions of their officials are not supported in court and financial management/autonomy can but with difficulty be achieved or cannot be achieved at all. Without official recognition of the right to organise, it is quite difficult to hold either user-groups officials or members accountable for their actions.

In case of isolated locations where irrigation or drainage is used primarily for agriculture private organisations will suffice. The situation changes when other possibilities for the use of water resources come into play. Other administrative organisations whether at local, regional or federal level will defend interests like water supply and sanitation or industrial purposes. Their presence will increase the level of conflict over the use of water and then public recognition of the user groups is needed.

C. Water boards experiences

Water boards, as they were separated from local public organisations, had to be officially recognised, as otherwise the separation would not have taken place. Later established water boards were in due order recognised as well by the regional authority that was exercised by the sovereign lords in the medieval ages. In order to obtain the approval of the external authorities they were obliged to send in their organisational charter. The later by-laws did not need approval. In the 17th and 18th century - during the time of the confederate state of the Netherlands - the position of the sovereign lords was taken over by the provinces. In the 19th century, when the Netherlands state system developed from a confederate state into a unitary state, the legal role and position of the water boards and the external public authorities were

mutually arranged. The provinces retained the supervising role, which was even extended. In addition, the federal state had supreme control. This last development was reinforced in the 20th century when the concern for water management implied a growing relationship with other fields of policy that had to be devised at national level. The water boards lost part of their autonomy in policy making but kept the responsibility for local and regional water management.

The establishing and strengthening of political and administrative organisations in the medieval ages did not – to our knowledge - lead to many discussions before court. This situation changed during the 16th and early 17th century. Water board users in the western part of the country found easy access to the general juridical authorities to seek justice. Although this might seemingly be considered a conflict-resolution problem, it turned out to be a problem of recognition of the water board's authority. The troublesome aspect was that the courts in general decided in favour of the users without proper knowledge of the situation as they did not ask the water board governors to inform them about the competencies and rights of the water board and the validity of water board laws. Water board governors grew increasingly irritated by this development as it was a rather costly matter to each time defend their rights and duties in the field of water board law. Also, they ran the risk of not being recognised. In a final attempt to resolve matters water board governors sent a verbal protest to the courts demanding them to refrain from verdicts without having consulted the water board governors. The courts must have recognised this plea as legal because during the second half of the 17th century the amount of law suits considerably reduced and no more complaints were voiced by the governors.

The situation remained unaltered until 1795 when the Dutch unitary state system was established. This led to reorganisation of the general and legal administration and subsequently of the water management organisations. A Department for Public Works was established, with a national office and 10 provincial offices. The ministry carried the overall responsibility for all water management activities at all levels. They exerted supreme control over the water boards, which the provinces had to supervise. In addition, an attempt was made to set up an all-encompassing law on water management. This exercise failed, probably due to the complexity of matters, and the water boards organisation was left untouched.

Around 1850, there was another attempt at national water management legislation. This time the legal arrangement of the provinces and the municipalities called for a re-determination of the competencies of the water boards as opposed to those of the other administrative bodies in the civil service system. The competencies of the provinces were defined and extended. Toward the end of the century the idea of an all-encompassing law on water management was dropped and following the English example, national politicians decided to issue laws for different aspects. This resulted in three main laws but still no water board law.

A change in the Dutch constitution of 1983, which for the first time ever explicitly mentioned water boards as public bodies in addition to provinces and municipalities (which had been legally re-arranged for in 1848), finally necessitated the legal arrangement of the water board in the legal system. The law reconfirmed the water boards' role and position and prescribed some main characteristics and general administrative elements that made it possible to achieve more uniformity in the water boards. The uniformity refers to the competencies, administrative and financial arrangements, election of the board, procedures for board meetings and external relationships. The variety in organisational apparatus like polders and regional water boards, in different accounting methods for relating payments to benefits, in representation of interest groups that each water board could determine more or less on itself (if approved by the province) was no more possible. The law set the standards within which the provinces approved the charter of each water board within its boundaries. The confusing variety in tasks among water boards was settled after a nation-wide discussion about the notion of water management. The new definition included the care for water quality as well as taking into account other related interests to water management such as nature conservation and spatial planning. As a result, the water boards changed into all-in water organisations. They now have to take care of flood protection (from the sea and from the rivers), water quantity and water quality.

