

# STRATEGIC ASPECTS IN INTEGRATED WATER RESOURCES MANAGEMENT ON TRANSBOUNDARY CONTEXT

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## ABSTRACT

*The goal of this dissertation is to explore the role of SEA as an auxiliary tool for IWRM in transboundary context, given the inherent complexity, and using two case studies of transboundary river basins. To meet this goal, a mixed methodology was adopted based on a literature review and case studies. The main conclusions are that a strategic based approach SEA constitutes a tool to assist the IWRM since: strongly consider participation; prioritize information; consider the complexity managing to understand relationships; consider uncertainty using mechanisms for its reduction; take into account the continuous adaptation; focus on strategic aspects; strongly seek and assist the decision making process and promote cooperation between institutions. Seems important in the future for the sustainable development of water resources, that further research on complexity is carried out; and that the potential of SEA in transboundary level IWRM is released to happen in more transboundary river basins.*

**Keywords:** Complexity; Uncertainty; Strategic Environmental Assessment; Integrated Water Resources Management

## 1. Introduction and Methodology

In a transboundary river basin existing water resources are shared by countries covered. The boundaries of the area allocation of these resources in the basin are not the same as the boundaries of each country, i.e. usufruct of the water by a country for domestic supply, for industry, for agriculture, among many other activities not only affect resource availability within the geographical boundaries of the country, but may constrain resource availability in other countries that share the same watershed. With the increasing scarcity of water, while there is a growing increase in population (Malthus, 1798), adding to the constant pressure that this resource suffers and taking into account the extent of a basin system, the management of water resources calls for an integrated management for sustainability of ecosystems.

The goal of this dissertation is to explore the role of Strategic Environmental Assessment (SEA) as an auxiliary tool for Integrated Water Resources Management (IWRM) in transboundary context, given the inherent complexity, and using two case studies of transboundary river basins.

In order to fulfill this objective the methodology of this dissertation was based initially on the research and review of existing literature, especially on the Internet, regarding integrated water resources management, complexity and strategic environmental assessment, seeking always take into account the cross-border level. The case studies in the second phase, refer to the analysis of two SEA of transboundary basins, with regard to

the strategic aspects and mechanisms of reduction of uncertainty identified previously, the complexity and how the SEA takes into account the complexity.

## **2. Integrated Water Resources Management in Transboundary River Basin**

Water scarcity is the main challenge in the management of water resources. In this sense, IWRM plays a key role in integrating environmental dimensions, economy, social issues, participation and governance in order to be a sustainable use of water resources (Kim, 2011). If a transboundary basin is an example of a complex system, it makes no sense to analyze the relevant strategic aspects of IWRM across borders, if it is not understood before what is the complexity, what is that translates and how can you deal with these types of systems.

Complex systems, in general, are characterized by uncertainty, lack of predictability, the existence of networks of connections and non-linear relationships, the interactions between the parties, by uncertainty (Estrada, 2009). Addressing the Cynefin Framework, it is stated that in the field of complexity results are unpredictable and emergent, the designated patterns, and that it is through these that progress happens, being also referred the importance of stakeholders to identify these patterns. Thus, for decision making in the complex area, the cyclic decision model exploration → perception → response<sup>1</sup> considers a continuous adaptation of the way, crucial for dealing with this type of systems.

The cyclical process of IWRM (Keur et al., 2008) reflects the need to continually adapt the way according to the results consequential from the given answer. In parallelism with decision model in the complex area after implementation (phase response) is necessary to return to the exploitation phase, then the phase of perception, in which adapt the steps, so you can implement a new answer. The scenario analysis; participation; access to more data and more information (also related to monitoring); more studies; and developing better models are assumed to be the means to reduce existing uncertainty in different outcomes of each step in the cyclical process of IWRM (Keur et al., 2008).

In the management of such systems is necessary to get a strategy (Estrada, 2009), mechanisms that are able to work in the organization of the system, which will identify and consider the different and diverse fundamental relations, taking into account, analyzing, emerging patterns (Griffith, 2008).

In a complex system, the identification of a strategic aspect may involve the verification of their interrelationships with other key points and see if changes in these aspects - and consequently these inter-relationships - may change patterns that exist, to walk toward the desired end.

## **3. Strategic Relevant Aspects of Integrated Water Resources Management in Transboundary River Basin**

The relevant strategic aspects in transboundary IWRM that were identified are governance, the price of water and water use / land use, due to its conditioning factor character, the possibility of being translated into actions that enable sustainable management of water resources, and their inter-relationships with the various and diverse issues, factors and other fundamental aspects inherent to water resources (The World Bank, 2004; Rahaman and Varis, 2005; ÁguaGlobal, 2014; Stallworth, n.d.).

