Revista Brasileira de Gestão e Desenvolvimento Regional
G&DR. V. 19, N. 1, P. 549-572, Jan-Abril/2023. Taubaté, SP, Brasil.
ISSN: 1809-239X

PARTICIPATORY GOVERNANCE AND SOCIAL INNOVATION: ANALYSIS OF THE SCHOOL CISTERN PROGRAM IN THE BRAZILIAN SEMIARID REGION

GOVERNANÇA PARTICIPATIVA E INOVAÇÃO SOCIAL: ANÁLISE DO PROGRAMA CISTERNAS NAS ESCOLAS NA REGIÃO SEMIÁRIDA BRASILEIRA

Received: 03/15/2021
Accepted: 02/11/2023

Naldeir dos Santos Vieira[1]
Daniel Paulino Teixeira Lopes[2]
Agnaldo Keiti Higuchi[3]
Fernanda Aparecida Guedes Honorato da Silva[4]
Nathália Stockler Fialho Soares[5]

Abstract

The main objective of this article is to analyze participatory governance as a key factor for the process of social innovation, resulting from the implementation of the School Cisterns Program, since it can be understood as a continuous process of associations that involve different agents. The Program, which began in 2009, brings water to rural schools of the Brazilian semi-arid area by enabling the construction of 52-thousand-liter cisterns to capture and store rainwater from school roofs. In this context, different agents are articulated and mobilized such as the State, organized civil society, the school community, and the local community. The empirical data were obtained by direct observation, documentary analyses, surveys, and in-depth qualitative case studies, in which semi-structured interviews were conducted with key informants. It is observed that cisterns, as an innovative social technology, solve most water scarcity problems in schools in the region analyzed.

[1] PhD in Administration (UFMG). Professor at the Federal University of the Vale do Jequitinhonha and Mucuri. Teófilo Otoni - MG, Brazil. Email: naldeir.vieira@ufvjm.edu.br
[2] PhD in Administration (UFMG). Professor at the Federal Center for Technological Education of Minas Gerais. Belo Horizonte - MG, Brazil. Email: daniel.lopes@globo.com
[3] PhD in Administration (UFMG). Professor at the Federal University of the Vale Jequitinhonha and Mucuri. Teófilo Otoni - MG, Brazil. Email: agnaldo.higuchi@ufvjm.edu.br
[4] Master in Public Administration (UFVJM). Teófilo Otoni - MG, Brazil. Email: faghs.nanda@gmail.com
[5] Master of Science (UFSJ). São João Del Rey – MG, Brazil. Email: nathaliastockler17@hotmail.com

The Program's replication, made through public policy, was only possible through the engagement of diverse actors, with participatory governance at different levels.

Key-words: Social Innovation. Participatory Governance. Public Policy. Cisterns. School Cisterns Program.

Resumo

O objetivo deste artigo é analisar a governança participativa como fator chave para o processo de inovação social decorrente da implantação do Programa Cisternas nas Escolas, visto que ele pode ser compreendido como um contínuo processo de associações que envolvem diferentes atores. Iniciado em 2009, o Programa leva água para escolas rurais da região semiárida brasileira, viabilizando a construção de cisternas de 52 mil litros para captação e armazenamento da água de chuva a partir do telhado das escolas. São articulados esforços de atores como o poder público, sociedade civil organizada e comunidade escolar e local. Os dados empíricos foram obtidos por meio de observação direta, análise documental, *survey* e estudos de casos qualitativos em profundidade, nos quais foram realizadas entrevistas semiestruturadas com informantes chave. Percebe-se que a cisterna, como uma tecnologia social inovadora, contribuiu para a solução de grande parte dos problemas resultantes da escassez de água nas escolas da região analisada e que a sua reaplicação, por meio de um Programa de Governo, só se tornou possível, diante do engajamento de uma diversidade de atores.

Palavras-Chave: Inovação Social. Governança Participativa. Políticas Públicas. Cisternas. Programa Cisternas nas Escolas.

Introduction

The conventional model of innovation (scientific development and technological innovations) has shown itself to be insufficient to solve social problems linked to the necessity of improving life quality of the population as a whole. Moulaert et al. (2013) point out that despite advances in science and technology, factors such as hunger, poverty, pollution, illiteracy, climate change, among others, continue harming society. Nevertheless, countless developmental actions have not only been inefficient, but they have increased social inequality and environmental degradation (DOWBOR, 2007).

All of the problems above are considered complex and their solutions involve the need to recover and minimize the impacts on the environment, as well as assist groups that historically have been marginalized from goods and services.

This context exposes the limitations of technological innovations generated and bounded by a bias of instrumental rationality in a market context. Nonetheless, it also points out the need to

relate the production of technology, science, and innovation with social necessities and the appropriation of scientific knowledge by different social actors, intending to solve adversities (BAUMGARTEN, 2008).

With this in light, the concept of social innovation is emphasized when innovation and technology are understood in accord to human necessities, taking advantage of their potentials, with possibilities of social inclusion in mind. The articulation of networks that bring together the State, the academy, and civil society can direct the development of science and technology to solve problems inherent to social exclusion and low life quality of vulnerable populations (DEFOURNY, 2009).

Within this network's structure, the State is one of the main actors by financing and fomenting the dissemination of social innovations with public policies. Such innovations emerge to solve many problems, for example problems related to precipitation irregularity (MEDEIROS; GÓMEZ, 2019). Such "basic" problems affect the economic and social reality of semi-arid regions, negatively impacting social indicators in education, health, infant mortality and illiteracy. This facilitates the maintenance of the socioeconomic and political environment marked by income and power concentration, especially in the rural area of developing countries like Brazil (LIRA et al., 2011).

As we discuss later, one action that constitutes a social innovation to solve the problem of water shortages in semi-arid regions of Brazil is the construction of cisterns (individual water reservoirs with a capacity of 52,000 liters) for the collection and storage of rainwater in schools. As collective spaces in rural communities, schools provide a fruitful space for experimentation with social innovations. In addition to allowing the regular functioning of the school, the implementation of these innovations becomes another pedagogical instrument.

