

## Water Resources Management Public Policy Evaluation: a Propositive Model from Brazilian Legal Context

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### ABSTRACT

This study proposes a conceptual model applied to water resources management for assessing environmental management policies according to sustainable development principles. The main premise is that public policies have a natural cycle of design, regulation, implementation and evaluation, to achieve their institutional objectives. Institutions involved in politics are conditioned by the cultural environment, so that institutional performance is influenced by subjects and standards behaviors, physical parameters, and in turn, can orient institutional change. These elements define the criteria for efficiency assessment under a measure of sustainable development and in accordance to Integrated Water Resources Management (IWRM) methodology. Based on literature, documents, case study and by applying the deductive method, Brazilian National Water Resources Policy (1997) is analyzed, especially for groundwater industrial user's rights in the lower course of Paraíba River Basin, Paraíba, Brazil, located on a semi-arid region. Through the establishment of qualitative and quantitative analysis, the generated model was calibrated at institutional and environmental levels with data from the case study. The generated metadata were used to compose the indicators that feed the model. This model allows a perspective of IWRM application, providing objective results on the efficiency feasibility assessment of environmental and water management public policies

**Key-words:** Water resources management, indicators model, public policies evaluation, institutional change, sustainable development.

### 1 GOVERNANCE AND INTEGRATED WATER RESOURCES MANAGEMENT (IWRM): A PRELIMINARY CONCEPTUAL APPROACH

The institutional treatment of water resources in Brazil is the greatest expression for a specific regulatory framework contained in Federal Law No. 9.433/97, that defined the Water Resources National Policy (WRNP) parameters. The WRNP innovated by introducing new principles and management models with essentially participatory sense, establishing therefore the parameters of water governance in the country.

The concept of water governance involves the political, economic, and social institutions by which governments, civil society and the private sector decide on how best to provision of water resources for the use, development and management (Tropp, 2004; ROGERS and HALL, 2003). The first experiments in this direction were observed, however, in São Paulo since 1991, where some of the elements of that law could now be put into practice (ANT-JONHSSON, 1998; CAMPOS, 2009). This concept has been widely exploited in order to provide the participation of social actors concerned (stakeholders) in decision making about the use of

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natural resources, global levels, regional and local. Have a system of governance can be characterized as an institutional arrangement designed to perform the functions of governance in a society and for a specific purpose.

Mota et al. (2008) offer insight from the global scenario, on the establishment of international environmental governance, determined by "all the agreements, covenants and international standards, which seek to articulate a comprehensive environmental policy proposal" for stakeholder participation in the discussion and definition of environmental policies.

Newig and Fritsch (2009) provide a theoretical exploration on the measurement of the effectiveness of such participation with respect to environmental compliance and consequent efficiency of the performance of the institutions responsible for natural resource management.

The management of water resources, in terms of Law 9.433/97, is delegated to the River Basin Committee (CBH) created within the meaning of subsidiarity that rule to allow decentralized decision making at the local level, with participation of system users, government and civil society (BRAZIL, 1997; GUIMARÃES and Ribeiro, 2007). A discussion of the effectiveness of this popular participation requires analysis focused on three levels this collegiate action, with evidence to highlight the elements inherent in such participation in the global institutional context.

The idea of IWRM governance and its philosophy has been widely discussed, not only to promote clear institutionalization in Brazil, but especially regarding the possible asymmetries of power deficits caused by poor representation of social groups (WARNER, 2005; SOARES, THEODORO and JACOBI, 2008). The presence of the decisions at the lowest levels, with the management process based on 'command-and-control' strategy replaced by current participatory national model, was a significant gain to the participatory decisions improvement (FARM and WARNER, 2006; GUIMARÃES and XAVIER, 2008).

By attracting the focus of research in a water resources methodology based on IWRM governance, with the involvement of multiple social actors, we expected to expose some apparently evidenced inconsistencies, contradictions, and incompatibility issues that the practice has caused in the execution of environmental water management policies.

The presence of entities like the River basin Committees is indispensable in the given context analysis and reports an element of politicization of water resources management (Jacobi et al., 2009), which can be assessed as possibly relevant factor in the measure of effective public policy.

## **2 SUSTAINABILITY AND GOVERNANCE INDICATORS IN WATER MANAGEMENT**

The general idea of sustainability is related to a phenomenon that has multiple dimensions, such as: environmental, social, economic, legal, cultural, political, historical and psychological, and the main premise of this investigation is that societies can take different paths to development and satisfaction of their material needs involving the natural resources use. The presence of the social element reinforces the need for cultural systems that allow for the regulation and control of this phenomenon.

