Analysis of the governance and integration of information systems for water management in the state of Amazonas

Análise da governança e integração dos sistemas de informação para a gestão das águas no estado do Amazonas

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1 INTRODUCTION

It is estimated that 97.5% of the water on the planet is salty and 2.5% is freshwater, and only 0.007% of freshwater is suitable for human consumption, the rest being found in glaciers or in underground waters that are difficult to access (Machado, 2003). Brazil is a privileged country, for it holds 12% of the world's surface fresh water (DAEE, 2006). However, it presents distinct situations caused by: irregular distribution of water resources, waste and degradation caused by domestic and industrial pollution (NUNES, 2009).

The National Water Resources Policy, also known as the Water Law, was established by Law 9433/1997, and was a milestone for the regulation of water resources in Brazil. Its preamble states: "It establishes the National Water Resources Policy, creates the National System for the Management of Water Resources" and among its determinations states that the hydrographic basin is the territorial unit for the implementation of the national water resources policy. Among the law's guidelines is the regulation of the CBH (Hydrographic Basin Committees), whose competencies include arbitrating conflicts related to the use of water and establishing charging mechanisms for the use of water resources.

Law 9433/1997 also established the National System of Information on Hydric Resources (SNIRH), with the objective of gathering, consolidating and disseminating data and information on the qualitative and quantitative situation of hydric resources in Brazil. In addition, the SNIRH must keep permanently updated the information on availability and demand of hydro resources throughout the national territory. A central management instrument capable of providing subsidies for the elaboration of Water Resources Plans, the classification of water bodies into classes, the granting of water resource use rights and charging for the use of water resources and compensation to municipalities.

Despite the legal provision that the data generated by the participants of the National System of Hydric Resources Management be integrated to the SNIRH, many states still do not have an information system focused on hydric resources. The lack of an information system focused on hydric resources prevents consistent evaluation and, consequently, decision making based on physical data of quality and quantity of hydric resources, from the granting of concessions, where there are countless variables and many uncertainties (AZEVEDO et al, 2003).

For the full exercise of the committees and other entities that manage water resources, it is necessary to have an IWRMS to support decision making with accurate data and information, preferably in real time, on all the parameters of the respective basin, such as quantitative and qualitative parameters and the uses already established in that basin.

2 OBJECTIVE

To conduct an analysis on the governance of water resources and the integration of information systems in the State of Amazonas, aiming to understand the current scenario of water management and identify opportunities to improve the information systems.

3 METHODOLOGY

To analyze the governance of hydric resources and the integration of information systems, the State of Amazonas was selected due to its extensive river network and the presence of the largest hydrographic basin in the world. Bibliographic research was carried out in order to identify the publications on the subject. Also studied was the

legislation that deals with the systematization of the organization of the management of hydric resources.

Furthermore, a research was carried out in governmental websites of the State of Amazonas in order to identify a direct or indirect system of information about hydric resources and compare, in a synthesized way, the organization with the other States of the Federation. In this sense, it is important to conceptualize what an information system is within the scope of technology, aiming to understand the results of the research.

Information Technology (IT) is the set of non-human resources dedicated to the storage, processing, and communication of information, and the way these resources are organized into a system capable of performing a set of tasks (LAUDON and LAUDON, 2016). IT is not restricted to equipment (hardware), programs (software), and data communication. There are technologies related to IT planning, systems development, software support, production and operation processes, and hardware support (STAIR and REYNOLDS,2017).

According to Peter Drucker (1999), information is a set of data endowed with value and purpose, and the meaning that is attributed to the data or combination of data requires human analysis and interpretation. Although data is static and information is dynamic, there is an even more significant difference between them. Whereas data is just a record, information supports decision making.

Figure 1 - Data to Knowledge Adapted from Davenport and Prusak

Source: Davenport and Prusak, 2000

Figure 1 is about the process from data to knowledge. Data itself are base elements, which serve as a basis for generating information through the process of categorization, correction, calculation, and contextualization. Information is already given with

semantics, which can be used for understanding an environment of a scenario. The information continues in the process of connection, comparisons, relations and results up to the knowledge stage, as can be seen in figure 2.

Figure 2 - Input, Processing and Output - ANA Manual

Source: ANA (2022)

4 DEVELOPMENT

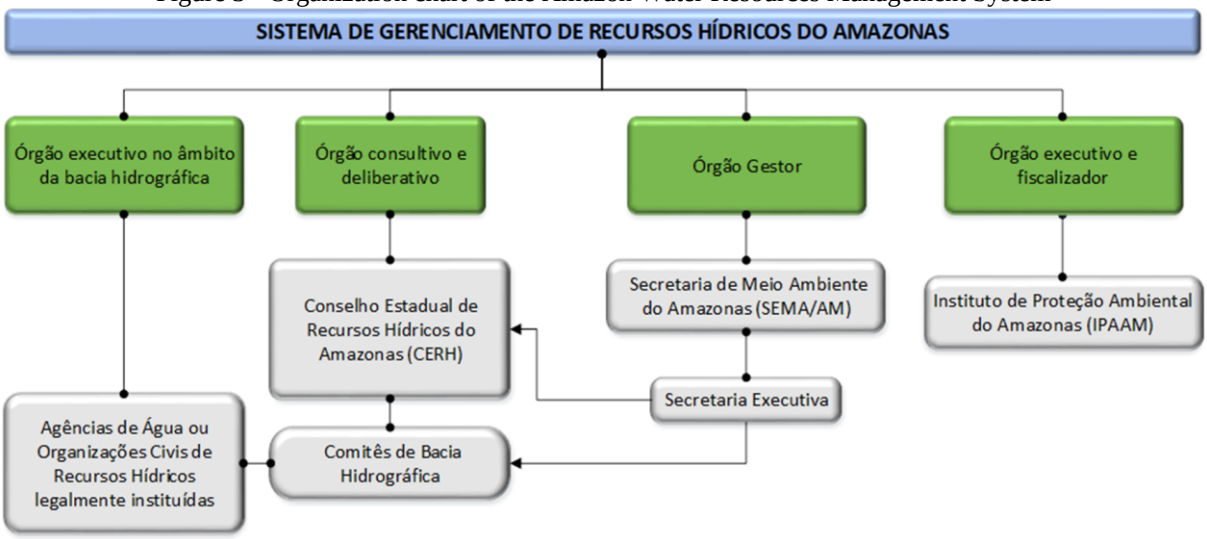
According to data from ANA, the State of Amazonas has a State Policy for Water Resources and a State System for Water Resources Management managed by law no. 2.712/2001, which also provides for the conservation of the natural balance of groundwater. Law 3.167/2007 amends Law 2.712/2001 and Decree 28.678/2009 regulates Law 3.167/2007.

