Urban water planning: working with subjectivity

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Abstract

Urban water resource (UWR) systems are essential to urban life. However, today’s UWR systems appear not to be sustainable, as these often have unacceptable negative effects on water quantity and quality. On the other hand, the potential contribution to the quality of the urban environment is high.

The question of finding sustainable balance between social, economic and ecological aspects precedes the question of how sustainable UWR systems can be designed and constructed. But weighing these aspects of intended sustainability appears to be a partially subjective process. In (Dutch) UWR management practice, this subjectivity is not widely recognised: the intractability of sustainable water management is often attributed to lack of data. In recent years UWR management has become even more complex, as a greater number of disciplines and stakeholders have become involved. Conventional UWR planning and design methods – based on formal, technical analysis – can’t handle complexity and subjectivity very well. ‘New water management’ requires new tools to be added to the water manager’s toolbox.

This paper contends that complex planning requires a process oriented approach. In a process approach, negotiations on problems, objectives and solutions decision-making are intertwined with objective technical expertise, as opposed to the separation between policy analysis and decision-making in a formal systems approach. Here, the process approach is adapted for management of UWRs. The resulting approach is based on experiences and tested in three case studies. The approach presented is explained using the underlying theory and illustrated using examples from the case studies.
1 Introduction

A very wide range of literature is available on water resources management projects that are claimed to be sustainable. In many cases the sustainability of supposedly sustainable projects is demonstrated by mentioning the application of certain measures or principles. An example of such a principle is limiting resource use or resolving all problems within the direct geographical project boundaries. In UWR management these measures are usually alternative, more ‘ecological’ ways of dealing with e.g. urban drainage and wastewater. Apparently, these alternative ways are viewed as inherently sustainable and application of these techniques is a reason for a project to be sustainable. Testing or assessing the sustainability of these ways is not easy. Globally, different methods for assessment of sustainability have been developed with varying degrees of success (see [4]). The most successful are methods for assessing the (relative) sustainability of products and constructions (e.g. the widely accepted Life Cycle Analysis method). Typically, development of holistic methods and methods intended for a (spatially) larger scale are less successful.

People with different backgrounds follow different approaches to dealing with environmental problems [1], [6]. These differences cannot be neglected. This is a major reason for the proliferation of many approaches to sustainable development [1], [14]. Because of divers and the intensive use of water resources, a number of different organizations will always be involved in designing or planning for these resources. These organizations (or stakeholders) will usually take different approaches to sustainable development, resulting from their different interests and worldview. Hence, it is necessary to take this subjectivity into account.

2 Planning for sustainable urban water resources

Developing sustainable urban water systems is a complex problem. In addition to the scientific point of view, the natural, social and economic processes involved are also complex from a decision-making point of view. For dealing with complex issues over the last decades, many planning and decision-making methods have been developed.

In policy sciences, generally two main families of methods are distinguished, a content oriented approach and a process oriented approach [8], [12], [17]. Durning [7] describes these as positivist and post positivist, respectively. Positivism is defined [12] as being based on the belief that reality can be known objectively and includes the belief in a deterministic universe. The reductionist/analytical approaches and the belief in the supremacy of quantitative analyses stem from these beliefs. Quinn [18], maybe more appropriate in the context of this paper, uses the terms ‘formal systems approach’ and ‘power-behavioural approach’, respectively.

In the positivist view, rational policy choices follow from rigorous analysis that selects that policy option from the options available then returns maximum
(societal) benefit against the lowest (societal) costs; policy analysis is a technical process taking place separately – in preparation or parallel – from political decision making. In the ideal case, the administrators follow the results of the analysis. Over the last decade, policy analysis has developed to incorporate public participation: involvement of stakeholders has a place in more recent methods that still adhere to same basic, positivist assumptions and premises [16]. A stakeholder's input is interpreted and treated as data on their preference; we use the term interpretive policy analysis [7] for these methods.

A 'power-behavioural' or post positivist process approach concentrates on opinion, bargaining and negotiation, and reaching consensus. Hence, these approaches are participatory. Process steps, decisions to be taken and the agenda are set according to the progress in the decision-making process, not directly by scientific considerations. In a process-oriented approach, the content of a decision depends on value-decisions in the process and is not based solely on scientific or technical arguments. In a post positivist view, the practitioner is not seen in a role of 'problem solver' but as facilitator of the process.