In Brazil, bringing cisterns to schools was a need identified by the *Programa Um Milhão de Cisternas* (P1MC - One Million Cisterns Program), which aimed to reach families living in rural areas of the semi-arid region, which extends from the northern part of the state of Minas Gerais (Southeastern Brazil) to the state of Maranhão (Northeast). According to Sousa et al. (2017), the Brazilian semi-arid region is the largest among the semi-arid regions in the world, corresponding to 18.2% of the national territory and 53% of the territory of the northeast region of the country. It has

the highest concentration of rural population in Brazil on a subsoil poor in water, which is often brackish and unfit for consumption.

Cistern implementation programs put social innovation side by side with relatively simple rainwater collection and storage technologies, constituting an important social, environmental, economic, and health instrument. At first glance, these programs meet the criteria of social innovation (PHILLS Jr. et al., 2008; MOULAERT et al., 2013; MEDEIROS; GÓMEZ, 2019) by involving vulnerable people in a participatory proposal via democratic management and new forms of intervention and local organization, aiming to overcoming previously unmet difficulties. It was in this scope that strategic partnerships were formed to implement actions for the development, financing and sustaining of programs of this nature, in a typical articulation of participatory governance (PETERS, 2005; CHAGNAZAROFF, 2009; BEVIR, 2011). But to what extent could we consider participatory governance as critical to social innovation in these kinds of programs?

This article aims to analyze participatory governance as a key factor in the process of social innovation resulting from the implementation of the School Cisterns Program. The Program was chosen for this research because of its uniqueness, since it is present in the entire semi-arid region of Brazil, through a model of participatory management for the articulation of socially innovative actions. The empirical data were obtained through direct observation, documentary analysis, survey and in-depth qualitative case studies, in which semi-structured interviews were conducted with key informants.

The relevance of this study lies mainly in the possibility of deepening, through the use of mixed methods, the view on social innovation as a process resulting from the articulation and engagement of different actors, requiring various forms of participatory governance for the efficiency and sustainability of implemented actions. In addition, we try to cover a gap by relating social innovation to a relatively simple technology, a relationship that has received increasing attention among researchers in the field (LOPES et al., 2017). We also complement the literature on participatory governance differently from previous studies on water resource management, such as Demetropoulou et al. (2010).

Conceptual Preamble on Social Innovation

Since the 1930s, the term innovation has been strongly referred in the Schumpeterian sense to obtaining economic value. However, later on it has had various meanings as a result of advances in studies and diversification of approaches on this topic. In general, the term innovation regards a process that triggers the generation and adoption of new ideas, practices and artifacts, the development of new procedures, solutions, products and methods of marketing, and the combination between creativity and risk, whose results alter the economic sector. Traditionally, this understanding has been much related to technological innovation. That is, the introduction of new goods, or new quality of goods, and a new production method in the specific branch of the transformation industry.

However, new concepts such as organizational, administrative, marketing, and social innovations have recently gained notoriety (BIGNETTI, 2011; LOPES et al., 2017). The detachment of the concepts of social innovation and technological innovation results from the fact that the latter focuses on objects/products, while the former focuses on contexts (employment, qualification, social security, and regions). However, such separation does not imply that social innovation cannot be combined with inventions or technological applications. The more complete the project is and the more diverse the agents involved in it; the greater will be its capacity to promote social change on a systemic level (DIOGO, 2010).

In the perspective of Frazão et al. (2015), novelty is not related to the need for innovation to be unique or original for all contexts, but to be perceived as new for the territory, sector, or area of operation. As a criterion for something to be considered a social innovation, the authors also highlight the improvement of the quality of life of those involved, by being something more effective or more efficient than the pre-existing alternatives. Baumgarten (2008) adds sustainability and fairness to this list in relation to other alternatives. Actions aimed at the preservation or maintenance of the environment are considered sustainable and fair actions seek to reduce social inequalities.

The social innovation approach was reinforced by the flaws and inconsistencies of the neoliberal growth model, which has expanded worldwide since 1980 (KLEIN, 2013) and by the new approaches to the innovative process to stimulate social development (BIGNETTI, 2011). As a distinctive aspect, the new concept encompasses "new ways of doing things for the explicit purpose

of rearranging social roles or providing other responses to unsatisfactory and problematic social situations" (RODRIGUES, 2006, p. 3). The analyses focus on actions aimed at satisfying human needs that have not yet been met. (RODRIGUES, 2006).

Despite the diversity of concepts of social innovation, two main theoretical approaches can be identified in the literature, distinguishing between those that emphasize the process and those that emphasize the result (MOULAERT et al., 2013). The first approach explores the organizational and social processes that produce innovation, such as individuals, organizational structures, environmental contexts, and social and economic factors. The second approach explores social innovation as a result that manifests itself in new products, resources, and production methods, analyzing their sources and economic consequences.

However, many studies have been identified that address social innovation with both the process and result approaches. In addition, those related to social intervention models are noteworthy (PARENTE et al., 2014). In these social intervention models, the empowerment of actors and the strengthening of individuals are prominent, as these are targets of an empowerment process.

It should be noted that, initially, the notions of social innovation were associated with the actions of civil society or the third sector. Later on, initiatives from the public sector and private companies were incorporated. Despite the different approaches, it is now generally believed that social innovations can be generated by the three sectors, especially when they collaborate (EZPONDA; MALILLOS, 2011). "Innovations that begin in one sector can be taken over by others, and often the most exciting innovations occur at the borders between sectors" (MULGAN, 2010, p. 59).

Table 1: Phases of a social innovation lifecycle

	Phase	Description	Obstacle
0	**Latent**	Identification of a social need. Launching of new ideas.	-
1	**Conception and development**	Discussion and selection of ideas.	Precipitate abandonment of promising ideas.
2	**Mobilization**	Adaptation of institutional context to the innovation.	Lack of support, resources or adequate leadership
3	**Generalization**	Incorporation of the social innovation to the practices and routines of its institutional context.	Opposition moved by established interests.

	Phase	Description	Obstacle
4	**Dissemination**	Transfer of the social innovation to other institutional contexts.	Embeddedness of previous practices. Institutional fragmentation.

Source: Adapted from Bacon *et al.* (2008 *apud* OLIVEIRA; BREDA-VÁZQUEZ, 2012, p. 525).

Social innovations develop along different paths according to the available resources and the interference of restrictive and/or driving factors. Nevertheless, (BACON et al., 2008 apud OLIVEIRA; BREDA-VÁZQUEZ, 2012) state that it is possible to identify patterns that result in similar phases of the life cycle of social innovations. In line with these patterns, social innovation generally includes demands for change, the random emergence of new ideas as a response to new needs, and the eventual development, testing and integration. The different phases described by the cited authors are presented in Table 1.