Box 5 Financial autonomy/solvability, congruency with developments in society and the right on existence of the water boards in the 20th century

In 1953 the western part of the country suffered from one of the most severe floodings ever. 1,835 people were killed and more than 180 kilometres of dikes were damaged: both numbers were without precedence in Dutch history. This called for an equally unparalleled counteroffensive in terms of hydraulic structures that were designed to achieve the desired goal of 'this never again'. Apart from technological solutions, institutional issues were addressed as well in answer to the question how the effects of the floodings could be prevented or at least mitigated.

It then appeared that already before the Second World War the water boards in the coastal region were unable to realise the sufficient strengthening of the dikes due to a lack of financial means. Most water boards in those days were very small (total area of the Netherlands = 34,000km² and about 3,000 water boards of which only a few were very large). The ineffectiveness of the traditional means of flood protection necessitated more investments in new technology. The provinces that were responsible for supervising the water boards proved unable to guide the water boards towards better performance. Moreover, the growing population called for food production increase and one of the means was land consolidation to enlarge the size of the farms. This development posed higher demands, technological as well as financial, on the drainage facilities that the water boards had to take care of. The water boards decided to merge into larger entities to create more financial support. This development, however, did not take place wholeheartedly and it was not until after the flooding had revealed the disastrous effects of neglected maintenance activities that the process of concentration was accelerated.

Meanwhile a discussion started in parliament about three basic issues that were interconnected:

- The effectiveness of the water boards;
 - The supervision as exercised by the provinces and;
- The allocation of financial means.

Effectively, this meant that the right of existence of the water boards was being questioned. Parliamentary committees and the commission on Legislation of Water Management could not find adequate answers how to adapt the water board order. The problems were complicated by additional developments in society:

- Increased democratisation affected the nature of procedures for decision-making in public bodies;
- Urbanisation created more and larger cities that were much more powerful than the rural oriented water boards;
- Industrialisation rapidly increased the problem of water pollution, which prompted public bodies to decide about the allocation of the responsibility for purification and water quality management.

A heavy governmental committee took into account all aspects. Finally, in 1974 it decided that the water boards were (still) the most adequate organisations for local and regional water management. Meanwhile, a number of recommendations had to be followed:

- The organisation had to be based on the boundaries of water management;
- Quantity and quality management had to be connected. Water quality management was a new opportunity for obtaining financial resources;
- Flood protection and water quantity management had to be in one hand as much as possible;
- All interested parties had to be involved;
- This involvement had to observe the triangle benefit-pay-say (this meant in case of water quality management that the polluters both had to pay and be represented on the board);

34

The interests of nature conservation, environment, spatial planning, recreation etc. had to be taken into account in the performance of tasks much more than before. This was a consequence of a newly developed notion of water management. To an increasing extent people in society felt that in taking measures for ensuring safety (flood protection) and dry feet (drainage), the interests of related policy fields had to be taken into account as well. It has to be acknowledged that this consideration was made at a moment when the 1953 storm surge had more or less faded from the nation's collective memory.

The foregoing shows that the right of existence of an institution with an ongoing history of almost a thousand years is not automatically granted if other governmental or public bodies are dissatisfied with its performance. The overriding issue in the discussion was the financial solvability causing inadequate maintenance and operation. Financial autonomy proved to be necessary to defend organisational autonomy and prevent a turnover by other authorities.

Source: B. Dolfing. Troubled water boards: The Aftermath of the 1953 flooding in the Netherlands. Paper for Special Workshop on the History of Irrigation, Drainage and Flood Control, ICID Congress, Granada 1999.

2.2.8 Design characteristic 8 'Nested enterprises'

A. Explanation of the characteristic

All foregoing activities for use, maintenance, monitoring, enforcement, conflict resolution and governance/management can take place at different levels of organisation. Depending on the structure and composition of a natural resource system the mentioned activities can be organised by user groups of different size. Some activities can be organised by a few individuals and for other issues it is necessary to organise multiple groups of individuals. All levels of organisation are interconnected so the activities can be considered to take place in 'nested enterprises'.

Nesting of enterprises can be advantageous to users in tying activities to the proper scale of organisation. Small-scale work teams are effective mechanisms to overcome free riding practices since the larger the team the less someone's absence will be noticed and felt. Close monitoring is more effective, basically for the same reason. On the other hand large-scale work teams can take advantage of relevant economies of scale.