The logic behind each of the two approaches is so powerful that, to some extent, their respective logic makes them seem mutually exclusive, while in practice both are used in a blended way, each attacking a specific class of strategic issue [18]; in short, process approaches to allow for shared value decisions, positivist approaches to avoid 'negotiated nonsense'. In complex cases, the project initiator, e.g. the municipality, cannot make all value decisions and trade-offs on its own authority. Other stakeholders may not readily accept these trade-offs, based on their different interests and beliefs, but may have power or necessary resources. Hence, they should be involved for practical reasons. This leads to the conclusion that – in a specific case – knowledge, science and experts alone cannot determine a commonly acceptable or authoritative solution. For example, domestic use of reclaimed effluents needs the co-operation of the people living in the project area. This inability to determine a commonly acceptable solution makes the positivist approach inapplicable in such cases. As a result, for example for a holistic Urban Water Management Plan (covering e.g. waste water, drainage, ecology, spatial planning, recreation and aesthetic value), a process approach will be unavoidable in most cases. This proposition is supported by the case studies.

A recent survey of Dutch UWR management practice demonstrated that the strongly content oriented way of policy development seems to be losing ground to more process oriented approaches [13]. Some point out that this could be an academic 'loss': process oriented approaches could be popular with scientists; in practice a positivist approach dominates (e.g. [7], [9], [12]). This position is supported by experience in the cases described later in this paper. Project proposals from all major consultants and engineering firms relevant to UWR management in the Netherlands were invited, and all but one of 14 project proposals submitted can be classified as distinctly positivist.
3 Description of the research method

Dutch water management practice has a distinctly positivist culture [9]. Common tools and practices are geared towards positivist approaches. Over recent years, the complexity of UWR management practice has been increasing, to the point where the ‘conventional’ tools and practices used by the water manager are not sufficient anymore. ‘New water management’ requires new tools to be added to the water manager’s toolbox. In my thesis [15], the process approach is adapted for management of UWRs. A distinct feature of UWR management is that there is a large role for engineering. The technical demands to the layout and dimensions of the UWR system even seem to overshadow other factors, making a process approach superfluous. For the case studies this was not true, however.

3.1 Research methodology

The case studies were analysed using a grounded theory methodology (GTM). GTM [10] does not use predefined hypotheses that are subsequently tested. Instead, theory emerges or is ‘constructed’ from the case studies. This makes grounded theory methodology particularly suited to explorative or explanatory case-study research. It was developed to deal with complex problems using a holistic approach. The result of GTM should meet the following criteria: it must fit the data available, it must work, i.e. provide an acceptable and credible level of understanding, have relevance to the core problems and processes from the analysis (and not those predicted by some theory, but of minor importance in the case studies) and must be modifiable or open to accommodate new information.

Information on the cases was collected through direct observation (i.e. meetings, research reports) and interviews. These interviews were semi-structured: they started with a limited number of open questions on the subject.

3.2 Introduction to the cases

Sustainable UWR management practice was studied is three cities: Almere, Amersfoort and Leidsche Rijn. The case study areas are highlighted in figure 1.

3.2.1 Waterplan Almere

Almere is a mainly suburban town, founded in 1976. Since 1976 Almere grew to over 160,000 inhabitants in early 2002. The hydrological and geological setting of Almere and the design of the urban drainage system are common in Dutch urban areas: peat and clay soils, originally very shallow ground water tables and a separated sewer system. Almere is different from other Dutch cities of comparable size: it doesn’t have a history dating back a number of centuries.

In 2000 the municipality initiated a ‘water planning process’, aimed at developing a shared framework for sustainable UWR management, together with the local water board. In spring 2003, the strategic Waterplan Almere is finalised.
The Waterplan deals with water quantity and quality aspects, inundation, urban and spatial planning, landscape architecture, ecology, recreation, operation and maintenance. The plan is developed using a participatory approach, using a/o concepts developed in the early stages of this research.