As can be seen in Table 1, the life cycle of social innovation can be divided into five phases. In phase 0, or latent, a social need is identified, providing a trigger for the generation of new ideas. Phase 1 contemplates the elaboration of a project and the discovery of alternatives to the problems encountered. It is particularly turbulent, with the discussion of new ideas that can be developed or abandoned. In phase 2 there is the mobilization, which implies the creation of structures or the redirection of existing ones, aiming to put the new idea into practice and pilot it. This process may not have continuity for a variety of reasons, such as lack of support, resources or adequate leadership or simply because it does not work in practice. However, when it works, it reaches a larger scale and becomes part of the main routine in its institutional setup. Phase 3, the generalization, is usually characterized by strong resistance from established interests. Phase 4, the dissemination, gives rise to intersectoral and inter-territorial diffusion processes, through inspiration or reapplication.

Mulgan (2010) states that social innovations are rarely just top-down or bottom-up. In these processes, a partnership is necessary because small organizations, groups, and individuals possess high creativity, mobility, and speed, whereas large organizations such as the state, businesses, and large non-profit organizations, are less creative, but have a high capacity for implementation, resilience, sustainability, and scale. Thus, the constitution of participatory governance throughout the process of social innovation can be central to achieving the objectives of this type of innovation.

The following section discusses the concept of participatory governance, including its purpose, benefits, and challenges for stakeholder engagement.

Participatory Governance

The concept of governance for the purpose of this paper refers to the use of networks formed by social actors - stakeholders - interested in solving a certain problem (BEVIR, 2011). Unlike managerial governance, which is based on technocracy and emphasizes efficiency and effectiveness in actions, participatory governance is based on the involvement of different actors, on actions that lead to the complementarity of resources, mutual influence, and horizontal coordination instead of a vertical hierarchy (BEVIR, 2011).

Participatory governance adopts the participatory democratic model, encouraging society's participation in political decisions (CHAGNAZAROFF, 2009). According to Pinto et al. (2018), participatory governance can also be called public governance, network governance, democratic governance, and good governance. These denominations refer also to cooperative, and collaborative rationalities, in addition to highlighting the protagonism of society in the construction of collective projects. In participatory governance, bureaucratic and instrumental rationality is abandoned and considered inadequate for the solution of social problems (BEVIR, 2011).

Besides society, another relevant actor is the Government, whose main guideline must be the promotion of citizenship, based on the democratization of spaces and insertion of local knowledge in the decision-making process (PINTO et al., 2018). In other words, it is necessary that experience, demands, and conflicts reported by local actors be considered in power spaces. It is a distinct role from those advocated by other models that place the Government as relevant for innovation to take place, following the example of the Triple Helix discussed by Etzkowitz and Zhou (2017).

From the Government's point of view, the objective of participatory governance is to make management effective, in order to generate trust in the public sector, enabling political legitimacy and governability (CHAGNAZAROFF, 2009). To this end, both administrative and democratic principles must be embraced. According to Peters (2005), the greater the democracy with citizen participation, the higher the quality of governance.

According to the above, it can be inferred that among the benefits of participatory governance is the improvement in services, since these are planned with the participation of the main people involved, and the consequent improvement in social welfare. However, according to Pinto et al. (2018), there are challenges to be overcome, represented mainly by the lack of data on the effects of participatory governance on the effectiveness of government actions and the promotion of democracy. Without these data, it is not possible to measure the results and verify if the democratic initiative is not actually causing slowness in the decision-making process or social exclusion (PETERS, 2005). One of the difficulties brought about by decentralization is the difficulty of articulating a larger number of actors, who may have different interests.

To overcome the challenging balance between effectiveness and social participation, Chagnazaroff (2009) proposes the intervention of the public sector to coordinate and articulate the Government, civil society, and private organizations. Peters (2005) highlights the importance of promoting mechanisms for participation and social awareness. In the case of Brazil, public audiences, public policy councils, and oversight agencies can be cited as mechanisms of social participation.

Methodological Procedures

Achieving the objective of this paper required the mobilization of mixed methodological procedures (CRESWELL, 2014) in three stages: 1) bibliographic research on the School Cisterns Program; 2) exploratory quantitative analysis with information obtained from the *Articulação no Semiárido Brasileiro* (ASA - Articulation in the Brazilian Semiarid), the *Ministério da Cidadania* (MC - Ministry of Citizenship) and from a survey answered by representatives of the target schools of the Program; and 3) qualitative study of multiple cases.

In the first stage, bibliographical research was conducted to characterize the social problem which the Program aimed to answer, with its history, implementation process (mobilization, planning, construction, and management of the cistern), and articulation of the actors involved in the Program design. This analysis was made at the national (Program) level.

In the second stage, the schools that were benefited from the Program in the Jequitinhonha and Mucuri Valleys were mapped. These areas in the state of Minas Gerais encompass 1,492,198 people in 91 municipalities within an area of 121,259 km² (SUDENE, 2018). In this stage, the

information was obtained in March and April 2020 through contact by e-mail and telephone with representatives of the ASA (Program executor) and the MC (main funder). With the mapping, 170 rural schools from 23 municipalities of the Valleys were identified with cisterns. When contacted, it was noted that 27 of the schools were inactive and 11 were located in indigenous communities. Faced with the obstacle to contact the representatives of the indigenous schools during the Covid-19 pandemic, they were removed from the research universe, as were inactive schools. As a result, the universe of the study became a total of 132 schools. Also, as part of the second stage, a questionnaire was prepared to conduct a survey of the schools mapped. First, a pilot test was carried out with the directors of two schools. After obtaining feedback, adjustments were made to the questionnaire, which was then sent to the other directors of the schools mapped. The questionnaire, with mainly multiple-choice questions, was built on the Google Forms platform and the link to fill it out was sent by email. The objective was to obtain, in each school, data on participatory governance, the process of construction and management of the cistern, as well as the benefits gained from its construction. The final sample was composed of 102 schools located in 16 municipalities of the region (return rate of 77.3%). After receiving the responses, the collected data were refined and tabulated with Statistical Package for the Social Sciences (SPSS®) statistical software.

