Chapter 20
Science and Water Policy Interface:
An Integrated Methodological Framework for Developing Decision Support Systems (DSSs)

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ABSTRACT

Despite many advances in the field of hydroinformatics, the policy and decision-making world is unable to use these highly technical decision support systems (DSSs) because there has been an undue emphasis on the technological aspects. The historical analysis of hydroinformatics concepts and modelling shows that the technical aspects have been incorporated far better than the social aspects. Hence, there have been calls for the development of 'socio-technical' DSSs. However, far greater effort is required to incorporate social and political sciences into the domain of DSSs. The goal of this chapter is to elaborate on the illusive interface between science and water policy within the context of DSSs. It is an attempt to address one main question: how to link or find an interface between policy (institutional matters) and science (technical and natural environment aspects). To achieve this goal, a new paradigm for the DSS modelling approach has been envisaged based on combining multiple theoretical and analytical frameworks into a single methodological framework to attain a linkage between science and policy-making. The integrated methodological framework comprises of: (1) two 'conceptual' frameworks: (a) decision-making perspectives and (b) IWRM interface frameworks; (2) analytical frameworks: (a) DPSIR socio-technical assessment and (b) institutional analysis (IA) frameworks; (3) core engine of the DSS consisting of coupled decision support tools (DST) such as process, planning and evaluation models; and (4) a stakeholder participation interface framework consisting of (a(a multi-windowed dynamic cyber stakeholder interface (MDCSI) system and (b) DSS performance assessment (uncertainty and risk

analysis) tools, within a shell of a graphical user interface (GUI). From experience, it can be concluded that DSSs are not just about software packages but they are a participatory communication platform for an interactive multi-stakeholder decision-making process. The required science-policy interface can be achieved by using a unique analytical approach in which technical, policy and institutional frameworks are combined within a DSS platform with an output framework, the MDCSI system, that facilitate policy dialogue by having a dynamic and interactive policy interface which can be linked to other technical and non-technical systems. DSSs should be integrated with institutional and socio-political frameworks to help attain both financial and institutional sustainability.

INTRODUCTION

Substantial growth in the world population, increased economic activities and improved living standards have put the world's freshwater resources under immense pressure which in turn has resulted in competition and conflict over this precious resource. In addition, water pollution is inherently connected with human activities as it often acts as a medium for transporting domestic, agricultural and industrial waste and as a constraint on the use of water resources. The above problems are aggravated by shortcomings in the management of water. Fractional (sectoral) approaches to water resources management have dominated and still prevail, especially in the developing world; as a result, fragmented and uncoordinated development and management of the resource is a real practice. The overall problem is deepened by inadequate legal legislation (governance), poor enforcement, increased demand (competition) for this finite resource, and imperfect conflict resolution mechanisms. Hence, there is a need for an integrated approach to water resources management (Cosgrave and Rijsberman 2000). The complexity of the nature of the problem is clear as Biswas (2004) lists some 36 issues that should be integrated. Hydroinformatics has the potential to foster the desired integrating approach but historically, there has been a tendency to model those issues that can be easily modelled with the available analytical and numerical tools (i.e. a highly technical approach) and we have many models that have not found any meaning-

ful application and have gone on the archive list (Cornell, 1972). Although made many years ago, Cornell's (1972) point that it is better to model the whole even if we employ assumptions and oversimplification rather than modelling a small part of the problem that we may know very well is a valid one. He implicitly makes a point for large scale, basin-wide DSSs (Hashemi & O'Connell, this issue). Therefore, hydroinformatics can facilitate an integrated assessment of water resources problems because it is an interdisciplinary area of study which draws from the three worlds of science, technology and society (Abbott 2002). It blends technological, hydrological, hydraulics and environmental engineering with social and ethical interests. It encompasses the application of information, communication and data technologies as well as geographical information systems (GIS) to problems of aquatic environments (e.g. Savic and Walters 1999; See et al, 2007).

Despite many advances in the field of hydroinformatics, the policy and decision-making world is unable to use these highly technical DSSs because there has been an undue emphasis on the technological aspects (See et al, 2007). The usual simple policy questions such as 'what should be the environmental water allocation for say year 2020?' cannot be easily answered within technically oriented DSSs. Therefore, DSSs are required to increasingly become "socio-technical" (Abbott, 2002) to create the "socio-technical democracy" (Steyaert and Jiggins, 2007) required for an integrated policy appraisal. Hence, a new methodological framework is required to reflect

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