In order to consider these strategic aspects and the multiplicity of factors in managing water resources in

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<sup>1</sup> Retrieved November 19, 2013 from the World Wide Web: <http://www.youtube.com/watch?v=N7oz366X0-8> Data de acesso:19/11/2013

a basin and in decision making to allow the sustainable use of water resources, there must be a process that takes into account the complexity of that basin, with linear and non-linear relationships between these factors and aspects.

Many agreements, treaties, conventions and plans are made, existing ambiguity regarding several important points, which influences decision making and therefore the actions performed (Rahaman and Varis 2005). The SEA with strategic approach has the potential to assume the role as fundamental tool of IWRM in order to reduce uncertainty, assisting the process of decision making. The SEA and IWRM have similarities: both are continuous processes that enable adaptive management with consideration of monitoring, evaluation and adaptation; both promote the integration of environmental and social issues and participation to decision making; and both seek to understand the relationships, the root of the issues to improve the governance of natural resources (Hirji & Davis, 2009). It is through its capacity to access the strategy and thus provide support for decision making, that SEA has the potential to assist IWRM to improve the conditions for sustainable management and development of water resources.

SEA with strategic approach acknowledges and understands the network of interconnections (Partidário, 2012) and uncertainty, i.e. deals with complexity, especially through the integration of environmental, social and economic issues; reduction mechanism mentioned uncertainty; and through monitoring and evaluation that allows continuous adaptation.

#### **4. Strategic Environmental Assessments of transboundary basins - Case Studies**

The previous two chapters are assumed as theoretical framework, the starting point for this exercise. Firstly the selection of cases has the primary criteria being SEA of transboundary river basins. After selection, the two cases - The Trans-Boundary Mara River Basin Strategic Environmental Assessment (TMRB-SEA) (Nelson, Nyarangi, & Maritim, 2012); Strategic Environmental Assessment Hydropower on the Mekong Mainstream (SEA- HMM) (ICEM, 2010) are reviewed with the aim of exploring the role of SEA in the context of transboundary river basins as an auxiliary tool for IWRM. Thus the screening exercise will initially identify key strategic aspects, check if it is considered the uncertainty and uncertainty reduction mechanisms identified - data, models, studies and information; scenario analysis; participation; and monitoring - and if complexity is considered.

Initially it is intended to make a contextualization of the basin first, followed by the identification of the relevant strategic aspects. This identification takes into account what has been previously perceived: the character conditioning factor that they must have; the existence of relationships with several key issues for the basin; and if these can be translated into actions. After the identification of these aspects it is intended to verify if the SEA considers the uncertainty inherent to complexity and the uncertainty reduction mechanisms mentioned above. Finally it is intended to verify if the SEA takes into account the basin complexity and ways of dealing with it, not only through the previous step, but also through the integration of environmental, social and economic issues; if it has a flexible feature and if takes into account the continuous adaptation. In the second phase will be compared in both cases the results of the first phase (Table 1): the relevant strategic aspects; consideration of uncertainty and uncertainty reduction mechanisms; and the consideration of complexity. Finally in the third phase the two SEA are discussed on the responses obtained in the two previous phases and strategic aspects identified in the previous chapter - governance; price of water; and water use / land use.

#### **4.1 Comparison of Study Cases**

Both countries involved in the Mara River Basin (MRB) - Tanzania and Kenya - are developing countries with a large share of the population living in poverty, with activities such as agriculture, mining and tourism very important for both countries. It is mentioned in TMRB-SEA that tourism has proven to be one of the strongest areas of growth in the local economy of the MRB, with great contribution to GDP of the two countries, which happens mainly due to the biodiversity of the region and particularly the annual migration of some herbivores such as wildebeest. With population growth, areas previously exclusive to grazing are made in agricultural areas and water reserves diminish due to deforestation and increased cultivation. With this decrease in grazing areas and water reserves, there is a decrease of habitats and livelihoods for these wild animals. A large percentage of water use for irrigation belongs to developing countries existing unfavorable environmental consequences if such use is uncontrolled (The World Bank, 2004). The inherent complexity of this basin is present in the above example, where the population depends on economic activities that hinder the development of some other. Without a sustainable development populations that continue to grow, will end up destroying some of the most important resources they have for their development and survival. In the case of a transboundary basin, efforts have to be made jointly, as an unbalanced use, over-exploitation of resources in a country, clearly affect the other country, also dependent on these resources. For such is required a structure and organization of concerted governance, with clear objectives and responsibilities, with policies, plans and programs based on the goal of a sustainable environmental, economic and social development of the MRB.