B. Comparing water boards and irrigation systems

In irrigation systems, the base-level irrigation group is composed of farmers who share a tertiary outlet or watercourse. In larger systems, the base-level groups who receive water from the same secondary canal may form a federation and become a Water Users' Association at secondary level. In principle, these secondary level WUA's can be aggregated into a WUA at the main system level that assumes responsibility for overall system management. The nesting of enterprises in irrigation systems, therefore, follows the flow of the irrigation water within the system.

Water board activities in general were organised in two ways. All through the Netherlands small and larger water boards with a variety of tasks existed. In the western part of the country the small, local water boards (polders) from the 15th century onwards lost their organisational autonomy and became subordinate to the principal water boards. Here nesting of enterprises *between* water boards could be perceived as the activities of the smaller being dependent on decisions from the board of the larger entity. In other parts of the country this development did not take place and small and larger water board organisations functioned as independent bodies.

Within a water board, nesting of enterprises was much more difficult to achieve. On-farm activities like dredging the ditches were an individual matter. Beyond that, other activities could not be structured in a hierarchical order. The inhabitants paid for maintenance activities of dikes as well as drainage installations but the technical staff carried out the several tasks in case of a larger water board. A collective group of farmers did the work themselves in case of a small water board. However, these activities were not divided along the lines of the several distinctions within a drainage system like collector, main drain and outlet drain nor along those of a dikes defence system like polder dike and boundary dike (and sea defence).

C. Water boards experiences

Water boards originated for the larger part in the medieval ages. The process of establishing water boards took place in roughly three to four centuries. Only the higher territories mainly in the Southeast were left out until much later. It can be said that the entire territory of The Netherlands in terms of water management was a 'nested enterprise'. Within its area of service and span of control, a water board performed its functions of regulating use and maintenance of the hydraulic structures, monitored and enforced compliance with the rules, resolved conflicts and managed the organisation.

Further considerations

Ostrom regards nesting of enterprises as an *intra-organisational* affair. This means that all activities necessary for managing self-governing organisations take place in layers *within* the organisation. This suffices for a relatively small-scale irrigation system or as long as the organisation functions independently from other developments affecting water management. With greater interdependence, nesting of enterprises of activities becomes an *inter-organisational* affair. The activities of the self-governing organisation have to be organised in other external enterprises, like general jurisdictions, bodies of general administration or fields of policy related to water management. This is the situation the water boards are facing since the Second World War.

3

SUSTAINABILITY OF DUTCH WATER BOARDS: DESIGN CHARACTERISTICS

3.1 Introduction

After the examination of the institutional development of the Dutch water boards, the main question of this paper can now be addressed. Are the design characteristics as developed by Elinor Ostrom adequate to achieve *sustainable* self-governing organisations like she assumes they will? In order to answer the question, Ostrom's list will be scrutinised on the issue of sustainability. This leads to a number of supplementary design characteristics. The last part deals with the relevance of the adapted list of design characteristics for self-governing water management organisations elsewhere.

3.2 Design characteristics: supplementing Ostrom's list on the issue of sustainability

Design characteristic 1 Both the boundaries of the service area and the individuals or households with rights to make use of the facilities of a resource system are clearly defined.

Defining boundaries is essential for sustainability of the system; if anyone can make use of the facilities provided by the system, there is little incentive for individuals to provide inputs for maintaining it. Also, if boundaries are not defined, what should be maintained?

Design characteristic 2 Proportional equivalence between benefits and costs: An individual's share of use of the collective facilities must be proportional to the share of inputs provided by that individual. Rules for establishing this proportional equivalence must reflect the locally perceived value of benefit and cost items.

Supplementary design characteristic 3

A financial formula that is accepted as equitable and will lead to financial viability of the organisation

Design characteristic 2 deals with day-to-day activities. The supplementary characteristic deals with the longer-term viability of the organisation.

The example of the principal water board of Rijnland showed that the governors' desire to meet particular user demands created harmful effects for the collective entity of users. Through their inability of creating sufficient income for meeting the rising costs of flood protection and drainage, they severely undermined the living conditions of their inhabitants.

Also in recent times, financial viability was a major worry for many of the smaller water boards. The growing demands of society required an increase of financial means that could only be obtained by merging water boards into larger entities. Like Meinzen and others concluded in a World Bank Paper, water user associations cannot operate at a deficit.¹² Financial viability is critical for the sustainability of the self-governing organisation. This means that the *total* costs of the organisation have to be born by the users. If these are too high in comparison to the benefits obtained from them, the organisation is not likely to sustain.

