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A planning-oriented sustainability assessment framework for peri-urban water management in developing countries

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ABSTRACT

DPSIR and the three-pillar model are well-established frameworks for sustainability assessment. This paper proposes a *planning-oriented sustainability assessment framework* (POSAF). It is informed by those frameworks but differs insofar as it puts more emphasis on a constructivist conception which recognises that sustainability needs to be defined anew for each planning problem. In finding such a consensus definition, POSAF uses participatory scenario analysis and participatory planning, technical feasibility study, participatory assessment, analysis of trade-offs and social networks in an unusual combination and for goals that differ from the original conceptions of these methods. POSAF was applied in a peri-urban area of Mexico City for the design of improved water service provision, integrating solid waste management. It supported consensus amongst users about the importance of environmental issues, informed planners about the values of stakeholders and users, detected local differences, and identified possible conflicts at an early stage of decision-making.

1. Introduction

1.1. *Concepts of sustainability assessment*

There is an abundance of sustainability assessment methods. They tend to differ in the tools applied, but most use just two well-established frameworks, namely the PSR (OECD) and DPSIR (EEA) framework of drivers, pressures, states, impacts, and responses and the three-pillar model of social, economic, and environmental dimensions, possibly expanded by institutions or culture as a fourth pillar. (A framework defines views on the factors and interactions which matter for sustainability.) Wallis et al. (2011) surveyed 54 approaches and most are based on these frameworks or combinations thereof. Their common ground is the (positivist) assumption that there are scientific models which correctly describe sustainability.

In the planning of water infrastructure it does not suffice to feed local data into sustainability theories and compute the

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most sustainable solution, because, 'there are no indicator sets […] backed by compelling theory, rigorous data collection and analysis' (Parris and Kates, 2003). Instead, in planning bottom–up sustainability assessments have been developed, as in the Strategic Choice Approach (Friend and Hickling, 2005; Lennartsson et al. 2009), CLUES (Lüthi et al. 2011), and Lundie et al. (2006), where stakeholders help in determining importance of criteria. Simon et al. (2004) ask stakeholders to identify antagonisms locally and overcome them by piecemeal improvements. Common to bottom–up approaches is the identification of the problem and the actors concerned, the factors that affect the problem (c.f. DPSIR), the aspects to consider (c.f. the three-pillar model), and finally the development of alternatives and their assessment, with various degrees of stakeholder participation. Because of the fragmentation of stakeholders (Lienert et al. 2013) such participation is difficult to implement, and in practice experts often decide what is best for users. Such planning is doomed to fail, however (Starkl et al. 2013b).

To overcome this difficulty, the paper presents a *planning-oriented sustainability assessment framework* (POSAF). POSAF aims at making stakeholder participation in sustainability assessment more consequential by using a *constructivist conception* (Roy, 2010). It does not presuppose a 'true' theory of sustainability, but instead limits itself to providing tools for communication between those concerned with planning and by supporting their reflection on problems commonly related to sustainability. Thus, POSAF focuses on the process by which stakeholders of planned water systems define their own common ad hoc notion of sustainability. In particular, POSAF addresses the potential problem of societal conflicts owed to the fragmentation of stakeholders, and introduces social network analysis and other tools from social sciences to sustainability assessment. This paper illustrates the application of POSAF and these tools.

1.2. *Water management applications for POSAF*

Peri-urban water management in developing countries is an issue of serious concern and lacks sustainable solutions. Centralised metropolitan systems often serve only a small urban core (Marshall et al. 2009) and their expansion lags behind the pace of urban growth (Peter-Varbanets et al. 2009). Environmental pollution may destroy the natural landscapes that still surround cities (Torres, 2011), weakening important ecosystem services such as improvement of water quality or protection from flooding (Butterworth et al. 2007). For instance, downstream of the capital city Delhi the water quality of the Yamuna River is amongst the worst in India (Kazmi et al. 2013). The situation is further complicated by the existence of various institutions with no clear responsibilities and inadequate financial resources to provide sustainable solutions. It can be concluded that peri-urban water management in developing countries faces multiple conflicts, including those between stakeholders (Douglas, 2006).

The authors tested elements of POSAF in China, Indonesia, and Nepal. On the basis of those experiences POSAF was developed and tested in Argentina and Mexico, whereby a complete demonstration was conducted for Mexico (see Section 3). Currently, POSAF is tested in India and preliminary results have also informed this paper. Overall, POSAF encompasses the following four steps (Fig. 1):

- Participatory scenario analysis and participatory planning. These are well-established methods, but applied in a novel context as tools to raise the awareness and interest of stakeholders, which in developed countries is a precondition for bottom–up approaches (Letsela et al. 2010), and engage them in a dialogue about water planning. In Mexico, users together with institutional stakeholders first created *development scenarios* which they could understand and evaluate. A development scenario is a vision of how the case study area could develop in future. It is not restricted to aspects of water management but includes all aspects of urban planning, allowing different sectors to be integrated in sustainability considerations.
- Technical feasibility study: In Mexico, this was supported by defining *concept scenarios*. This is a set of concrete water technologies suitable for the overall goals of the development scenario. For instance, if the development scenario is increasing urbanisation then a centralised water system may be most suitable. A technical feasibility study, conducted by experts, refines this and identifies feasible technical concepts that would best support the goals of each development scenario.
- Participatory assessment: this encompasses established methods for environmental, economic, social and institutional assessment. In Mexico, participation was ensured in two ways. First, stakeholders were involved in defining the criteria to be used for comparison of the concept scenarios and their technologies. Second, social assessment with the future users of the system determined the acceptance of the proposed technologies by users, and institutional assessment investigated the compatibility of the proposed technologies with the existing institutional system to highlight the changes which would be required.
- Analysis of trade-offs and social network analysis: this new step in sustainability assessment supports the consensus-finding of stakeholders. In optimal cases individual preferences do not differ substantially between stakeholders and consensus criteria weights may be input into multi-criteria decision aid and a high level of aggregation is possible (Brunner and Starkl, 2004). Multi-criteria decision aid is often applied in such way in environmental assessment (Halog and Manik, 2011; Wallis et al. 2011). Where there are multiple conflicts of interests, however generally there are

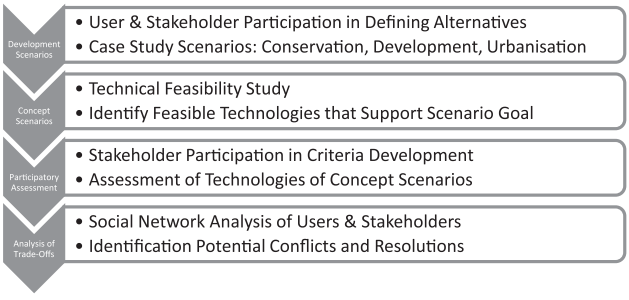

Fig. 1 – Components of the sustainability assessment framework.