3.2.2 Waterplan Amersfoort
Like Almere, Amersfoort is a medium-sized city. The city is representative for Dutch medium-sized cities (of about 80,000 to 200,000 inhabitants). Its history dates back to the 1200’s, but most of its expansion took place in the 20th century. Amersfoort is similar to many other Dutch urban areas: a wide range of soft soils, ranging from peat to sand. The old part of the city is built on sandy soils; urban development dating from around 1960 and later is built on peat and clay soils.

Initially, the main motivation for developing a management plan was the perceived environmental 'return-on-investment' of a more holistic optimisation. Over the years the need to have a shared framework for dealing with water issues – together with the water board and the drinking water company – became more urgent, resulting in Waterplan Amersfoort with the same wide range of subjects as Waterplan Almere. In 2000 a planning process was initiated. Initially, an interpretive policy analysis approach was chosen.

3.2.3 Water system design in Leidsche Rijn
Leidsche Rijn, near the city of Utrecht, is a new urban development with an area of about 2,500 ha and a projected number of houses of 30,000 and is to be developed between 1997 and 2015. A main pillar in the strategy of the municipality to build an attractive large urban area was sustainability. The water system designed for Leidsche Rijn is one of the main contributions to sustainable development in the area. Although concepts and techniques pioneered in Leidsche Rijn are becoming more and more commonplace, the scale of the water system and the level to which the concepts are carried through are still unique in the Netherlands. A multidisciplinary project group made the master design.
4 Tools to facilitate planning and design

Based on the analysis of the cases, three related dimensions to describe the process and its result were found: concept, scope and knowledge (see fig. 2). These terms are labels, and do not cover all aspects included in the dimension. In addition, there are aspects relevant to all three dimensions: (1) different process phases, (2) the continuity in the planning or design process, (3) the perception of the UWR system (in a broad sense — including elements as diverse as stakeholders and aesthetics), and (5) the basic approaches to sustainable development used (after [14]). These are the aspects that emerged during research of the case studies, further research is likely to provide more or other aspects.

Figure 2: Three related dimensions of (sustainable) UWR planning, with general aspects relevant to all three, based on case experience.

4.1 Concept – four elements of sustainability

Although it possible to provide a reasonably clear picture of the (intersubjective) concept of sustainable development, it is not possible to come up with one generic definition, that is generally acceptable and specific enough to be used as a reference or benchmark for UWR management. This is due to the subjectivity mentioned earlier. In a literature review [14] including some 750 papers and other publications, four key elements of sustainable development were found:

- Needs of the present
- Needs of future generations
- Maintenance of the quality and quantity of components of the system at an acceptable level
- Maintenance of system integrity at an acceptable level

The first two key elements represent the ‘demand side’, while the latter two represent the ‘supply side’. In working with these key elements equity, both intergenerational and intragenerational is of great importance to the concept. The operationalisation of the concept changes as the process passes through different phases, e.g. from abstract to concrete. What actually is the system and its integrity mentioned in the key elements is discussed in §4.4.3, on system perception.
In the cases, the participants readily identified 'unsustainabilities': situations where either resources are wasted, environmental quality is obviously lacking, or system integrity violated. Describing a 'sustainable water system' turned out to be difficult. Anything linking the choice of 'sustainable' measures to the abstract concept was missing in two out of three cases. In Amersfoort, '10 sustainability principles' were drawn up, based on a workshop session attended by civil servants from the municipality, water board and drinking water company. Each principle had a paragraph with a specific description for the Amersfoort situation. The present situation was then assessed to see where these principles were violated. Afterwards, the view of these 10 principle is mixed: some participants think they are inspiring and provide a good framework for choosing measures, others think they are pointless.

4.2 Scope – actors, issues, areas

The ‘scope’ of the process (for lack of a better word) is defined by who is a part of the process, what problems are discussed and where these problems manifest themselves: actors, issues and areas. These three elements are related: the actors have certain interests in the issues; the issues are relevant to a certain area through (in our case) water system relations; the actors all are active in an area, e.g. their territory, jurisdiction, county, municipality or living environment.

The scope can change over the different phases of the process: actors enter and leave, issues are added or dropped, priorities change. The geographical boundaries in the case studies did not change, however. These boundaries were discussed in the initiative phase and not challenged afterwards. Changes in the group of actors or issues to be dealt with were not accompanied by changes in the geographical scope, but were made to fit the boundaries.