The Amazonas State Council of Water Resources (CERH/AM) was created by Decree 25.037/2005 and there is a State Fund of Water Resources instituted by Law 3.167/2007 that has not been implemented yet.

The State Plan for Water Resources is still under preparation and the managing body for water resources is the State Secretariat of Environment (SEMA), created by Law No. 3590/2011. The Instituto de Proteção Ambiental do Amazonas (IPAAM) is the executing agency of the Water Resources Policy.

Despite the vastness of the water resources in the state of Amazonas only two committees were installed: the Tarumã basin committee and the Puraquequara basin committee. In figure 3, it is possible to analyze the organization chart of the Amazonas Water Resources Management System.

Figure 3 - Organization chart of the Amazon Water Resources Management System



Source: Santos (2022)

Within the research, it was possible to identify that the Amazonas Information System of Hydric Resources (SIRH-AM) is not a platform with data and information related to hydric resources, as is the case of São Paulo, for example. Therefore, it is an indirect system, since the management of Hydric Resources is shared by two State public agencies, which in this case is the State Secretary of the Environment (SEMA) and the Institute of Environmental Protection of Amazonas (IPAAM), which is the executing agency of the Hydric Resources Policy.

Browsing the SEMA website (https://meioambiente.am.gov.br), it is possible to find in the options a link (http://meioambiente.am.gov.br/conselho-estadual-de-recursos-hidricos/) to the State Council of Water Resources. This deals with data on the Internal Regulations, current Calendar, and approved minutes from previous years (2016 onwards).

Still within SEMA's website, in the accessory part, there is a link (https://meioambiente.am.gov.br/assessoria-de-recursos-hidricos/) that deals with the Advisory Office of Water Resources and Solid Waste. Within the content of the page, there is a subdivision with links to issues related to water resources, as listed below (SEMA, 2023):

- PROGESTION
- PROGESTION II
- STATE WATER RESOURCES PLAN
- STATE WATER RESOURCES COUNCIL

- SITUATION ROOM
- WATER RESOURCES MANAGEMENT REPORT 2019
- WATERSHED COMMITTEE
- LEGISLATION
- TECHNICAL TEAM

Browsing the site (http://www.ipaam.am.gov.br) of the Institute of Environmental Protection of the Amazon - IPAAM, it is possible to observe that it is a well structured portal with visual aspects and accessibility. Within the system there are several forms available and systems with online functionalities such as, for example, to request the allocation of water resources or a fishing license.

Navigating through the IPAAM portal we will find the link (http://www.ipaam.am.gov.br/gerencia-de-recursos-hidricos/) that will direct us to the Water Resources Management - GERH. It is an administrative management within IPAAM that has the following responsibilities:

- Licensing, monitoring and controlling activities related to the use of Water Resources;
- Analyze the requests for granting the right to use water resources;
- Analyze plans, projects and studies related to environmental licensing.

But the GERH link has no information and no links to data on water resources. And to find data on water resources, it is necessary to navigate the portal between many tabs, and more objective data can be found in the link (http://www.ipaam.am.gov.br/estatisticas-ipaam/) that deals with IPAAM statistics.

In researching the other states, it was possible to identify that only 10 (ten) have information systems for the management of hydric resources directly: São Paulo, Minas Gerais, Rio de Janeiro, Paraná, Rio Grande do Sul, Santa Catarina, Bahia, Pernambuco, Ceará and Goiás.

5 CONCLUDING REMARKS

The information about water resources is divided, one part is at SEMA and the other at IPAAM. In view of what was presented, no systemic evidence was found that it is possible to identify that the websites of these agencies share or centralize the

information. And since this integration does not exist, the generation of data with the purpose of generating subsidies for decision making is impaired, since it becomes expensive to navigate through two sites in order to find the necessary information.

Since there is no integration, a possible solution would be to implement an *Application Programming Interface* (API). Aiming at the integration of SEMA and IPAAM sites. This integration through API would happen without the need to change the sites, and the data would already be available in a systematized way and directed to support decision making. In addition, with API the scalability curve would be lower, facilitating the aggregation of information from other agencies or monitoring systems.

It can be concluded that there is still a lot to be developed in the state of Amazonas regarding Information Systems for Water Resources, in view of the fact that besides the governmental bodies, there is still the integration of information from the Basin Committees, which, despite having only two functioning in the State, there is the expectation of implementing new committees.

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