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Original Article

Bitury dam, in the Ipojuca river hydrographic basin, in the state of Pernambuco: approach in the light of water governance

O açude do Bitury, na bacia hidrográfica do rio Ipojuca, no estado de Pernambuco: abordagem à luz da governança das águas

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Abstract

Purpose: The study proposes to analyse the water governance process of the Bitury weir, located in the Ipojuca river basin, in Pernambuco.
Design/methodology/approach: A methodological approach with qualitative predominance was used, guided by comprehensive paradigms. It was an exploratory and descriptive case study, with the research corpus consisting of: (i) bibliographical and documentary research and (ii) semi-structured interviews. The Bitury weir, located in the hydrographic basin of the Ipojuca river, in Pernambuco, was adopted as a reference space for the research. The interviews were carried out with 10 subjects, from October 2020 to February 2021 and were treated through simplified content analysis — defined a priori and based on the OECD principles for water governance — were grouped into three dimensions: "effectiveness", "efficiency" and "trust and commitment".
Findings: The roles and responsibilities of the management bodies are clear, however, the management practices are not compatible, in their entirety, with the local conditions of the hydrographic basin; the actors demonstrate to have technical skills and the data and information produced prove to be consistent, but the application of financial resources in the basin is deficient; and water allocation is carried out in the management of the weir, however, greater transparency and involvement of the actors is needed, as well as expanding inspection actions.
Practical implications: Conception and implementation of public policies to face the challenges related to the management of water resources.

Originality/value: The study contributes to the improvement of institutional models of water governance, based on knowledge of the water resources management model in force and the proposal for adjustments.

Keywords: Governance; Water resources; Hydrographic basin

Resumo

Objetivo: O estudo se propõe a analisar o processo de governança da água do açude do Bitury, situado na bacia hidrográfica do rio Ipojuca, em Pernambuco.
Desenho/metodologia/abordagem: Foi utilizada uma abordagem metodológica com predominância qualitativa, norteada por paradigmas compreensivos. Tratou-se de um estudo de caso exploratório e descritivo, sendo o *corpus* da pesquisa constituído de: (i) pesquisas bibliográfica e documental e (ii) entrevistas semiestruturadas. Adotou-se como espaço referencial da pesquisa o açude do Bitury, situado na bacia hidrográfica do rio Ipojuca, em Pernambuco. As entrevistas foram realizadas com 10 sujeitos, no período de outubro de 2020 a fevereiro de 2021, e foram tratadas por meio de análise de conteúdo simplificada. As categorias de análise — definidas *a priori* e tomando por base os princípios da OCDE para a governança da água — foram agrupadas em três dimensões: "eficácia", "eficiência" e "confiança e compromisso".
Resultados: Os papéis e responsabilidades dos órgãos gestores são claros, porém, as práticas de gestão não são compatíveis, em sua totalidade, com as condições locais da bacia hidrográfica; os atores demonstram possuir competências técnicas e os dados e informações produzidos se mostram consistentes, mas a aplicação de recursos financeiros na bacia é deficitária; e a alocação de água é realizada na gestão do açude, contudo, é preciso maior transparência e envolvimento dos atores, assim como ampliar as ações de fiscalização.
Implicações práticas: Concepção e implementação de políticas públicas para enfrentar os desafios relacionados à gestão de recursos hídricos.
Originalidade/valor: O estudo contribui ao aperfeiçoamento de modelos institucionais de governança da água, a partir do conhecimento do modelo de gestão de recursos hídricos em vigor e da proposição de ajustes.

Palavras-chave: Governança; Recursos hídricos; Bacia hidrográfica

1 INTRODUCTION

Water is an indispensable resource to the social-economical development of a nation, once it is essential for the maintenance of life and of people's well-being, in addition to being a needed supply to the agriculture — and, by consequence, to the food safety of the human civilization — to the generation of energy to the industrial activities, navigation, fishing and tourism, among others (Pinto-Coelho & Havens, 2016).

In Brazil, the inattention to water safety is particularly perceptible at city level, which demands immediate adjustment in the National Policy of Water Resources (PNRH) — Law n. 9.433, from 1997 —, in order to value the role of cities in the National System of Water Resources Management (SINGREH) and, in those, the PNRH itself (Nicollier, Kiperstok, & Bernardes, 2023).

However, the effects of the environmental destruction point to a crisis, whose signs are already noticed in the scope of water resources, from the pollution and amount of available water (Wolkmer & Pimmel, 2013). The excess exploration of water, associated to the misuse, have put the water crisis in the center of studies and researches and in government agencies.

In face of the possibility of scarcity of water resources in several regions of the world, the problem has been widely debated in national and international events, being recommended that countries adopt modern management principles.

In the scope of the GRH — which, according to Lanna (2014), consists of an activity based on the formulation of principles and guidelines, on the structuring of management systems and making decisions related to the promotion of the inventory, use, control and protection of water resources —, their intrinsic characteristics make it highly sensible and dependent on a governance system, supported on action that ensure the water management in a sustainable, integrated and inclusive form (Organization for the Cooperation and Economical Development [OCDE], 2015).

Each day more the process of water governance has been discussed by associating it to different governmental agents and social actions responsible for the management of water resources — GRH —, as well as for the institutions, rules and for the procedures of decision making process regarding the use (Campos & Fracalanza, 2010).