The third stage was based on a qualitative study of multiple cases with visits to five schools benefited by the Program between September and November 2020. The field research was conducted after approval by the Ethics Committee of the Federal University of Jequitinhonha and Mucuri Valleys (Report 4,220,713) and the interviewees signed the Term of Free Consent and Clarification (TCLE) before the interviews. Schools were selected for in-depth analysis based on accessibility, having answered the questionnaire in the second stage, cistern usage, and representativeness of the different sub-regions of the Valleys, with four from Jequitinhonha Valley and one from Mucuri Valley. Jequitinhonha Valley had more cases because most mapped schools were located there (89.4%). In these schools, in addition to the documentary research and direct observation, semi-structured interviews were conducted with representatives of municipal governments, principals, teachers, employees, and parents of students enrolled in the benefited schools. The objective was to identify perceptions about the characteristics of governance to build and manage the cisterns, as well as the benefits gained from them. The selection of interviewees

was by convenience, following the criteria of availability and relevance to the study. A total of 49 semi-structured interviews were carried out, considering the five cases analyzed in this stage. To complement the information on the Program governance, another interview was carried out with a representative of one of the social organizations linked to the ASA (Interviewee Z), who is responsible for building most of the cisterns in the study field.

During the qualitative analysis, the recorded dialogues were retrieved and transcribed, highlighting some special moments from memory or noted for the final analysis. Later, we registered the nuclear meanings of the responses in a double input matrix - in one column, the interviewees' statements, approximated by stratification characteristics; in another, the analysis categories. This procedure allowed for data cross-checking (MATTOS, 2006). In addition, each case was enriched by documentary analysis of list of presence in courses, booklets, photos, among others, and the field notebook. The main categories for analyzing the results are related to the phases of the life cycle of social innovation presented by Oliveira and Breda-Vázquez 2012).

The School Cisterns Program – origin, main actors, innovation characteristics

The School Cisterns Program was founded after the experience of the One Million Cistern Program (P1MC) articulated throughout the Brazilian Semi-arid. The initial mark of the Cisterns Program was the Conference of Parties of the United Nations Convention to Combat Desertification and Drought (COP-3), which happened in 1999 in Olinda, Pernambuco (SANTANA; ARSKY, 2016). Parallel to the COP-3, a forum of Non-profit Civil Society Organizations (CSOs) that are present in the semi-arid region was held (MORAES, 2011). In this forum, various organizations which worked with cisterns in the project discovered that their articulation had become systemic, permanent, and could have political interference (COSTA; DIAS, 2013).

As a result of the Forum parallel to COP-3, the ASA was founded in 1999 as an NGO and the group of organizations that would compose it articulated themselves around the perspective of coexistence with the Semi-arid. Moreover, an experimental project to test technologies to collect and store water was proposed to the government. The systematizations and experimental units created in the first project legitimized and proved cistern efficiency in guaranteeing quality and enough water for a family. Moreover, it allowed a greater approximation between the ASA technical staff and employees from the *Agência Nacional das Águas* (ANA - National Water Agency),

facilitating the negotiation to build 12,400 cisterns (SANTOS; BORJA, 2020). Thus, with larger actions and the ASA's legitimacy, the program became a public policy with funds mainly from the Ministry of Social Development (MDS), currently, the Ministry of Citizenship, broadening the scope and reaching all of the Brazilian semi-arid (SOUSA et al., 2017).

In addition to cisterns for families, there have also been important experiences of cistern construction in collective spaces, especially in rural schools not serviced by the urban water supply network. The lack of water in schools has been one of the factors that influence their functioning and it was because of this fact that the ASA, after debates motivated by UNICEF, expanded the program to build individual cisterns for the school context as well.

The Pilot Project was developed in 2009 and after 2010 the initiative expanded under the coordination of the ASA in partnership with the MDS, via the *Secretaria Nacional de Segurança Alimentar e Nutricional* (National Secretariat for Food Security and Nutrition - SESAN), the *Instituto Brasileiro de Desenvolvimento e Sustentabilidade* (Brazilian Institute for Development and Sustainability - IABS) and the Spanish Agency for International Development Cooperation (AECID) (DIETRICH, 2019). Since then, 7,186 cisterns have been built under the School Cisterns Program (ASA, 2020).

In 2020, the Program covered schools in the nine Brazilian semiarid states (Pernambuco, Paraíba, Alagoas, Sergipe, Bahia, Ceará, Rio Grande do Norte, Piauí, and Minas Gerais) that did not have access to water and that were mapped by the Federal Government. This list also included schools located in indigenous villages and *quilombola* communities, which were prioritized (ASA, 2020). According to SESAN, the action aims to ensure water access for consumption and preparation of school meals, directly benefiting students, teachers, and other employees of rural public schools, providing a better quality of life for the school community and better conditions for teaching-learning (DIETRICH, 2019).

The cistern is built with cement slabs and is a simple and easy technology to replicate. It is a circular construction that is buried in the ground to about two-thirds of its height. It is built close to the school and connected to the roof by a gutter. The water collected from the first rain of the season cleans the entire system and has to be disposed of. Thereafter, the water from the following rains is collected and stored in the cistern (COSTA; DIAS, 2013).

Dietrich (2019) states that the implementation of cisterns in schools involves three stages: 1) mobilization, selection, and registration of schools; 2) training of teachers on the proper use of cisterns, water management, and practices for coping with the semi-arid climate; and 3) construction of the cistern. Another defining step for the success of the Program is the management of the cistern and its water. Cleaning and preserving the reservoirs and collection systems are essential to maintain the quality of water for consumption by the students (GOTTFRIED, 2010). The Program is characterized by a networked articulation involving many actors. Table 2 presents the roles of the main actors involved.