The countries involved in SEA-HMM - Cambodia, Laos, Thailand and Vietnam - are also developing countries (plus China and Myanmar as dialogue partners for the Mekong River Commission). These projects are being studied by the private sector and have the potential to bring benefits of additional energy and investment / revenue. Yet for all countries is associated loss of biodiversity, and impacts of fishing activities - activity quite important among poor populations (Rahaman and Varis 2005) - among others. Even the benefits of this construction can carry some uncertainties, particularly in terms of their distribution. In fact, during a workshop was obtained a ranking between countries in terms of benefits and costs, and, in descending order countries with more benefits for the construction of these projects would be Laos, Cambodia, Thailand and Vietnam (being the reverse order in as regards the costs). The construction of these projects or not, according to the SEA-HMM, is inserted in water use / land use strategic aspect. It is said that in a transboundary level this is a sensitive aspect due to its influence on the flow of water in the basin and the alteration of ecosystems. Issues inherent to governance are very relevant in the construction of a hydroelectric. It is fundamental that cooperation and agreement between the different countries in the infrastructure development of this type, that causes drastic changes in ecosystems.

Key issues / strategic issues identified in both SEA, through meetings with stakeholders, resemble. Concerns and the need to take into account the strategic development / management of the economy; food security; biodiversity and ecosystems; population management and social systems are common points between SEA. There is a greater difference in the issue of tourism in the MRB (for being an activity of great importance in this basin) and the issue of power generation in the Mekong River Basin, key in building an infrastructure for energy production.

In both SEA it is clear that there is an institutional inability to sustainably manage the two basins. The

analysis of policy consistency in TMRB-SEA establishes a comparison exercise of legislation and policies in the two countries that help to better understand their relationships. The proposal for a Secretariat to monitor the implementation process of the SEA can also function as an agreement platform between the two governments as well as a facilitator of policies adjustment on the sustainable development of the two countries. Also serves as a facilitator to deal with the challenges of this Basin. The policy analysis and governance of SEA-HMM contributes to the establishment of specific recommendations at the institutional level. It is clear that the capacity of existing institutions are not sufficient for these projects, as there are also important questions regarding the execution of PNPCA, existing also recommendations for improvement.

The analysis of the complexity and uncertainty inherent to the basin and the strategic aspects seems to be much higher in the Mekong Basin compared to the Mara. Uncertainties related to the construction of the twelve projects are mentioned numerous times in the SEA-HMM and are clearly taken into account throughout the process, such as the recommendations. In SEA-HMM different sources of uncertainty were presented, with some proposals on the recommendations of tools to reduce them -especially the development of further studies and monitoring. Scenario analysis and participation have reduced some uncertainties, but also helped to realize where others remain.

When comparing both SEA it is perceived a greater complexity in the SEA-HMM, due to the construction of hydroelectric projects involving four countries (twice as many countries covered by the MRB), which increases the number of relationships to consider, studies, which increases the complexity of involvement of actors, as more and different interests exist. This increased complexity of connections and factors to take into account also increases the uncertainty and complexity of assessment.

Both SEA identify the key issues to take into account - which resemble as already mentioned - prioritize information, take into account the need for monitoring and need to collect more data and more research and development of studies and, fundamentally, question the environmental quality of strategic options. Also the two were betting heavily on the participation in all phases that are inherent, promoting involvement, understanding, discussion between all parties interested, encouraging cooperation. Participation processes seem more complex in SEA-HMM, since it had to involve many more stakeholders, with the existence of many more expectations and priorities. Therefore, the engagement process appears to be more complex in SEA-HMM involving many more meetings than the SEA of the MRB.

With scenario analysis, with the participation and policy analysis, both TMRB-SEA and SEA-HMM can anticipate policy priorities, identify existing risks and opportunities, understand relationships between various factors and can set conditions and guidelines for a more sustainable development of the basin, with the strengthening of institutions and the creation of new organizations that promote integrated management. Scenario analysis is much more detailed and complex the SEA-HMM which also suggests the greater complexity inherent in this basin and SEA.

Both SEA grab the complexity through uncertainty reduction mechanisms; through the integration of environmental, social and economic issues; through its flexibility and consideration of continuous adaptation in accordance with the results from monitoring and evaluation.

## **4.2 Discussion**

In the literature review, the major strategic aspects relevant to IWRM on a transboundary level identified

were: governance; price of water; and water use / land use. In both case studies, relevant strategic aspects settled in governance and water use / land use. In both SEA the price of water is not addressed as a strategic aspect which may be due to the fact that countries covered by the SEA are developing countries, with populations in situations of extreme poverty, especially in countries of the Mara River Basin.