Several studies point to the water governance as one of the most relevant challenges to the improvement of the GRH, once the governance structures directed to the promotion of the multiple and sustainable use of the resource provide access to it and the implementation of policies, by the mediation of the shared responsibilities

between different *stakeholders* — govern, companies and civil society (Theodoro & Matos, 2015).

Likewise, the water "crisis" observed in certain regions, in such conjuncture, falls on the scope of conditioning factors – aspects related to the management, social-economical development, availability, increase of the demand, deterioration of the quality, sectorial management, among others — making Tundisi (2008) to defend the need of an integrated, systemic, predictive and decentralized GRH as an approach capable of promoting efficient solutions to the problem.

In the context of Brazilian semi-arid region — characterized by the heterogeneous relief, by the rain regime and even the soils — the GRH requires, undoubtedly, the use of the governance in the process of water management, in which it is centered, mainly, in the mediation of conflicts of interests related to the use of the resource, having as purpose the adoption of policies and practices which favors its sustainable use.

In other words, for the GRH to fulfill its functions in an assertive way, it needs to result collective and participant practices, which the interaction of different social actors is present — society, users and public power — articulated and supported by a governance structure that contributes to the strengthening of the democratic, integrated and shared management, which broadens the deliberative spaces and citizen participation, enabling the qualitative mode and the ability of the representation of interests and of the public response to the social demands (Jacobi, 2003).

By being a process that occurs in different levels and whose practical implications may be applied in govern, market and civil society entities, the water governance is indispensable to the GRH strengthening, in terms of the PNRH.

Considering that the legislation supports the participation of the civil society in the GRH, through the creation and broadening of the democratic spaces — having as principles the decentralized, integrated and participant management — structures and collegiate organisms started to play an important role in face of the countless challenges that involve water management and governance, as example of the councils

of water resources — in the national and state scope — whose functions may be of normative, consultative or deliberative nature; and the committee of the hydrographic basin, which are instances created to resolve conflicts regarding the use of the water, offering possibility of participation of the society in the local public policies of water (Law n. 9.433, 1997).

There are also the so-called management councils (CONSU), which are collegiate that act in areas of influence of a certain micro-basin or reservoir. In general, they are created to intervene in the Wild and Hinterland – once the rivers are intermittent and the available water is accumulated in dams and reservoirs (Water and Climate Agency of Pernambuco [APAC], 2020).

In the state of Pernambuco, in particular, there are 19 collegiate, encompassing 23 reservoirs. Among them, it is highlighted the Council of Users of the Bitury Dam — Consu Bitury —, non-profit entity that acts in the wild region of Pernambuco, in the cities fed by the Engineer Severino Guerra reservoir — more popularly known as Bitury Dam — located in the micro-basin of Bitury, fraction of the hydrographic basic of the Ipojuca river.

In face of the exposed, the present study proposes to analyze the process of water governance from the Bitury dam, located in the hydrographic basin of the Ipojuca river, in the state of Pernambuco. The area of the study was selected due to the fact that: 1) it encompasses a portion of the land correspondent to 3.49% of the extension of Pernambuco and where 25 cities are inserted; 2) it presents high climate and hydrological diversity; and 3) for being inserted in it the Bitury dam, which feeds Belo Jardim (PE) and other economically relevant semi-arid cities in the surroundings.

In addition, the study of water governance has as base, essentially, principles and guidelines recommended by the OCDE, international organization composed by countries that aim at promoting effective and sustainable economic, social and environmental policies in several areas of acting, among those here described.

Since 2010, the OCDE has been acting in the sense of proposing suggestions and good practices with the purpose of overcoming flaws in governance that end up

hindering the formulation and implementation of water resources public policies. Therefore, in 2015, it was proposed by it a group of twelve principles associated to three dimensions — "effectivenss", "efficiency" and "trust and commitment" — adopted as categories of analysis in this article.

2 REVIEW OF THE LITERATURE

The review of the literature presents definitions and basic concepts regarding the GRH and, within the scope that involves the theme, brings implications related to water governance.

2.1 Management of water resources in Brazil

According to Lanna (2014), the GRH is an activity that aims at promoting the inventory, use, control and protection of water resources, having as elements the policy of water resources, the plan of water resources, the management of water resources and the system of management of water resources.

In the Brazilian context, the GRH is supported by the Law n. 9.433, from January 8, 1997 – also called as The Water Law – which instituted the PNRH and created the SINGREH.

Regarding the fundamentals of the PNRH, the law establishes that the water is a public domain good, limited and gifted of economic value, whose priority use, in case of scarcity, should be for human consumption and for animal watering livestock; still, it establishes that the GRH should always provide the multiple use of water (Law n. 9.433, 1997).

In addition, the GRH is implemented by the adoption of the hydrographic basin – region that encompasses a territory and several water courses — as territorial unit for the implementation of the PNRH and acting in the SINGREH. The GRH should also be integrated, decentralized and rely on the participation of the public power, of users and of the communities.

Other devices are part of the Water Law, such for example the committee of the hydrographic basin (CBH), which is a forum in which a group of people reunite to

discuss over a common interest – the use of the water in a certain basin. Such instance, therefore, is part of the new way to make the PNRH, in a decentralized manner by hydrographic basin and having the participation of the public powers, of the users and of the organizations from the civil society (National Agency of Water and Basic Sanitation [ANA], 2011).

The committee of the hydrographic basins play a central role in the sustainable management of water resources, promoting the participation of the society in the decision making process related to water. Regarding such, Morais et al. (2018) highlight that such instances perform the participating and decentralized management of water resources in a certain territory, through the adoption of management instruments, negotiation of conflicts and promotion of multiple use of the water.