Table 2: Actors' roles in School Cisterns Program

Nature	Actor	Role
Federal Public Authority	SESAN/MDS	Estimate the demand for rural public schools without access to the public drinking water supply network or with precarious access to drinking water sources. Provide public financing for the implementation of cisterns in schools. Articulate the implementation of cisterns with other Ministries.
Organized Civil Society	ASA/AP1MC	Articulate mobilization. Give visibility to the actions. Train those involved. Organize demands and socially control the invested resources and the quality of the actions implemented.
School Community	Teachers, parents, students, lunch ladies, janitors, etc.	Involve in the training process, take care of the cistern, the quality of the water, and the whole process of rainwater collection and/or all the ways of supplying the cistern. Take advantage of the cistern as an educational element that allows students to get to know better the region where they live.
Local Community	Population living around the school	Provide support at all stages. When mobilizing, negotiate with the government school improvements. Involve in the training and knowledge building process. Support the masons in the construction of the cistern.
Local Public Authority	The municipal government via its departments, especially Education and Health.	Authorize the work of ASA/AP1MC alongside the school to build the cistern and perform activities with teachers and employees. Commit to the replenishment of the cistern, guaranteeing water in quantity and quality for the entire school community. Stimulate the debate on contextualized education and on creative and didactic ways of working on environmental education and management of water resources in the school, with the cistern as a mediating element in learning. Accompany the pedagogical coordinator of the municipality in the cistern implementation process.

Nature	Actor	Role
Landowners	Landowners neighboring the schools	Grant or authorize construction on private land around the school when the school's land is not large enough for the implementation of cisterns. In these cases, the municipality is also required to dialogue with the landowner.

Source: adapted from Neves and Pereira (2011)

It is worth highlighting the fundamental roles of the federal government, the ASA, with its legal arm Associação Um Milhão de Cisternas para o Semiárido (One Million Cisterns for the Semi-arid - AP1MC), municipal governments, and the schools and local communities.

The School Cisterns Program – A Summary of Cases

Table 3 presents a summary of the results of the Program in five rural schools for kindergarten and elementary schools in Jequitinhonha and Mucuri Valleys – i.e. the municipalities of Monte Formoso, Padre Paraíso, Virgem da Lapa, Ponto dos Volantes, and Catuji. In all of them, on-site interviews with key informants, documentary analysis, and direct observations were carried out. It was observed at this stage that the cisterns were built in different periods, starting in 2015. The cisterns were considered very relevant for improving the quality of life of the school community and, mainly, avoiding interruptions in classes due to the lack of water supply.

Table 3: Field research in five schools with cisterns implemented under the Program

School	Description
A **Monte Formoso**	Ten interviews were conducted with a representative of the municipality, the principal, three teachers, two general services assistants, and three mothers of students. School A, with 59 students, was benefited by the Program in the year 2018. At that time, it faced water shortage problems in periods of prolonged drought and when the electric pump of the artesian well shared with the community had problems. After the construction of the cistern, this problem was solved, since the school now has another source of water supply.
B **Padre Paraíso**	Eleven interviews were conducted with a representative of the Municipality, the principal, two general services assistants, two librarians, a secretary, and five parents of students. School B, with 344 students, benefited from the Program in 2017. Even though it had two sources of water supply (artesian well and spring), because it served a large number of students, during prolonged dry periods it faced difficulties in maintaining the regularity of classes due to the lack of water. The Program solved this problem, since the cistern's water was used to clean the vehicles that transport the

	students. This made it possible to use the water from the other sources to meet the school's consumption, food preparation, and cleaning needs.
C **Virgem da Lapa**	Seven interviews were conducted with the Municipality representative, the principal, the teacher, the general services assistant, and three parents/guardians. School C, with 10 students, was recently benefited by the Program, in the year 2020. The school draws water from a perennial river for all its uses. However, this water is not of good quality, and pumping is frequently interrupted. The cistern has not been used yet, because classes have been interrupted due to the Covid-19 pandemic, but it is expected that the water it collects will be of better quality than the river, and will allow the regular operation of school activities, as it is another source of supply.
D **Ponto dos Volantes**	Eleven interviews were conducted with the principal, vice-principal, pedagogical advisor, two teachers, general services assistant, and five mothers of students. School D, with 653 students, benefited from the Program in 2018. At that time, although it received piped water from the water supply company, the supply was often interrupted by low water pressure, which often did not reach the school's water tank. The construction of the cistern solved this problem by serving as another reservoir.
E **Catuji**	Ten interviews were conducted with a representative of the Municipality, the principal, three teachers, and five parents of students. School E, with 47 students, was benefited by the Program in 2019. At that time, the only source of water for the school was a spring, which, in addition to poor quality, had its flow frequently interrupted by problems in the plumbing or shortages in prolonged dry periods. In addition to the cistern having solved the problem of water scarcity in dry periods, it enabled an improvement in water quality, impacting the regular functioning of school activities and the health of the students.

Source: research data, 2020.

As highlighted in Table 3, all the schools faced problems related to the regularity of the water supply, which often impacted their functioning and activities. In all schools, the cistern was built through a partnership between *Cáritas* (one of the organizations linked to the ASA), the municipal government, the school community, and the local community. Only in School B did nobody in the community participated in the construction of the cistern. It was observed that in all cases, the Program managed to achieve its main objective, which is to provide water for the regular operation of rural schools in the region (DIETRICH, 2019). Thus, the Program meets the characteristics of social innovation because it introduced a novelty that improved the life quality of those involved, by implementing a more effective and efficient technology than pre-existing alternatives (FRAZÃO et al., 2015). Baumgarten (2008) highlights the sustainability and fairness of the innovation in relation to the alternatives with the fact that the cistern implementation has provided rational management and training concerning

environmental preservation and water resources. Moreover, it provides school communities in regions historically marked by social inequality with water, a basic and indispensable resource for life.

Through the survey answered by representatives of 102 rural schools benefited by the Program, it was observed that most respondents were satisfied or very satisfied with the results obtained by the Program (Table 4).

Table 4: School representatives' satisfaction with the Program's results

	Very satisfied	Satisfied	Indifferent	Unsatisfied	Very unsatisfied
Satisfaction with the cistern	43.1%	24.5%	12.7%	2.9%	16.7%
Satisfaction with the orientation received	44.1%	25.5%	16.7%	3.9%	9.8%

Conservation status of the cistern	**Great**	**Good**	**Reasonable**	**Bad**	**Terrible**
	36.3%	35.3%	15.7%	6.9%	5.9%

Impact on the student's life	**Greatly improved**	**Slightly improved**	**No impact**	**Worsened**	**Very Worsened**
	53.9%	19.6%	25.5%	0%	1%

Importance of the cistern	**Very important**	**Important**	**Indifferent**
	69.6%	28.4%	2%

Source: elaborated by the authors, 2020.