Uncertainties identified by the SEA-TMRB that stand out were: insufficient understanding of relations between Plans and Programs Policies (PPP) for whom that implements; and the size and urgency of the challenges and the best way to deal with them. Also issues related to absence or excessive breakdown of data makes it difficult to analyze the situation. Making a simple exercise of comparing uncertainties of the process of TMRB-SEA, with the uncertainties addressed by (Keur et al., 2008) related to the cyclical process of IWRM can note similarities to the inherent uncertainties and evaluation of the present situation and future due to some unavailability data; and also the uncertainties related to the institutional frameworks and political systems. In SEA-HMM there are uncertainties associated with the construction of these infrastructures, the extent and exact nature of the environmental and social damage, the environmental and social damage itself, the divergence of opinions in choosing the option from stakeholders, uncertainties in projections of demand energy, uncertainty to the extent and distribution of benefits, among others. In simple comparison with the sources of uncertainty addressed by (Keur et al., 2008) related to the cyclical process of IWRM, there seem to be many uncertainties regarding the analysis of the future situation and in relation to different interests and perceptions by the stakeholders. All the uncertainty reduction mechanisms identified in the literature review are taken into account in both SEA although adapted to each situation (e.g. as already mentioned the existence of more meetings in SEA-HMM than the TBRM-SEA).

Both SEA allows to help in the decision making within these complex systems, managing both to access the strategy, considering the complexity inherent to transboundary basins through the integration of environmental, social and economic issues, by considering the continuous adaptation; and by uncertainty reduction mechanisms. Thereby SEA seems to acquire a great importance as auxiliary tool for IWRM in transboundary context.

## **5. Conclusions and Recommendations**

Complex systems, in general, are characterized by lack of predictability, the existence of networks of connections and non-linear relationships, the interactions between the parties, by uncertainty, existing emerging unpredictable results - patterns. In a complex system of a transboundary river basin, priorities and issues assume different levels in each region, state and basin, with an added importance to participation from stakeholders, which allows to obtain practical answers regarding problems, which foster the cooperation and that can identify opportunities through their experiences and putting new practices in order to improve the system itself.

The major problem that exist regarding to water resources is its scarcity, its physical unavailability in terms of quality and quantity as to its uneven distribution across borders. Being essential to life and transversal to any question of our planet, IWRM plays a key role in integrating environmental dimensions, economy, social issues, participation and governance in order to be a sustainable use of water resources.

The relevant strategic aspects in IWRM are key aspects in the management of water resources, which not only relate to them, as with the multiplicity of factors in this management, having the greatest potential for

change, to amend unsustainable patterns. In this sense, in the transboundary context, the key strategic aspects of IWRM appears to be governance; the price of water and water use / land use. The first - governance - has the greatest potential of conditioning the way people uses the water. It is governance that makes the decision, being essential to be a good governance, with cooperation of the different riparian states. The strategic allocation of a water price has the potential to slow the rate of growth of demand and educate people to the real value of water and its scarcity. Water use / land use also assumes is also a strategic aspect since it is a conditioning aspect. Infrastructure development associated with agriculture activities, among many others activities affect ecosystems and populations dependent on these resources.

In the context of IWRM, SEA, if applied taking into account its strategic potential, plays an important role as an auxiliary tool in this process, since verify preference to perceive relations, to have a more holistic view than actually focusing on decentralized unit; and also in the search for patterns in order to be able to give answers that allow the setting of the next steps. The attempting to meet strategic environmental assessments of transboundary basins revealed that this is a poorly implemented process in this context, being scarce. Still, in the two case studies it was noticed that the SEA with strategic approach strongly consider participation, allows to prioritize information, takes into account the complexity and uncertainty of the basin, takes into account the monitoring in order to adapt the way, focuses in the strategic aspects and seeks to heavily assist the decision making process and promote cooperation between all institutions.

The reality is that there is no panacea when it comes to water management. What we can understand is that in order to achieve integrated management of transboundary water resources, inevitably there must be cooperation between the different riparian states, it is essential that the plans, strategies and decision making are performed jointly, with an iterative implementation, adapting the strategic options along the way, so as to achieve more sustainable use of water resources, taking into account the complexity of such systems and, in that sense, the strategic environmental assessment can play a key role.

With this thesis, it is found that SEA stands out as an assist tool in transboundary IWRM, accessing the strategy with consideration of the complexity and uncertainty inherent in a transboundary system and therefore its management, thus supporting decision making. In the future, it seems extremely important for sustainable development of water resources, both execution of more detailed studies about the complexity and the way to deal with it; as the disclosure of the potential of SEA with strategic approach in IWRM across borders for this process to happen more in transboundary river basins.

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