Design characteristic 4 Most individuals affected by the rules on boundaries, use and input can participate in modifying these rules

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Supplementary design characteristic 5 Decisions and rules with regard to use and maintenance are consistent and coherent

It is not sufficient that users can participate in decisions resulting in rules for their activities. The decision-making process has to fulfil higher criteria as well, like consistency and coherence.

The problems with pumping and milling to level in the principal water boards of Delfland and the problems with the control of peat-digging illustrate the need of consistent and coherent decisions and rules. If rules are repealed or not fully implemented the users practices of free riding are not discouraged. Furthermore, if policy measures in one field, for instance flood protection, are contradicted by those in another field, for instance peat digging, the collective resource base is threatened.

Design characteristic 6 Monitors are accountable to the users and/or are the users themselves

Design characteristic 7 Users who violate the rules receive graduated sanctions

The above design characteristics on monitoring, enforcement and sanctioning do not need any specific addition. They are a necessary complement to the designing of rules as rules are neither self-generating nor self-enforcing. The development of the monitoring, enforcement and sanctioning mechanisms in the water boards have shown to be of elementary importance to commit generations of users to the organisations and in gaining their compliance to the rules. Regular monitoring - implying a great chance to be caught -, effective sanctioning - meaning that the height of the sanction outweighed the advance of rule-breaking - and the competence to enforce the sanctions contributed most to diminishing the effects of free riding behaviour of users.

Design characteristic 8 Users and their officials have rapid access to low cost local arenas to resolve conflict between users or between users and officials

Supplementary Design characteristic 9

Decisions and rules guiding and directing rules on use and maintenance have to be present, consistent, coherent and transparent

Experiences of the past have made it clear that decision-making procedures that drag on for years are harmful to a proper management of the resource-base. This may occur when users have conflicts about use or maintenance activities. In such cases it is not apparent which behaviour of the users is reprehensible and which is not. It may also happen that governors are reproached by external agencies and this may threaten their competence of self-governance.

Sustainable water user associations: lessons from a literature review, Ruth Meinzen-Dick et al. In: A.Subramanian, N.V. Jagannathan and R.Meinzen-Dick (eds.). User organizations for sustainable water services. World Bank Technical Paper. Washington, D.C. 1996

In case of internal conflicts, position rules have to demarcate the boundaries between the specific responsibilities of the governors. Also, the amount of control or influence that an individual ruler or group of rulers can exercise over other individuals or groups has to be within certain limits. In case of absence or unclear definitions, debates will result, involving power games in which case proportional equivalence between benefit-pay-say may easily get lost.

Position rules are required in case of external conflicts as well. Beyond these rules, agenda rules are needed to specify the agenda of each of the organisations involved in water management. For proper and reliable inter-relationships, mutual expectations have to be based on legal arrangements that specify the issues or concerns which each of the organisations is allowed or obliged to deal with.

Design characteristic 10 'Nested enterprises'

The 'nested enterprise', consisting of a federation of sub-organisations, offers better opportunities to take advantage of economies of scale and therefore enhances the sustainability of the organisation.

Design characteristic 11 Recognition of rights to organise

Supplementary Design characteristic 12

In addition to recognition of rights to organise, external (governmental) authorities provide support of management activities and conflict resolution between self-governing organisations that manage natural resources

The presence and mutual interdependence of other self-governing organisations that manage similar resources determine the importance of this supplementary design characteristic. In case of isolated functioning of the organisations, there is little or no need to arrange relationships with other organisations. The presence of similar organisations and the growing interdependence and complexity of the external relationships are not sufficiently structured by boundary setting of the respective rights and duties. Just as it proved to be necessary to arrange for conflict-resolution mechanisms to settle conflicts between users or between users and officials *within* an organisation, it is necessary to create mechanisms for settling conflicts *between* organisations. Conflicts rise because individuals interpret rules in their own way according to their interests and if this happens on an organisational scale, the negative repercussions for other individuals are proportionally larger. The importance of external support implying more than the recognition of the rights to organise is thus more than justified.

The above text is summarised in table 2.