In addition to the instruments to the GRH, the national and state water policies and from the state of Pernambuco define their respective management systems, the roles of different actors and their participation the process of water management.

The GRH, through great part of the 20th century, was sectorial, centralized and focused on the solution of problems resultant from contamination or disasters. However, in the last two decades of this century, new initiatives started to be implemented in the legislation and institutional organization. The GRH has become more efficient, broader and more systemic, leading to a moderation of processes (Tundisi, 2013).

New mechanisms started to be recommended by the national policies and policies from Pernambuco from the GRH, among them, the "decentralized management" — which has the hydrographic basin as management unit – and the "participating management" — which takes into consideration the importance of the civil society's participation in the water management (Fracalanza, 2000).

The integrated management of water resources (GIRH) is a process able to promote the development and coordinated water, land and correlated resources management, in order to maximize the economical result and the well-being of the

population – equally – without compromising the sustainability of vital ecosystems (Global Water Partnership [GWP], 2000).

Another pilar upon which the GRH is founded in Brazil is the decentralization, which, according to Pereira & Formiga-Johnsson (2005), means the institutionalization, at local level — here, the hydrographic basin as unit of planning and management — of institutional, technical, financial and organizational conditions for the implementation of management tasks, according to the attributions designated in the PNRH, guaranteeing the continuity of the offer of goods and services flow.

Machado (2003), once, highlights that, among the purposes of the decentralization of the GRH, are: 1) to ensure the diversity of the interests of each segment in the decision processes; 2) to enable, by part of the citizens, greater inspection and control of the actions performed by the CBH; and 3) to produce and to become available to the society information regarding the committee and the GRH.

The PNRH brings the ideal of a GRH, in a way that it becomes integrated, decentralized and participative, having as landmark the decentralization regarding the creation of the CBH. However, beyond the stimulation to the democracy and a more efficient management, problems and challenges are also found.

Regarding the collegiate and participative management in the GRH, it is known that the management by hydrographic basins assume a crescent relevance, however, its processing, according to what is predicted in the PNRH, is still embryonic.

The dynamic of the collegiate enables the transparency and the permeability of the relations among the several actors – community, businessperson and organizations of the civil society – inserting the *stakeholders* in the process of the GRH, through channels of participation. Through a crescent participation of a plurality of actors and broadening of the participating mechanisms, it can advance towards the institutionalization of the social control. However, according to Jacobi (2009), the greatest challenge, still, is to ensure that such spaces are, effectively, public, both in terms of shapes as of their results.

The participation in the GRH also raise issues regarding to the structure of efficient methodologies, which assure a qualified participation of the civil society and, most of all, that ensure the satisfaction of broad segments, able to make efficient decisions and that break with limitations of the technical and specialized knowledge (Medeiros & Santos, 2009).

Regarding the management model of the Brazilian water, Campos & Fracalanza (2010) highlight as challenges to be faced: 1) to reach, in fact, the integration proposed in the PNRH, overcoming the fragmentation that resulted in the creation of several entities to manage water and its uses; 2) to overcome the resistance of several actors and of the own institutional arrangements created by old management models; and 3) to overcome the limitations of the process of technical and social negotiation, mainly due to the lack of the articulation among the entities of the GRH and city governments, as well as of communication and participation of the different actors involved.

2.2 Water governance in Brazil

The expression “governance” has been used for a long time and may be applied to different historical contexts and areas of knowledge (Cavalcanti, 2015). Therefore, many times, it acquires a mixed and polysemic character, being necessary clarification towards its conceptual aspects.

According to Camargo (2005), there is a distinction between the terms “governance” and “govern”, in a way that it is possible to observe cases in which there is governance without govern and vice-versa. Meanwhile “govern” indicates a formal authority, constituted by power of police, to ensure the implementation of public policies, the governance refers to the activities supported in common and shared purposes, which involve both governmental as well as non-governmental institutions, whose mechanisms of functioning require the approval by most of the actors.

In the organizational scope, it is also necessary to distinguish “management” from “governance”, once one is not interested in only executing a business, but in

directing the organization, supervising it and controlling the actions of the managers, satisfying the legit expectations through accountability and regulation, according to what is stated by Harrison (1998 as quoted in Slomski et al., 2008).

From a historical point of view, the term "governance" appeared in the international debate through reflections conducted, mainly, by the World Bank, with purposes of deepening in the knowledge of conditions that ensure an efficient State (Diniz, 1995).

In such sense, the financial institution understands the governance as the way through which the power is exerted in the management of the social and economical resources of a country, aiming at the development; it involves, yet, the ability of governments to formulate and implement policies and fulfill functions (Diniz, 1995).

Another definition of governance is presented by the Global Governance Commission (1996) and encompasses all forms by which individuals and institutions – public and private – manage their ordinary issues. In addition, it is about a continuous process of accommodation of conflicting and/or divergent interests and the fulfilling of cooperative actions.

The expression "water governance", still, appeared for the first time in official documents in 2002, in the National Water Policy from Quebec, in Canada. According to what was predicted in the normative instrument, the process of water governance takes into consideration multiple interests — economical, social, environmental and of health — having as purpose to apply principles of sustainable development and to ensure the well-being and quality of life to present and future generations (Québec, 2002).

The OCDE defines as water governance a group of policies, practices and processes – of formal and informal character – through which the decisions are taken, the interested parts may articulate their interests and have their worries considered, and the management organs are responsible for the water management (OCDE, 2015).