The attempt to formulate a concept of sustainable development is related to a model of development and use of natural resources that provide future generations the opportunity to enjoy the environment, like the present. However, because it is a complex and dynamic concept, despite the references to national legal theme (Guimarães, 2008) it is necessary to use instruments that will enable scaling the uses of these resources, especially for operational decision criteria and their management (VAN BELLEN, 2005).

Sustainable development and governance of water are used today as a reference institution in the global development agenda with sustainability. The rise of Governance in areas of water management, however, comes from an old concept that dates back to the medieval period in Europe, and currently earns strengthening the implementation of Brazilian water management

policies. However, the processes (decision-making) with popular participation require information accessible to non-technical and management strategy to cover a process that is intensely social and political, and that goes beyond the relationship between society and government, as well as require interaction of values and norms between public and private institutions. The use of tools to provide useful information for decision may ultimately help the quality of participatory processes proposed by the water policies. The information about the processes and their effectiveness is indispensable to be done about the control of management tools (GUIMARÃES and XAVIER, 2009; JACOBI et al., 2009). For the control of efficiency, complementing the cycle of creation, implementation, evaluation and revision of public policies, the use of indicators models facilitate the reporting process and provides suitability for the adoption of IWRM methodologies. Within the aspects mentioned, the evaluation of the management process is critical to the achievement of policy proposals for IWRM. Evaluation instruments are especially relevant to know the functions that are performed [...] beyond the technical aspects, the analysis of political conditions is also of fundamental importance (CAMPOS, 2001).

The assessment, together with the revision, becomes the final phase of the implementation of specific policy and should consider, in the case study, the largest number of possible constraints on the scope of IWRM methodology, which comes against the need for incorporation of concept of governance in this process. It must be noted the incipient state of sustainability indicators adoption, especially in the measurement of the public policies efficiency (MAGALHÃES Jr., 2007; Vrba et al, 2006; Januzzi, 2004). The production of more comprehensive measures suggests the aggregation of information from as many dimensions as possible for planning purposes management policies. The assignment of a model of indicators, quantitative and qualitative, for incorporation of a philosophy based on IWRM and sustainability assessment of management policy, has been meeting this need.

### 3 MECHANISMS OF POPULAR PARTICIPATION IN WATER MANAGEMENT: THE RIVERBASIN COMMITTEES

The traditional approach to water resource management led to little or nothing to concern with the results of public policies and their effects on society. A systematic evaluation of public policies had increased in Brazilian 90's, with social actors participation and allowed to assessing the adequacy of the models proposed to lawfully reality of implementation, in the pursuit of efficiency and sustainable development goals.

The Federal Law No. 9.433, from January 1997, instituted the water as a limited natural resource with economic value. This statute has emerged in the period in which economic instruments were highlighted in relation to alternative to the "command and control" regulation. This law is based on the following grounds: "Water is a public good; water is a limited natural resource with economic value; the management of water resources should always provide the multiple use of water;" (BRAZIL, 1997). This same law created institutional mechanisms for participation of citizens and communities of water users, including their representatives in the National Council on Water Resources (CNRH) and River basin Committees (CBH) to establish the need for popular representation in water management. In its Article #1: "The management of water resources should be decentralized and rely on the participation of the government, users and communities." The River basin Committees are collegiate bodies with regulatory powers, deliberative and consultative to be exercised in the watersheds of their area of expertise and should work with parliaments as representatives of different sectors of society and government. The need for management of distinct users' interests in their respective water demands provides a potential situation of conflict, it lacks tools for analysis and control of many aspects of availability and potential water use, managed at the CBH level.

#### 4 SUSTAINABILITY INDICATORS APPLICATION IN WATER MANAGEMENT: A BRAZILIAN CASE

The evaluation of environmental public policies has become a recognized tool in the field of institutional assessment (MICKWITZ, 2003). The institutional model is one of the possibilities of instrumental adoption regarding the evaluation of public policies, and provides features such as the relationship between the governmental entities and certain policy, formulated, established, implemented and made meet by public institutions accountability. According to Dye (2009) defines that the first characteristic of a public policy is the legitimacy conferred by the home law and institutions and that part of the participatory democratic process coming from the legislative process, since its origin, and its legal nature, which compels compliance by the citizens. The second feature is universality, placed by targeting all people in society and coercion, as third feature, which allows government institutions to impose penalties for the breach of legal requirements and violation of public policy.