Table 2: Design characteristics and their supplements

Ostrom's design characteristics (regular font) and supplementary design characteristics (Italics)

Design characteristics:	Content:
Design characteristic 1	Clear definition of the service area and the individuals or households with users' rights
Design characteristic 2	Proportional equivalence between benefits and costs
Design characteristic 3	A financial formula that is accepted as equitable and will lead to financial viability of the organisation
Design characteristic 4	The majority of the users can participate in modifying the rules for use and maintenance
Design characteristic 5	Decisions and rules with regard to use and maintenance are consistent and coherent
Design characteristic 6	Monitors are accountable to the users and/or are the users themselves
Design characteristic 7	Users who violate the rules receive graduated sanctions
Design characteristic 8	Users and their officials have rapid access to low cost local arenas to resolve conflict between users or between users and officials
Design characteristic 9	Decisions and rules guiding and directing rules on use and maintenance have to be present, consistent, coherent and transparent
Design characteristic 10	'Nested enterprises'
Design characteristic 11	Recognition of rights to organise
Design characteristic 12	In addition to recognition of rights to organise external (governmental) authorities provide support of management activities and conflict resolution between self-governing organisations that manage natural resources

3.3

Conclusions: the relevance of design characteristics for sustainable self-governing water management organisations elsewhere

Reasons for adaptations and supplements

The investigation of the experiences of the Dutch water boards has led to adaptation and supplementation of the list of Ostrom's list of design characteristics. The adaptations are partly due to the differences in physical circumstances between irrigation systems on which she mainly based her conclusions and the Dutch water boards that take care of drainage and flood protection. The supplements mainly refer to the arrangements for *external* arrangements whereas the original design characteristics basically deal with *internal* organisational aspects. This partly originates from the same physical differences between water boards and irrigation systems. Whereas irrigation systems could often function independently, the early water boards already faced a situation of mutual dependence when draining the water onto a common outlet or when maintaining an ongoing flood protection structure. Where several - let alone many - and different self-governing organisations managing the same natural and man-made resources

man-made resources within a country and even within a province or region, it is definitely necessary to exceed the level of the internal organisation and pay attention to the external relations between these organisations as well. In such a situation, it is insufficient that the external, higher authorities recognise the right to organise of the self-governing organisations. There has to be more elaborate support of management activities and for resolution of conflicts between water management organisations.

Relevance for self-governing water management organisations elsewhere

Design characteristics can be considered to be essential conditions in (re-)designing organisations for self-governance. If the design characteristics are meant to contribute to the long-endurance of the organisation, then the rules that express the characteristics have to be maintained, revised and adapted to changing circumstances over time. Rules cannot remain static in a dynamic environment. In order to fit society, rules have to reflect the current norms and values. A self-governing organisation, therefore, cannot consider its original agreement as a certificate or guarantee for sustainability.

Design characteristics express a number of issues that have to be taken care of and that are necessary in drawing up an agreement between the users themselves or between users and an external authority to create a self-governing entity. Although the design characteristics as discussed before have been given a number, this is not intended as a ranking. It is very difficult to state which design characteristic is more important than another. Each situation will create its own rules according to needs and requirements, which will evolve over time depending on changes in these very needs and requirements.

This conclusion on the importance of all design characteristics and their interdependence brings up the point of their relevance for self-governing organisations elsewhere. The design characteristics as presented for the Dutch water boards are not tied to these organisations nor are they unique for this country only. The way these characteristics are developed into rules is determined by a number of other factors. Rules are in fact part of a larger complex that all together make out the behaviour of individual(s) within organisational structures. Characteristics of a physical world are to be linked with those of the general cultural setting, with the decisionmaking situation, with the goods and services to produce or consume and with the specific rules that affect the incentives of the individuals facing a particular situation. All these elements vary in every situation and thus produce unique outcomes. The Dutch experiences are a proof of this.

The physical conditions in the principal water board of Rijnland were not very different from those in neighbouring Delfland. Yet, the peat-digging activity that was allowed on a much larger scale created quite different outcomes over the centuries. On the other hand, Delfland was in bigger trouble with another neighbouring water board. Rijnland could be said to be in need of strict monitoring and Delfland was in need of arrangements for external relationships and conflict-resolution. And this is only one example out of hundreds, even thousands of differences between individual water boards. Design characteristics offer the possibility to design rules that are appropriately linked to local circumstances. Thus, neither the model of the Dutch water boards nor the design characteristics offer blueprints for designing self-governing water management organisations elsewhere.