The water governance may be still considered an inter-dependent group of political, social, economical and management systems that regulate the development

and the GRH, as well as to the provision of water services, guiding the use of the natural resource to a desirable state (World Water Assessment Program [WWAP], 2009).

The water governance is associated to the ability of the social system to mobilize energies, in a coherent way, to the sustainable development of water resources. Advances in law and institutional regulations are not enough to surpass the challenges of the GRH, but, a construction of new landmarks that enable the interaction between policies, laws, institutions, civil society and service providers and users is necessary (Rogers, 2002). It is necessary to turn to the knowledge produced continuously by the nets and observatories, which dedicate themselves to approach the subject (Ferrão, Rando, & Braga, 2020) and, in addition, many times, to more innovative solutions (Empinotti et al., 2021).

In Brazil, there is a solid legal framework, gifted with modern foundation to the GRH, among which the decentralized management, which enables the participation of the public power — in different levels of acting — of users and of the society in general. In addition, the Brazilian governance system encompasses, as well as the federal scope, the federation states, in which different management institutions should harmonize their procedures, so that the GRH may be fulfilled in an integrated form (Pagnoccheschi, 2016).

Although the first landmarks regarding the process of water governance in Brazil go back to 1934, through the creation of the Water Codes – through the creation of the Water Code — Decree n. 24.643, from July 10, 1934 —, the main changes occur from the 1980's and 1990's decades, with the restructuring of the State and consolidation of the environmental legislation — Law n. 6.938, from August 31, 1981, which establishes the Environmental National Policy (PNMA). As follows, in 1997, the Water Law was published — Law n. 9.433, from January 8, 1997, which institutes the PNRH and creates the SINGREH — having as main foundation the decentralized and participative management of the water resources (Wolkmer & Pimmel, 2013).

Regarding the PNRH, specially, Jacobi (2010) states that the Brazilian legislation,

which previously was based in technocratic and authoritarian planning, started to gather as fundamental elements for water governance the decentralized management by hydrographic basins, the integrated management and the participative management.

However, despite Brazil having a system of water resources with a certain level of maturity, the reality of the country still faces great challenges, mainly due to: (i) embodying the heterogeneity of demanded solutions in a continental scale country; (ii) ensuring the effectiveness of the existing inspection mechanisms and governance; and (iii) ensuring the decision making process from the technical-scientific knowledge (Water Observatory, 2019).

At international level, it is known that the universe of water governance has been gathering heterogeneous knowledge — confuse and chaotic, it is natural — stimulating discussions and idiosyncratic and useful proposals (Ribeiro & Johnsson, 2018).

2.2.1 Public policies and water governance

Within the Brazilian context, considering that the water governance occurs from the delineation of the PNRH, and such, on the other hand, establishes an integrated approach to the GRH, being not possible a water governance system dissociated from the several public policies that are related, in a transversal and integrated form with the Law n. 9.433/97, as for example the Environmental National Policy (PNMA) — instituted by the Law n. 6.938/1981 —, the National Policy of Safety of Dams (PNSB) — instituted by the Law n. 12.334/2010 —, the National Policy of Solid Residues (PNRS) — instituted by the Law n. 12.305/2010 —, the National Policy of Environmental Education (PNEA) — instituted by the Law n. 9.795/1999 —, the National Policy on the Climate Change (PNMC) — instituted by the Law n. 12.187/2009 —, among others.

At a broader level, the water governance mechanisms receive influence from other mechanisms and from the actions of organisms that started to treat the theme and to recommend principles and guidelines considered essential to the outreach of an effective GRH, as for example the principles for the water governance, proposed by the OCDE.

Aiming at diagnosing and overcoming the main deficiencies and bad water governance practices, the OCDE proposes a group of principles, which are associated to three complementary and inter-related dimensions (OCDE, 2015): 1) efficiency, which involves the contribution of the governance to define clear and sustainable purposes and goals to water policies; 2) efficiency, related to the contribution of the governance to maximize the benefits of a sustainable water management and to social well-being; and 3) trust and commitment, which approach the contribution of the governance to reinforce the society's rust and to ensure the inclusion of the *stakeholders* through legit democracy and equity.

According to the OCDE, to improve the efficiency and to reinforce the trust and the commitment regarding the water governance, it is indispensable to be adopted, in a systemic and inclusive way, a group of twelve principles, which deal with: roles and responsibilities; proper scales; coordination among sectors; training; data and information; financial resources; regulation boards; innovation practices of water governance; integrity and transparency; commitment of the interested parts; balanced tasks and monitoring and evaluation.

3 METHODOLOGICAL PROCEDURES

For the production of this article, a qualitative-predominant methodological approach was used. Among the subjacent characteristics that allowed to classify its research as such, it can be highlighted (Creswell, 2010): 1) to occur in a natural scenario, enabling the research to be detail-oriented regarding the water governance process in the dam; 2) to be interpretive, including the description of the researched context and the data analysis and information to identify the theme categories and subcategories; and 3) to adopt the case study as a specific research strategy.

The research was guided by comprehensive paradigm, ensuring the better appropriation of the context in which the multiple social subjects were inserted (Guerra, 2006). It is regarding, still, of a study of a descriptive and exploratory case,

being its *corpus* composed of: (i) documentary and bibliographic researches and (ii) semi-structured interviews.

The bibliographic research encompasses books, journal articles, dissertations, thesis, among other publications, meanwhile the documentary encompasses the analysis of official documents, as for bulletins for example, resolutions and technical notes published by ANA, in addition to the broad legislation related to the theme "water governance".