Antunes et al. (2009) point out that although there is a solid definition of governance, especially for IWRM, there is a lack of management tools and methodologies, especially in the river basin level, with involvement in participatory processes. The contribution of the election of methodological strategies for coping IWRM involves the aggregation of information useful for decision making. In contributing to the adoption of this mechanism of creating useful information to decision-making, the main feature of the use of indicators as elements of measurement of efficiency conditions systems is analyzed with the desirable simplicity and direct form of presentation when compared with other forms of presentation of information, intentionally to be accessible to all kinds of public.

The indicators can inform a given situation, but also can convey the idea of a perception of a trend or phenomenon not detected immediately (HAMMOND et al., 1995). This factor brings relevance to the process of decision making in public policy.

#### 5 STRUCTURE OF THE MODEL FOR EVALUATION INDICATORS

The compatibility between the aspects of sustainable development and environmental protection needs to be taken into account for the establishment of a methodology that provides the Integrated Water Resources Management, considering a conceptual framework covering institutions (state model, standards management) and institutional change, their interactions with the procedures and management policies and sustainable development (environment and qualitative development) (Figure 1).

Figure 1 - Conceptual framework of public policies on water management.



The processes of developing and deploying models and management policies founded on institutions (norms and regulation) needs to be guided by sustainable development principles, which in turn involve economic, social and environmental justice and equity.

The theoretical framework selected considered personal observations, reading legal documents, project reports and research results publications, websites and institutional organs of national and international research that guided the preparation of the conceptual model. As part of the process of bringing the model, the procedures included a survey existing models in national and international experience and institutional data collection targeted to the industrial user of groundwater in the state of Paraíba, located in the Sedimentary Basin region comprised Coast Paraíba – Pernambuco, in the Northeastern Brazil.

The United Nations Program for Development (UNDP) excels by adopting the similar scheme, and provides a support system (UNDP / CAP-NET, 2008) in policy evaluation which uses indicators that can be adapted to a methodology IWRM, to consider the following dimensions: water allocation according to multiple uses, pollution control, qualitative and quantitative monitoring, planning-level watershed, economic and financial management and information management for decision. The dimensions established for IWRM and their meanings are (UNDP / CAPNET, 2008):

- **One.** Granting water: water allocation for priority uses, maintaining minimum levels for social and environmental uses while maintaining fairness necessary for the development of society;
- **2nd.** Control of pollution: pollution management with application of the polluter pays principle and promoting incentives for reducing pollution problems most relevant to minimize the social and environmental impacts;
- **3rd.** Monitoring: Implement effective monitoring for production of essential information for management, identifying violations of rules and regulations and permits;
- **4th.** Planning-level watershed: prepare and update the watershed plan incorporating views of stakeholders on the development and management of the priorities of the basin, using them to inform the review of plans for the basin;
- **5th.** Economic and financial management: application of economic and financial instruments for cost recovery and promotion goals to stimulate equitable and sustainable gains for society by use of water;
- **6th.** Information management: Provide data needed to promote transparent decisions based on information, to promote sustainable management of water resources of the basin;
- **7th.** Social participation: Implement stakeholder participation as the basis for the decision, taking into account the best interests of society and the environment in the development and use of resources in the basin.

In considering these theoretical approaches lifted, there were established metadata indicators to substantiate the selection of this evaluation model and carried out a preliminary application of them. According to the results of the application in the studied region, the model allowed an assessment of the current management policy by defining levels or degrees of efficiency according to the criteria mentioned above:

- No meets: Most indicators are not satisfied;
- Partial meets: average of indicators meets the IWRM strategy;
- Meets: Most of indicators meet the IWRM strategy;

The selection of the study area and subsequent categorization of industrial water users in the survey was done according to a combination of elements of their river basin districts. It was considered the unit of management by basin and its respective CBH, the local management entity for excellence, as outlined below.

## 6 THE SPACIAL CHARACTERIZATION

The Aquifer System Paraíba-Pernambuco (PB-PE) system is the largest and best water potential of the State of Paraíba and occupies an area of approximately 3,400 km<sup>2</sup> in the coastal region, located east of the country. Due to the intense economic movement in the region, favored by the intensive use of groundwater sources beyond subsistence, the study was limited in this portion of the Coastal Sedimentary Basin (Figure 2).