4.3 Knowledge – dialogue, verification, documentation

In short, the label of knowledge encompasses all things to do with knowledge, information and results. Important aspects include dialogue, which is the essence of a process approach, verification of information and discussion results and the documentation of any progress and agreements.

4.3.1 Dialogue

In Dialogue, two factors turn out to play a major role: communication and inspiration. Communication falls outside the scope of this paper. Inspiration denotes a good dialogue in the context of this paper – inspiration in the sense of ideas and points of view coming into the process, leading to new ideas and
improvements in quality. Inspiration can come from exploring and combining each other’s points of view or from inputs by experts from outside the process. In effect, inspiration in the sense of enriching the process with ideas and expertise.

In Almere and Amersfoort, a workshop was organized with a broad group of stakeholders early in the process – from provincial civil servants to local fishing clubs. At a later stage, workshops were held with civil servants from the municipality and waterboard. However, external experts were not invited, and stakeholder consultation was limited to focus group discussions on draft texts. This was not only an issue of limited resources. The people involved were busy reporting and solving problems; most people in the process felt bringing in more outside information would complicate their task and essentially set the process back. In hindsight, the process would have benefited from the experience of people who had solved similar problems in other situations. In Amersfoort, one participant had been asking for ‘outside inspiration’ very clearly more than once, naming experts and other projects. Nobody picked up on his signals. This may be because he had been critical, cynical even, of the process ever since it had begun.

4.3.2 Verification
As in any planning or design process, there is a need for verification of the notions used in the process. An important pitfall is the emergence of negotiated nonsense: negotiation results that make sense to the parties involved, but are not valid according to science or practical experience. Any process result should be verified against science and practical experience, on e.g. technical, physical, economic and public health aspects. Basic standards for living conditions should not be open for discussion, as this would be a waste of time. However, to avoid negotiated nonsense, it is essential to void dogmatic use of principles. In a complex process, some problems or issues can be measured, calculated or solved by experts outside the mainstream of the process, as represented in figure 4. These projects could well be carried out by hired consultants and engineers.

![Figure 4: View of the haphazard progress of a planning process, ‘spawning’ research projects, where results are fed back into the process.](image)

In Almere, the water vision is based on an analysis by a major engineering firm done in parallel to the process, including e.g. computer simulations. The unexpected results of this analysis lead to changes in the participant’s perception
of the problem. Initially, according to general opinion, additional storage would be needed to accommodate increasing rainfall intensities due to climate change. The analysis showed that this would be unnecessary. In Amersfoort, assessment of the current situation was done by expert judgment (through interviews with experienced civil servants) and comparison with standards of the limited measurement data available. The process results were not really tested at all.

However, there seems to be no relation between the amount of research done into the robustness of a solution and the confidence in the process results. Process participants are confident in their results and that any problems that do come up in the future will be resolved. Time will tell whether their confidence is justified.

4.3.3 Documentation
For an efficient process, documentation of a progress is very important. Documentation can encompass accords, covenants, contracts – with differences in legal status – research documents, meeting reports, etc. This documentation serves purposes like recording agreements, facilitating communication of results to outsiders, and development of a shared memory. Having a shared memory helps in avoiding discussions over interpretation of earlier results.

The cases studied all successfully used some form of ‘growth document’, adding new results to the document as the process progressed. The growth documents were oriented on technical and scientific progress and were intended to form the final report in the end. This function could not be performed without extensive rewrites, however. In situations where progress was not documented well, discussions were repeated, sometimes almost literally, starting with the same dissensus and reaching the same result as weeks before. Time was wasted. Almere and Amersfoort had a start-document that is probably best described as a memorandum of understanding.