The semi-structured interviews were performed with ten subjects, from October 2020 to February 2021, both in person as well as long distance – through the *Google Meet* platform. In addition, they were recorded, ensuring free and informed consent from the subjects, respecting the ethical and scientific foundations established to the executing of researches involving human beings. Following the conduction of the interviews, a script was produced, having twelve questions, grouped in three dimensions, aiming at obtaining the comprehension of the subjects regarding the process of water governance in the dam.

Through the characteristics of the qualitative analysis, it was aimed at ensuring the representativeness through the application of two criteria for the subjects' choice – diversity and saturation. As for the analysis of the *corpus*, as adaptation of the model proposed by Guerra (2006), was performed, translated into the steps: 1) full and faithful transcription of the subjects' narratives; 2) reading of the interviews for the registry of the summaries of each narrative – summary of the speeches – to identify themes and problems; 4) descriptive analysis – analysis of the category and theme; and, at last, 5) interpretation of the resultant material – interpretative analysis – crossing the several findings with the constructed theoretical framework.

The research counted on the participation of 10 interviewed, approaching members and non-members of the Consu Bitury — 6 and 4, respectively. The members of the Consu Bitury approached 2 representatives from the govern – one linked to the Permanbuco Agronomic Institute and the other, to the City Hall of Belo Jardim —, 3 representatives from

the civil society — two linked to the Faculty of Belo Jardim and one, to the Rural Workers Union — and one representative from the users — the IFPE – *Campus* Belo Jardim.

The participants in the research fit as non-members of the Consu Bitury were the representative: from the Ipojuca River Hydrographic Basin Committee; from the Coordination of the Inspection, from APAC; from the Management and Support to the Basin's Organs, from APAC; and from the Coordination of Regulation Landmarks and Water Allocation, from ANA.

The selection of the participants in the research was due to the characteristics and evidences that the researcher aimed at gathering, as well as to the representativeness of each subject to the comprehension of the study. It is noticed that previously to the performance of the research, the profiles of the subjects were analyzed.

Regarding the analysis of the category and the theme, the *corpus* was structured in different categories — defined *a priori* —, related to the water governance system of the Bitury dam. Regarding the process of categorization, the principles of the OCDE for water governance was considered, grouped in three dimensions: "efficiency", "effectiveness" and "trust and commitment". Therefore, the original transcript material was resumed and the fragments of the narratives dispersed in the texts were recomposed. In other words, each category was built from selected parts of the speeches from the interviewed and counted with the support of the theoretical referential.

At last, by entering each interpretative step, new concepts were conceived and it was able to move forward with explanatory theoretical propositions regarding the process of Bitury dam water governance.

4 RESULTS AND DISCUSSION

4.1 Dimension "effectiveness"

The dimension "effectiveness" encompasses four theme categories: 1) clear attribution of roles and responsibilities; 2) proper scales in the board of management

of basins; 3) coherence of policies and coordination among the sectors; and 4) training for the performance of the attributions. By being questioned about the attributions of the management organs of the reservoir – theme category 1 – all the interviewed evaluated the acting of the DNOCS as quite "deficiency" and "absent". Some of theme reported that the Bitury dam is found in situation of "abandon".

Regarding the acting of ANA, although the entity is present in the management of the dam through the participation in meeting, the level of estrangement, including demographic, is high. According to two interviewed, the visits of representatives from the organ happen annually, with the purpose of only establishing the shares for the use of water from the dam.

Regarding the role played by the APAC, two interviewed highlighted that the entity performs a more directed job to the mobilization of the interested parts in the Consu Bitury, since, as exposed, the Bitury dam is of federal domain, meanwhile the scope of acting by APAC, from the legal point of view, is state, with the exception of the cases of delegation of power.

About the proper scales in the board of a management of basins — theme category 2 – by approaching the issue of water in the reservoir and its appropriation to the local conditions, three interviewed mentioned in their speeches: 1) activities and projects focused on Bitury's micro-basin, with highlight to the "incompatibility" in certain moments, of some courses and formations that are promoted to the members of the Consu Bitury with the local context; 2) the performance of discussions about the implementation of the project "Water Producer", which "hasn't gone off the paper yet"; and 3) the need of actions to preserve the water sources.

Still regarding the item 2, four interviewed emphasized the existence of inappropriate practices by the dam's users, mainly regarding the irregular and indiscriminate use of the margins with performing activities that degrade them, such as car and animal washing, and the use of pesticides in neighboring plantations.

The subjects' speeches, therefore, indicate that the management practices

applied to the reservoir need better responses to reach the economical, social and environmental goals, at the same time that they need better fitting and cooperation among the users of the wealth, within what is stated by the ODS 6 and 15, and the principle 2 of the OCDE for the water governance (OCDE, 2015; ONU, 2015).

Also, based on the perceptions of the interviewed, it is understood that the actions of inspection in the dam are not enough, once the predominance of irregular use around it. To ensure the functioning of the existing inspection and governance mechanisms constitutes a great challenge, as defended by the Water Observatory (2019).

In theme category 3, on the other hand, regarding the procession of water allocation in the reservoir, two subjects stated that the practice is compatible with the local reality, once that for its promotion technical studies are performed and the demands of the users and the water availability in the dam are considered.