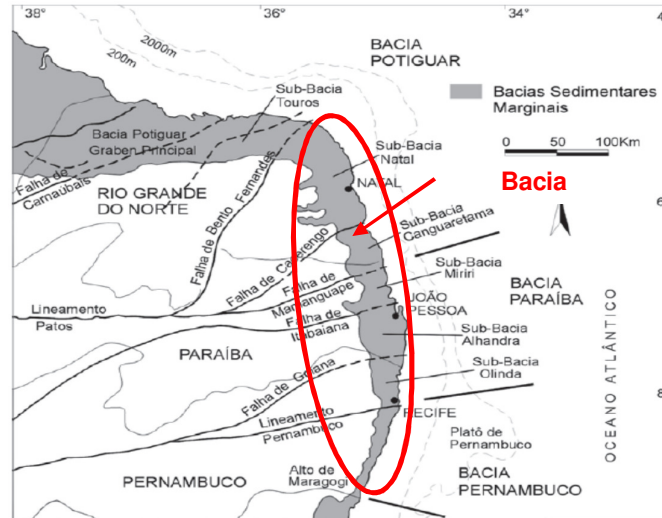


Figure 2 - Coastal Sedimentary Basin Paraíba -Pernambuco, Brazil.  
Source: PB-ASUB, apud Barbosa et al, 2003)

Originally, the model was applied considering two dimensions: the institutional and environmental. Here we report, for the purposes of this study, the results of applying the model in the institutional dimension, the criteria for the grant of water.

## 7 AN INSTITUTIONAL DIMENSION MODEL

The production of metadata, application of the model and preliminary analysis regarding the institutional dimension, is based on the intersection of data and information in the records of government agencies responsible for managing water resources in the state of Paraíba, Brazil. This dimension considers data relating to the granting of use of water resources for industrial activities with groundwater use in the region delimited. Within the delimitation proposed methodology and inputs were obtained, then explained, such as the criteria of granting water.

The criteria for the granting of water is based on some definition of efficiency indicators, which are: i) Number of users of groundwater regularized(formalized); ii) The second criteria includes water use efficiency, best practices (reuse) and economic and social objectives, iii) The third criteria regards respecting zoning areas; iv) There is monitoring of the groundwater use.

For the indicator "i" (Number of users of groundwater regularized with grants issued and valid) data from the managing agency of users, provided the information for analysis and application.

The Region of the Lower Rio Paraíba course, represented by Paraíba CBH, is characterized by intensive use of groundwater in industrial activities, the example of the ceramic industry, exploitation of mineral water and agribusiness facing sugarcane production. It has in total, ie, without differentiating users of groundwater and surface water, 863 registered users, 154 users granted, 88 in the process of granting users and 308 users with grants won (EFSA, 2009). Therefore presents the highest absolute number of industrial units in the state, registered users

of groundwater. According to historical data obtained for the Region, in 2008, the percentage granted to the industrial sector, with the use of well water presents seemingly insignificant in relation to other uses, a percentage bordering the 7%. However, this data might mean, hypothetically, poor institutionalization of the managing agency for this user segment at the time. Since the implementation of the grant in Paraíba, in 1998 until mid-May 2008, 64 were processed in managing agency processes related to groundwater in the region of the Lower Course of the River Paraíba. Of the total volume until then granted to the industrial sector of the Paraíba River Basin, was 97.33% in the Lower Paraíba, most industrialized area, and 2.67% in other river basin (High, Medium and Taperoá). The current scenario of institutionalization indicates an increase in the absolute numbers joined the managing agency (EFSA, 2010a). In 2010, through the end of May, the amount awarded to the industrial user of groundwater in the study area is 1.12733,00 m<sup>3</sup> / year, with 25 grants within validity. The evaluation of the application of the model, according to the criteria and proposed objectives can be summarized by the following table (Table 1):

**Table 1 – Summary of the model application for granting water criteria.**

EFICIENCY INDICATOR	CRITERIA ATTENDANCE		
	NO MEETS	PARTIALLY MEETS	MEETS
1. Number of groundwater users that are regularized (formalized)		X	
2. The award criteria includes use efficiency, best practices (reuse) and economic and social objectives	X		
3. The criteria respects the zoning area	X		
4. There is monitoring of groundwater use	X		

Considering that for an IWRM process efficiently, it is necessary to provide clear information that minimize the asymmetries of power and provide conditions for promoting accountability, by offering more information about the water management processes, generating greater opportunities for control efficiency in the public policy, according to participatory assessments.

#### 4 CONCLUSIONS

For the defined criteria as part of the institutional dimension of the model, in the 4 indicators assessed, 3 received the review "does not meet", and 1 "partially meets". This assessment revealed a degree of efficiency that is considered low, with most indicators-not satisfied.

The application of the model, considered the institutional dimension, revealed a low level of efficiency, with most of the criteria evaluated unsatisfied, in whole or in part.

Whereas IWRM philosophy placed as an assumption of analysis, even if the institutional evaluation had reached a high degree of efficiency, a low average degree on the environmental dimension revealed negatively policy evaluation, since it does not reached the institutional objectives of environmental protection and increasing sustainability.

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