Relevance for other types of water management organisations

Ostrom's design characteristics were developed on the basis of research in self-governing irrigation systems that were established by the farmers themselves. A major part of the irrigated area in the world, however, is located in systems that were developed by a government agency and with public funds. As indicated in the introduction, there is great interest worldwide in reducing the role of the government in managing those systems. The major driving force behind

2 SUSTAINABILITY OF DUTCH WATER BOARDS: APPROPRIATE DESIGN CHARACTERISTICS FOR SELF-GOVERNING WATER MANAGEMENT ORGANISATIONS

this is the desire to reduce public spending. Another important argument is the overall poor performance of public irrigation systems. At the same time, however, governments are urged to strengthen national capacity for integrated water management at the river basin level. The driving force here is the desire to control and optimise the allocation of scarce water resources to various – and sometimes conflicting – uses. Exposure to these two driving forces that act in opposite directions creates a confusing situation for those who work in the water sector. Here too, there are no standard recipes or ideal models. Each nation will need to find its own appropriate mix that combines elements of self-governing organisations with elements of centralised control. The experience of the Dutch water boards tells us how such a mix was concocted in the Netherlands.

Finally, we would like to draw attention to parallels between the summary in Table 2 of the design characteristics that have been discussed in this paper and the key-elements of the service-approach for restructuring irrigation & drainage organisations in Box 6. The serviceapproach is a product from our research programme on irrigation performance, jointly with the International Water Management Institute (IWMI, Colombo, Sri Lanka) and the International Institute for Infrastructural, Hydraulic and Environmental Engineering (IHE, Delft, the Netherlands). We developed the concept of the service-agreement, initially as a tool for achieving greater effectiveness and efficiency in the delivery of water management services at system (or project) level¹³. Later, we proposed similar service-agreements for transactions between organisations involved in water management, as an instrument for water management at the river basin or national level. The items that we considered essential in drawing-up serviceagreements and organisational charters for service-oriented restructuring of irrigation & drainage organisations appear to correspond largely with the design characteristics and accountability mechanisms that proved to be essential for the sustainability of the Dutch water boards. We like to think that this report provides some useful elements for those who are interested in applying and developing the service-approach.

¹³D.H: Murray-Rust and W.B.Snellen. Irrigation System Performance Assessment and Diagnosis. International Irrigation Management Institute, Colombo, Sri Lanka 1993

Box 6: Key elements of the service-oriented approach for the restructuring of irrigation & drainage organisations

- 1. An irrigation & drainage organisation is **service-oriented** when it (1) makes every effort to provide services that are well adapted to farmers' needs, (2) aims to provide these services at the lowest possible cost to its users, and (3) is accountable to farmers on the above issues 1 and 2.
- 2. A **Service-Agreement** between a service-oriented irrigation & drainage organisation and its users specifies (1) The services that will be provided and the method used for checking that services are delivered as agreed upon, (2) The procedure for calculating the cost of service and for checking that services are delivered at the lowest possible cost, (3) The consequences for each party of not fulfilling (parts of) the Service-Agreement, (4) The authority that will be addressed in case of conflicts, (5) The procedure for renewal, updating and improvement of the Service-Agreement.
- 3. For **large-scale systems**, irrigation and/or drainage water within the system is sometimes handled by several organisations. Such systems require a Service-Agreement for each level in the system where water is transferred from one organisation to the next. The set of Service-Agreements regulates the transactions between the organisations that provide irrigation and drainage services.
- 4. Organisations need to be **authorised** to make a Service-Agreement. For public-funded organisations, the manager or representative of the organisation needs authorisation from the ministry or department. In this authorisation, restrictions or conditions may be imposed to ensure consistency with higher-level policies and especially with overall river-basin management policies. For Farmer Organisations or Water Users' Associations, the procedures for preparing, negotiating and signing the Service-Agreement must be described in an Organisational Charter.
- 5. The **Organisational Charter** specifies rules for behaviour within an organisation. In addition to specifying procedures related to the Service-Agreement, it describes the purpose of the organisation, the organisational structure, the procedures for electing council members and appointing functionaries, the rights and duties of council members, functionaries and regular members.
- 6. Service-oriented restructuring of irrigation and drainage organisations is a process of identifying, designing and implementing the technical and institutional modifications needed for sustained operation of the system on the basis of an appropriate set of Service-Agreements and Organisational Charters.

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