On the implementation of several policies, four interviewed were emphatic by declaring not realizing the existence of integration among the policies directed to the Bitury dam. And, in addition to confirming the absence of coordination, they indicated several situations that highlight the non-application of the PNMA, the PNRH, the PNEA and of the PNRS, for instance.

Another aspect related to the effectiveness of the water governance is the training of the competent authorities for the performance of the attributions – theme category 4. Regarding the legal training, one of the interviewed stated that there is no gap regarding the capacity point of view given to the competent authorities by legal means. As for the technical training, six of them said that the representative of the management organs which provided consulting to the reservoir management — ANA and APAC — have training and technical knowledge to perform well their attributions.

To four interviewed, despite the authorities having fine level of technical training, such area requires continuous formation processes. According to one of them, since the APAC was created, this has been such a persistent problem, since the organ has never been able to generate an efficient format to whom each representative would

feel better prepared – with minimum technical leveling and consciousness of one's attributions – to participate in the collegiate organs.

One interviewed highlighted that more elevated levels of technical training are demanded, in its majority, from the ANA's technicians. However, the entity has been presenting good management and, in his perception, the greater "flaw" happens by making the several actors, obligatorily, to exert their respective attributions, according to what has been predicted in the legal instruments.

This is, it is surmised that the level of technical training of the responsible authorities is satisfactory and corresponds to the complexity of the challenges faced in the GRH scope, meanwhile gaps of institutional training need to be better identified and filled, as the principle 4 from OCDE establishes for good water governance (OCDE, 2015).

4.2 Dimension "efficiency"

Regarding data production and information in the Bitury dam — theme category 5 — five interviewed said to believe in the consistency and reliability of the raised data, both those related to the water availability of the wealth as well as its use. According to one of the subjects, among all the "imprecision" that the GRH has, in the specific case of Bitury, they are not relevant, once the ANA has the necessary information to manage the water resources.

Regarding the use and sharing of data and information, four interviewed showed to have access to them, in the form of bulletins, which are forward, periodically, by ANA. For two of the interviewed, the information are yet used to the management of the reservoir, but, in an inefficient form.

It was possible to realize that the data produced in the scope of the Bitury dam presents satisfactory level of consistency. However, in addition to being trustworthy, they need to be available to all the interested parts, through different tools (Medema, Mcintosh, & Jeffrey, 2008), which still remains a challenge to the Consu Bitury.

Regarding the efficient use of financial resources — theme category 6 —, two

subcategories have emerged, as follows: 1) investment applied on the reservoir; and 2) financing of the Consu Bitury's activities.

About such aspect, six interviewed were emphatic by affirming that investments in the Bitury dam are not applied. In the perception of one of them, this is due, mainly, to the fact that there is no instrument to gather resources, as for example, tax on the use of the dam's water, as predicted in PNRH (Lei n. 9.433, 1997).

Three interviewed, however, mentioned the possibility that the Bitury dam may, soon, receive some investments, through two programs: "Water Producer" and "PSA Ipojuca". These are important initiatives that may result in great benefits for the Basin of the Ipojuca river and, consequently, for the Bitury micro-basin.

As to the financing of the activities of the Consu Bitury, three interviewed highlighted that the Council receives financial aid from the great users of the dam — companies — to be able to finance its actions. This is possible, according to one of them, due to the great organizational structure of the entity.

Regarding the theme category 7 — solid regulation boards —, the descriptive analysis resulted into two subcategories — "legal and institutional board" and "regulation mark and water allocation".

From the legal and institutional point of view, the water governance in the Bitury dam, according to one of the interviewed, is characterized by some "gaps", due to a complex relation involving the action of different actors in the processes of management, inspection and use of water resources.

The fragments of the interviews given by six subjects were grouped in the category "regulation mark and water allocation" by mentioning, direct or indirectly, the process which is performed by ANA, with the purpose of establishing the rules, the water allocation and the responsible regulation mark for the creation of an environment that unites the needs of uses and users of water resources (ANA, 2021).

Through the finalized documental research, the existence of a Regulation Mark was determined — published through Technical Note n. 14, from March 27, 2018 (ANA,

2018) — and its operationalization — through the water allocation, being the decisions effected in the so called “Water Allocation Term”. Encompassing the Bitury dam, the 2020/2021 Water Allocation Term - Bitury and Ipojuca/PE Water System is current (ANA, 2020).

Hence, the principle 7 of OCDE for the good water governance states that regulatory boards for the GRH in the reservoir are ensured – supported by resolutions and technical notes emitted by ANA. Thus, it is ensured a legal and institutional board that defines rules and guidelines to the obtention of the intended result, which is the disciplining of multiple use (OCDE, 2015).

In the issue “innovative practices of governance” — theme category 8 — two subcategories emerged, associated, respectively, to “programs and innovation practices” and “knowledge generation”.

Two interviewed, when being questioned about the supposed innovative practices on water governance in the Bitury dam, quoted the program “Water Producer”. To finish, three interviewed classified, respectively, the formations offered for the disclosure of new management practices, the performance of studies on water courses and the mapping of water sources as being some of the generation actions for new knowledge and, therefore, innovative. Studies and researches in these areas are essential to subsidize the decision-making process supported in the technical-scientific knowledge, one of the great challenges to a governance system, as in the Brazilian case (Water Observatory, 2019).

In general, in the perspective of what establishes the principle 8 of OCDE for the water governance and through the fragments of the interviews, it is inferred that, although some discussions involving the issue of innovation are performed, few practices are still seldom adopted. It is regarding embryonic actions and that need greater articulation between science, technology and public policies, having at sight the promotion of practices and innovative GRH processes (OCDE, 2015).