Adding up the two positive scales of perception (very satisfied and satisfied), 67.6% were satisfied with the functioning of the cistern, 69.6% with the guidance they received about its functioning and handling, and 71.6% said that the current state of conservation of the cistern was good or excellent. The percentage of the positive evaluation was even higher in the impact of the cistern on the lives of the students, with 73.5% saying that their lives improved after its construction. The cistern was evaluated as at least important by 98% of the respondents.

The School Cisterns Program as social innovation via participatory governance

To complement the information obtained in the previous stages of this research, a representative of the *Cáritas Diocesana de Almenara* (Interviewee Z) was interviewed. As one of the executors of the Program, *Cáritas* has no direct relationship with the MC, which is responsible for funding the resources allocated to AP1MC. As the legal arm of the ASA, AP1MC receives and manages the resources financed by the MC. *Cáritas*, being linked to the ASA, signs contracts with AP1MC to execute the Program's activities. However, the political articulation is carried out mainly by the ASA.

In each state of the Brazilian semiarid region, there is an ASA executive board. Thus, the executive board of ASA Minas Gerais discusses with the National ASA what needs to be decided about the Program in the semiarid region of Minas Gerais, which, in turn, liaises directly with the MC, encouraging, especially, the expansion of the Program through new funding (Interviewee Z).

To implement each cistern, the executing organization formed teams with a project coordinator, mobilizers, office staff, and an educational coordinator. At first, the activities involved visits and meetings with the municipal government and the local and school communities. From there, the prioritized schools to build the technology were defined. Except for indigenous or *quilombola* schools, the definition of the schools to be included was made by municipal commissions. Subsequently, prices were checked and materials for the construction were purchased, and the mason and helper were sent to the community to start working. At the same time, the training of those involved was also carried out (Interviewee Z).

As one of the bottlenecks in this process, Interviewee Z highlighted the fact that financial resources are limited and that the execution must be carried out in a short period (in the case studies an average of 15 days was cited for construction), making it difficult to meet the goals more effectively. Since it depends on the municipal secretariats, the formation of committees, and the effective participation of the school community in the workshops, the executing institution would need more flexible deadlines to execute the project. From Interviewee Z's perspective, the implementation of the workshops also needed to follow many protocols, becoming very bureaucratic.

The collaboration and support of the municipal governments were requested to dig the holes for the installation of the cisterns, transport the materials used, and repair the roads and

bridges to provide access to the school communities (Interviewee Z). In addition, the importance of the municipal secretariats stimulating the participation of school staff in meetings and training was highlighted. In all case studies, the municipalities' involvement was identified to develop the mentioned activities. However, in some cases, the need for more involvement was reported.

Although community members were expected to be involved in the construction of the technology, not all communities helped (as observed in School B). In the quantitative stage, it was stated that in 63.7% of the schools, people from the local and/or school community participated, corroborating that this engagement did not occur in all schools. According to Interviewee Z, in some communities, there was more engagement because they were more organized. When there was a structured community association with regular meetings, the local mobilization was facilitated. Thus, the local social capital also had a direct effect on facilitating the implementation of the Program.

As for the opportunity for the community to have a say in the actions implemented, Interviewee Z highlighted the possibility of choosing the schools and the place where the cisterns were built in these schools (a possibility also identified in all cases). However, Interviewee Z stressed the need for a technical approach, advising about some impossibilities, such as the construction of cisterns near trees and septic tanks. As for changes in the pre-defined protocols defined to implement the Program, not even Caritas had room to make changes. However, there were spaces to discuss identified problems, which impacted changes incorporated in later proposals and protocols. Thus, the executive board of ASA Minas took these considerations to the national ASA executive board so that they could be forwarded.

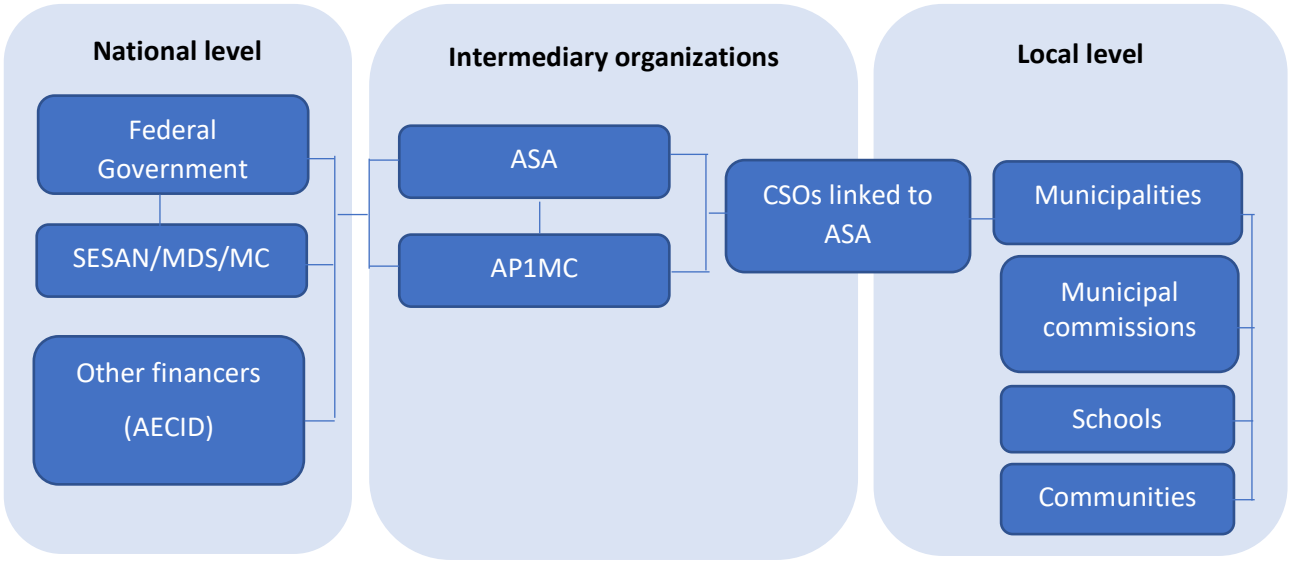
Thus, not only have the protocols of the Program changed, but also the cistern has undergone changes over time. Such is the case of the different types of bypasses for the first rainwater, which did not exist in the first cisterns built. With the invention of this system by a mason and subsequent experiments, today the program provides three alternative bypassing models.