4.4 Aspects common to all three dimensions

4.4.1 Process phases
In the literature on formal systems approaches, the planning process is typically described as a linear series of steps, from problem identification to implementation of the solution. In practice, these steps are not taken sequentially, but in parallel and iteratively. For this reason, some prefer to speak of rounds (e.g. [4], [8]), a term that fits the metaphor of the ‘policy arena’ as the place where policy is developed with other actors. Practice is described as a chaotic mix of steps: not a straight line but a bowl of noodles. This is a difference in perspective: looking at one project, separated from its (institutional) context, it progresses from initiative to implementation and use, or fails. Looking at the policy practice of e.g. a municipality, all stages of the project lifecycle co-exist; at any time, vision elaboration can meet initiatives or experiences from the use of the systems in place. In the processes in the cases studied, no clear steps can be distinguished, but over time the activities observed in the cases do change in character. Figure 5 tries to come to terms with both
views: it shows the erratic development of phases, that meet at points in time – rounds – and shows the progress of a process as it moves from one phases in its ‘life cycle’ to the next.

Figure 5: A planning process as it progresses through its five phases of life in ‘rounds’; all along its path there are connections to other phases; the process can e.g. ‘spawn’ new initiatives at any ‘round’.

4.4.2 Continuity
Here, continuity in three respects is described: in concept, in progress and in participants. In concept – the concept developed in the process (of sustainable development) should accommodate continued learning, and modification. This means that the design or strategy should not contain unnecessarily restricting (design) choices. On the other hand it should be reasonably robust in the sense that new information does not mean a rigorous break from the past, leading to destruction of capital.

In progress – pauses in the process require labour intensive restarts, because participants have moved on to other subjects. A pause in a project may lead to the project being stopped and forgotten altogether.

In participants – participants to a process develop a shared memory and go through a social learning process. Newcomers lack both the shared memory and the knowledge and insight resulting from the learning process. The replacement of participants in a process means a loss of knowledge and insight. This includes the replacement of hired consultants and engineers.

4.4.3 System perception
All participants have some view of the ‘system’ that is the subject of the process, even though it is often unarticulated. This system consists of components and relations between these components; e.g. surface water bodies, their aesthetic values and local ecology. A systems view of the cases turns out to be a useful representation of the system for a number of reasons. Such a ‘spaghetti and meatballs’ representation (see figure 6 for an example) is easily related to the key elements of sustainable development in the concept (notable to the quantity, quality and integrity of the system). It forms a modifiable mental model of the system, where the components can easily related to issues and stakeholders, and thus forming a good basis for discussion on scope, measures, problems and objectives.
The concept of the ‘spaghetti and meatballs’ view of the system is the most effective as a mental model. A graphical representation of the full system as perceived in e.g. Amersfoort easily clutters up an A3 sheet even without the connecting arrows added (only the ‘meatballs’). As a consequence, it does not provide much insight or overview, although it does demonstrate the complexity of the process quite well.

Figure 6: A simple example of a systems perception, using a ‘spaghetti and meatballs’ view. The scope of the project is marked.

4.4.4 Basic approaches
Within the subjectivity surrounding sustainable development, four basic approaches can be distinguished [14]. In the case studies, the differences in approaches lead to many misunderstandings and dissensus. These approaches differ on two dimensions.

The first is whether an anthropocentric or nonanthropocentric approach is followed, representing the two extreme positions. A hominocentric [1] or anthropocentric [3] approach (with a focus on human needs) typically values nature instrumentally. Nonanthropocentric approaches tend to value nature intrinsically.

The second dimension is the preferred way for evaluation: compliance to standards versus virtue. Both Douglas [6] and Hofstede [11] come to similar conclusions regarding the evaluation of risk or the way uncertain situations (like proposals for sustainable development) are assessed. An approach with a low tolerance to uncertainty is focused on norms or standards; comparing measurements to standards based on extensive research provides some assurance as to the validity of the conclusion. In an approach with a higher tolerance to uncertainty, options are evaluated on their individual virtue or value, which may not be quantifiable, like aesthetic or cultural values.
5 Conclusions

Urban water resources or water system management is a complex problem that is not solved efficiently using conventional, technical approaches. New tools are necessary, and one is presented in this paper.

The process approach described above is developed from the experience in the case studies, and focuses on three dimensions of planning and design: concept, scope and knowledge. Concept is particularly relevant in cases where sustainable development is an issue; scope and knowledge are relevant to all projects with a holistic view or UWR. The case studies in this paper show that planning for UWR can benefit from a process approach.

References