4.3 Dimension "trust and commitment"

The dimension "trust and commitment" encompassed four theme categories, as follows: a) integrity and transparency; b) commitment of the interested parts; c) management of the water's multiple uses; and d) monitoring and regular evaluation of policies.

Regarding the theme category 9 — integrity and transparency —, through the lines of three interviewed, it was possible to notice that, in relation to the actions developed by the Consu Bitury, there is a satisfactory level of transparency. Two of them highlighted as positive elements and that contributed to the improvement of the responsibility and increase in the trust of the decision-making processes the direct and open dialogue among the members of the Council, through the real and trustworthy exhibition of the situations put into discussion. This is possible due to the process of decentralization of the GRH, which ensures the production and dissemination of information regarding the collegiate organs to the several actors involved, as well as to the society (Machado, 2003).

About the process of accountability by part of Consu Bitury, one of the subjects claimed to believe in the existence of a preoccupation and an effort from the Council to make it clearer as possible the way that the financial resources are used, despite the amount being small. In such aspect, the OCDE understands the establishment of clear mechanisms in the accountability as one of the means to reinforce trust and to make practices of integrity and transparency general (OCDE, 2015).

However, one negative aspect that was rated regards the transparency through the feedback to ANA from the records from meetings promoted by Consu Bitury. The interviewed was unable to say where the entity makes the documentation available, which is of essential importance to give the due publicity to the themes that are debated and listed by CONSU. Therefore, it is necessary that the Council broadens its practices of transparent management, in a way to ensure the several parts involved the right to information, through several platforms.

As for the actions of transparency and integrity linked to the management organs — ANA and APAC —, the interviewed presented their perceptions through different perspectives: one of the interviewed, for example, said that, the lack of disclosure of relevant information regarding the projects executed by Consu Bitury, but led by management organs; another one mentioned that, in terms of accountability, the APAC is active and shows to act with transparency and integrity in the available data to CONSU; another, yet, presented a different point of view regarding the action of the APAC — to him, the organ shows to be deficient in the forwarding of information; the last punctuated that ANA gives transparency to all its jobs, whether through the participation *in loco* and in the annual meetings, or by through the performed monthly updating — according to him, as well as in the ANA's website, the APAC should also make pertinent information on water allocation from Bitury dam available.

By approaching the issue of transparency and integrity of the actions by part of the dam's users, one of the subjects exposed a very preoccupying situation: the reading of the hydrometers is performed by the users themselves. He even related a case in which the water meter from a big Belo Jardim company is located within its own installations, which could compromise the process of data generation and consistent information – principle 5 of OCDE for a good water governance (OCDE, 2015).

In theme category 10 — commitment of the interested parts — the fragments from the interviews were grouped in four subcategories – involvement of the public actors; involvement of the users; involvement of the civil society; and general commitment from the members of Consu Bitury.

Based on the fragments of the interviews from three subjects, the commitment of the public actors — in special, the city public power and the DNOCS — lacked, mainly in the last years. With the exception of APAC, both the City Hall as well as DNOCS has shown to be "absent".

In case of the users, the participation of the industries and of COMPESA has not been much different. According to two interviewed, the commitment of the latter

regarding the representation exercised in Consu Bitury is very shy. Simultaneously, another interviewed highlighted that the entity only performs some kind of upgrading in the Bitury dam when is of its interest.

As for the industries, their involvement with the Council is by a relation of interest surrounding the maintenance of the water withdraw for the development of their economical activities — this was reported by one of the subjects. The form of acting by part of the companies highlights unbalances between the dimensions of sustainability, at the same that a reflex of the structures of uneven power that exist in our society is constituted.

The participation from members of the civil society in Consu Bitury, according to one of the interviewed, is "unsatisfactory", once that, in other periods, the Council even counted on the involvement of representation from churches, schools, service clubs, etc.

In general, five interviewed described the level of commitment from the members of Consu Bitury as being low, translated in meetings, eventually "empty". Likewise, one of the subjects associated the low level of commitment of the interested parts to the limited amount of representatives.

It is inferred that, in the governance structure of the Bitury dam, although there are institutional mechanisms and legal boards that approach the different interested parts — as example of the own Consu Bitury itself — it is noticed that their involvement in the policies and decisions related to GRH could be more effective, mainly related to promotion and application of the several public policies in the scope of the Bitury micro-basin.

In such sense, the commitment from *stakeholders* linked to the management of the dam still represents a challenge that remits to the adoption of collective and democratic practices, gathering the interaction among the several social actors – society, users and public power -, supported by a governance structure that contributes to the strengthening of the democratic, integrated and shared GRH (Jacobi, 2003).

Another theme of severe importance for the analysis of the governance in the Bitury dam refers to the management of multiple use of water — theme category 11.

With the exception of two interviewed, the remaining, in their speeches, revealed that, in Bitury dam, the commitment among the multiple water use is "balanced". In an implicit or explicit way, the perceptions of the subjects remit to the management processes founded in the regulation mark and water allocation, employed by ANA to discipline the conciliation of the needs of uses and users of water resources (ANA, 2018; 2020).

The management practice adopted in the Bitury dam, in addition to contributing to a good water governance — as established by OCDE, in its principle 11, which defends the existence of legal boards that promote the equity among the water users — tends to lessen eventual conflicting situations among the users (OCDE, 2015).