As identified in the case studies, after the construction of the cistern, the school community and the municipal government are responsible for the maintenance and handling of the water it collects and stores. Due to the lack of resources for this follow-up, *Caritas* is only responsible for

recovering the cistern if it presents defects due to construction errors over a period of two years (Interviewee Z).

Thus, the governance of the Program can be represented in Figure 1, which entails the level of action of each actor. It is worth highlighting the role of the ASA in articulating the organizations executing the Program in rural schools in the Brazilian semi-arid region and in lobbying with funding entities, due to its political experience of debates and articulation for the region (MEDEIROS; GÓMES, 2019), especially with the Federal Government, now represented by the MC. At the intermediate and local level, the articulation between the executing CSOs, municipalities and municipal commissions, and the school and local communities stands out.

Figure 1: Governance of the School Cisterns Program



Source: Elaborated by the authors, 2020.

By deploying mixed methods, we observed that different actors in different levels played different roles in overcoming the bottlenecks identified by Oliveira and Breda-Vázquez (2012), making it possible to reach the dissemination phase of the Program. The roles of the main stakeholders are highlighted in Figure 1, in which we describe their importance for each phase of the social innovation process.

The School Cisterns Program is an example of a social innovation resulting from participatory governance since its conception to political articulation and social mobilization, at different levels. Moreover, it is notable that the program only scaled up due to the articulation of organizations from

different levels and territories of the Brazilian semi-arid region and to the status of a public policy of the federal government. The feedback and adjustments that adapted the technology were not immediate because the protocols followed, but were reviewed and changed in later edicts.

Table 5: The importance of stakeholders for the sustainability of the School Cisterns Program in each of the phases of social innovation

	Phase	Importance of the Stakeholders
0	**Latent**	Perception that the lack of water in schools has been one of the factors influencing their functioning. The Program started in the wake of the ASA's successful experiences with the construction of cisterns for families in the semi-arid rural region, which, after debates motivated by UNICEF, articulated the expansion of these experiences to the school context.
1	**Conception and development**	The Pilot Project for schools was developed in 2009 and, as of 2010, the initiative has expanded, under the coordination of the ASA, in partnership with MDS/MC, via SESAN, IABS, and AECID.
2	**Mobilization**	ASA's mobilization with the MDS/MC was fundamental, as well as the mobilization carried out by its executing CSOs with the municipal governments and the school and local communities.
3	**Generalization**	It is worth highlighting the meetings for mobilization and training of those involved (school and local community) held by CSOs and mediated by the municipal governments. With these trainings, it was possible to spread information about the importance of the cistern and its proper handling. In addition, they provided feedback for changes in the protocols of the Program and the social technology itself.
4	**Dissemination**	MDS' role in making the Program a public policy is critical in this phase, guaranteeing the financial resources necessary for its expansion. Logistical support provided by the municipalities is also important to carry out the activities. Thus, the Program was able to cover schools in the nine states of the Brazilian semi-arid region.

Source: prepared by the authors based on Oliveira and Breda-Vázquez (2012, p. 525).

It is also worth mentioning that the local social capital acted as a driver or limiter of collective cistern construction. It also affected the practical learning of the community members about the importance of the cistern, its construction, maintenance, and management.

Final Considerations

Confronting the challenges of drought experienced by the population of the semi-arid region through collective strategies and the development of social innovations contributes to the strengthening of relations and the improvement of living conditions in the communities' daily lives. From this perspective, the School Cisterns Program is characterized as a networked structure that feeds back and reflects the ideas of the different actors and the political exchanges established among them.

The governance of this Program is complex, not because of its degree of innovation, but because of its large scale, demanding a considerable volume of financial investment, and the diversity of the actors involved. Different levels of participation and decision-making power are observed. In this context, it is worth mentioning the strategic role of the MDS/MC and the ASA in defining and financing the policy, associations linked to it, and municipal governments, at the intermediary and local levels. The local community is mainly involved in the cistern construction stage, with little margin for participation in the design or planning stages of the activities. Thus, there is a trade-off between the gain in scale of the social innovation and the balanced involvement of the actors in different levels.

The political articulation that unites the different actors is done by the ASA and its associates and not by the Government, as advocated by some of the authors discussed in the section on participatory governance. The municipality could contribute more to coordinate the actors involved, guaranteeing the necessary "glue" to obtain the desired results. If in the design phase of the program this articulation was clearer, in the implementation of the cisterns the public authorities did not always act in an ideal way. This reinforces the importance of social participation mechanisms for the proper dissemination of social innovation, such as public hearings, councils, and auditing bodies (PETERS, 2005). At the local level, it is worth highlighting the importance of community social capital for the engagement in the construction, maintenance, and management of the cistern.

As another form of participatory governance, one can observe in the Program a mix of democratic and collaborative rationality with bureaucratic and instrumental rationality (BEVIR, 2011). Although the protocols defined by the ASA and the MDS/MC have limited the flexibility of the processes, they have allowed legitimacy and governability for the implementation of actions (CHAGNAZAROFF, 2009). Thus, the challenges related to the slowness of the decision-making process and the articulation of a large number of actors (PETERS, 2005) were overcome. This article contributes by putting participatory governance at the core of an extremely important social innovation in the context of developing countries. In addition, based on the triangulation of methods and exhaustive qualitative data analysis, it provides new evidence on the School Cisterns Program that could be relevant to other national contexts. Although the visits, questionnaires, and interviews provided rich data, future studies can explore the perspective of subjects working in other social organizations linked to the ASA that build cisterns in other regions.

Acknowledgments:

The authors thank the *Conselho Nacional de Desenvolvimento Científico e Tecnológico* (National Council for Scientific and Technological Development - CNPq) and the *Ministério da Cidadania* (Brazilian Ministry of Citizenship - MC) for funding this study.

References

ASA – Articulação no Semiárido Brasieliro. Ações - Cisternas nas Escolas. Disponível em: <https://www.asabrasil.org.br/acoes/cisternas-nas-escolas&gt>. Acesso em: 27 mar. 2020.

BACON, N.; FAIZULLAH, A; MULGAN, G.; WOODCRAFT, S**. Transformers.** How local areas innovate to address changing social needs. Research Report. NESTA - National Endowment for Science, Technology and the Arts, London. 2008.