As last, theme category 12 — monitoring and regular evaluation of policies — is related to principle 12, proposed by OCDE, and involves the implementation of mechanisms that allow to monitor and evaluate the policies and practices of water resources.

By the fragments of the interviews from five subjects, it was possible to notice that the main monitoring policy practiced in the Bitury dam consists in the monthly update of the conditions established in the Water Allocation Term, which the registries — of volume, expected and observed consumption and of concerted actions among the involved parts — compose the Update Bulletins of Water Allocation, shared with the public.

One practice that, according to two interviewed, has been widely implemented in the management of the dam are the adjustments in the governance system, in order to reach the purposes. Such adjustment are predicted in the 2020/2021 Water Allocation Term: "alterations in the allocated values may be only performed in the drought period (from March to July 2021), only if duly approved in pre-allocation meeting conducted by Consu Bitury, as well as by ANA" (ANA, 2020, p. 2).

5 FINAL CONSIDERATIONS

Based on the perception of the research subjects, the existing process of water governance in the Bitury dam was analyzed, from three dimensions proposed by OCDE: efficiency, effectiveness and reliability and commitment.

Regarding "effectiveness", the governance model adopted in the dam enables the reach of regular results. The roles and responsibilities of the involved organs in the reservoir management — DNOCS, ANA and APAC — are clear and predicted in legal instruments. However, what it is noticed, in certain contexts from the Bitury dam – as the ones linked to DNOCS —, is the non-fulfillment totally or partially of their organizational competences.

The management water practices adopted in the dam are not compatible, in its fullness, with the reality and the local conditions of the Bitury micro-basin, once that irregularities are perceived, for example, as to the use of the surrounding areas. In addition, it is evident the need of a higher level of implementation of policies and integrated strategies of GRH, in a way to strengthen the role of Consu Bitury as collegiate organ.

The implementation of public policies regarding the water does not occur in a coherent and coordinated form with the rest. There is certain misalignment among them, which is revealed through the social-environmental problems that interfere in the dam, such as release of household waste, the use of pesticides in plantations situated in their margins, etc.

The technical training of the interested parts in the management of the Bitury dam is satisfactory and constitutes fundamental element to the governance of the water system. The several actors who participate in the management process show to have the required competences for the fulfillment of their obligations. However, specially to the members of the Consu Bitury and the owners of water sources, the education and formation programs should be continuous and attend, mainly, the local needs.

Regarding "efficiency", the data and information produced on the management of the Bitury dam showed to be consistent and used to conduct the management actions. The main gaps regarding them refers to the sharing process, in a way that the flow of communication becomes more accessible to all the *stakeholders*.

As for the management practices, in terms of application of financial resources, they are considered not efficient, once the dam, built in the 60's decade, needs important

maintenance and recuperation work. In addition, in the reservoir, there are no own mechanisms of income generation implemented, the lack of financial resources is a limiting fact to reach the factual results.

Regarding the regulation board, in the management of the Bitury dam, the process of water allocation is employed, in which it is founded in the Regulation Mark, which approaches the conditions of use of water resources. Therefore, it is noticed that the Bitury system has a solid board to regulate and apply the management instruments predicted in the PNRH.

On the other hand, regarding the adoption of innovative governance practices, the establishment of the Regulation Mark and the adoption of the process of water allocation are the main implemented actions. In an incipient form, debates are promoted and ideas are raised with the potential of application in the dam, but, for several reasons, they end up not being fully executed.

Regarding "trust and reliability", as for the integrity and transparency, the disseminated practices by management organs are recognized as insufficient. It is noticed that the level of transparency which is dismissed by ANA to the water policies is superior to the one dismissed by APAC and by the Consu Bitury themselves.

On the commitment of the interested parts in the process of water management of the dam, although the current governance system enables their involvement, specially through the participation of public, private actors and entities of the civil society in Consu Bitury, the level of their involvement is low and translated into meetings with reduced number of representatives.

Regarding the management of multiple water uses, formally, the balance between them is established by the process of water allocation, in which meetings are performed with the presence of ANA and the other interested parts, to establish harmonic commitments among the main users of the Bitury dam — COMPESA, industries and IFPE – *Campus* Belo Jardim. Thus, it is necessary to broaden the inspection on its fulfillment.

In the scope of monitoring and evaluation of the policies, the governance system of the reservoir has a follow-up, which happens through measurements of parts of water in the dam, just as of volumes captured by public provision, by local industries and by IFPE – *Campus* Belo Jardim. The data of monitoring are published every month in Bulletins emitted by ANA. Nonetheless, it is not rare that the measurements of capture are promoted by the users themselves and, in some cases, the hydrometers are installed in the surroundings of the beneficiaries themselves and/or are found damaged, which raises questioning on the reliability of the consumption registries.

It can be accepted as research limitations linked to the production of this article the approached founded in the perception of the interviewed subjects on the object of study. Perhaps, generalizations of results should be applied carefully. Therefore, for future researches, it is suggested to broaden the analysis of the water governance process in the Bitury dam, by turning to the perception from members of the local populations and owners of areas with water sources from the Bitury micro-basin; and to search for scenarios with water scarcity through which the water sources go through, and to whom the actions of Consu Bitury and management organs should focus on, due to this.

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1. Definition of research problem	√	√	√		
2. Development of hypotheses or research questions (empirical studies)	√	√	√		
3. Development of theoretical propositions (theoretical work)	√	√	√		
4. Theoretical foundation / Literature review	√	√	√	√	
5. Definition of methodological procedures	√	√	√		
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