BAUMGARTEN, Maíra. Ciência, tecnologia e desenvolvimento – redes e inovação social. **Parcerias Estratégicas**, v. 26, p. 101-123. 2008.

BIGNETTI, Luiz Paulo. As inovações Sociais: uma incursão por ideias, tendências e focos de pesquisa. **Ciências Sociais Unisinos**, v. 47, n. 1, p.3-14. 2011.

BEVIR, M. Governança democrática: uma genealogia. **Revista Sociologia Política**, v. 19, n. 39, p. 103-114. 2011.

CHAGNAZAROFF, Ivan Beck. Reflexões sobre Estratégias de Governança Local. **Revista Eletrônica Gestão e Sociedade**, v. 3, n. 5, p. 23-47, jan./jun. 2009.

COSTA, A. B.; DIAS, R. B. Estado e sociedade civil na implantação de políticas de cisternas. In: Costa, A. B. (Org.). **Tecnologia social e políticas públicas**. São Paulo: Instituto Pólis. 2013.

CRESWELL, John. **Research Design:** Qualitative, Quantitative, and Mixed Methods Approaches. 4. ed. London: SAGE Publications. 2014.

DEFOURNY, Jacques. Economia Social. In: Cattani, Antonio D. et al. **Dicionário Internacional da Outra Economia**. Gráfica de Coimbra Ltda: Coimbra. 2009.

DEMETROPOULOU, L. et al. Water framework directive implementation in Greece: Introducing participation in water governance – the Case of the Evrotas River Basin management plan. **Environmental Policy and Governance**, v. 20, p. 336-349. 2010.

DIETRICH, T. P. **Acesso à Água e Resultados Educacionais: evidências para o semiárido brasileiro.** Dissertação de Mestrado em Economia Aplicada. Programa de Pós-Graduação em Organizações e Mercados. Universidade Federal de Pelotas. Pelotas. 2019.

DIOGO, Vera. **Dinâmicas de Inovação Social e suas Implicações no Desenvolvimento Espacial: três iniciativas do terceiro sector no norte de Portugal.** Dissertação de Mestrado em Riscos, Cidades e Ordenamento do Território. 2007.

DOWBOR, Ladislau. Inovação Social e Sustentabilidade. In: Farfus, Daniele et al. **Inovação Social**. Curitiba: SESI/SENAI/IEL/UNINDUS, v. 2. 2007.

ETZKOWITZ, H.; ZHOU, C. Hélice Tríplice: inovação e empreendedorismo universidade-indústria-governo. **Estudos Avançados**, v. 31, n. 90, p. 23-48. 2017.

EZPONDA; Javier E.; MALILLOS; Lucía M. Cambio de Paradigma em los Estudios de Innovación: El giro social de lãs políticas europeas de innovacion. **ARBOR- Ciencia, Pensamiento y Cultura**. v. 187, n. 752, p. 1031-1043. 2011.

FRAZÃO, Nuno; CARVALHO, Isabel L.; CARLOS, Filipa. **Social Innovation in Cidadania Ativa Programme Projects.** Calouste Gulbenkian Foundation. Lisboa. 2015.

GOTTFRIED, M. A. Evaluating the relationship between student attendance and achievement in urban elementary and middle schools: an instrumental variables approach. **American Educational Research Journal**, v. 47, n. 2, p. 434–465. 2010.

KLEIN, Juan-Luis. Introduction: social innovation at the crossroads between science, economy and society. In: Moulaert, Frank et al. **The International Handbook on Social Innovation**. Cheltenham – UK: Edward Elgar. 2013.

LIRA, P. G. R. et al. P1MC e resiliência: um estudo no município de Soledade-PB. In: Jornada Internacional de Políticas Públicas, 5., 2011. **Anais**... São Luís: UFMA. 2011.

LOPES, D. P. T.; VIEIRA, N. S.; BARBOSA, A. C. Q.; PARENTE, C. Management innovation and social innovation: convergences and divergences. **Academia Revista Latinoamericana de Administración**, v. 30, n. 4, p. 474-489. 2017.

MEDEIROS, C. B.; GÓMEZ, C. R. P. Inovação Social na Análise do Ciclo de Expansão do Programa 1 Milhão de Cisternas. **Revista de Gestão Social e Ambiental**, v. 13, n. 3, p. 44-59. 2019.

MATTOS, Pedro L. Análise de entrevistas não estruturadas: da formalização à pragmática da linguagem. In: Godoi, C. K., Bandeira-Demelo, R.; Silva, A. B. **Pesquisa Qualitativa em Estudos Organizacionais:** paradigmas, estratégias e métodos. São Paulo: Saraiva. 2006.

MOULAERT, Frank; MACCALLUM, Diana; HILLIER, Jean. Social Innovation: intuition, precept, concept, theory and practice. In: Moullaert, Frank et al. **The International Handbook on Social Innovation**. Cheltenham – UK: Edward Elgar. 2013.

MULGAN, Geoff. Inovação social. In: Azevedo, Carlos et al. **Gestão de Organizações Sem Fins Lucrativos:** o desafio da inovação social. Porto: Uniarte Gráfica S. A. p. 51-74. 2010.

NEVES, Rafael S.; PEREIRA, Clara M. Cisternas nas escolas: portas de entrada para uma educação contextualizada no Semiárido. **Curso de Formação em Gestão Pública**. 2011. Acesso à Água e Convivência com o Semiárido FGP/SAN – Águas – Cisternas. 2011. Disponível em: <http://redesan.ufrgs.br>. Acesso em: 18 de mai. 2020.

OLIVEIRA, Carlos; BREDA-VÁZQUEZ, Isabel. Creativity and Social Innovation: What Can Urban Policies Learn from Sectoral Experiences? **International Journal of Urban and Regional Research**, v. 36, n. 3, p. 522-538. 2012.

PARENTE, C.; MARCOS, V.; DIOGO, V. Sobre inovação e empreendedorismo social. In: Parente, C.. **Empreendedorismo Social em Portugal**. Porto: Universidade do Porto. 2014.

PETERS, Guy. Governanza y Burocracia Pública: ¿nuevas formas de democracia e nuevas formas de control? **Foro Internacional**, Distrito Federal, México, v. XLV, 4, p. 585-598, out./dez. 2005.
PINTO, Tainá R. G. S. et al. Governança Participativa: possibilidades e desafios na gestão local. **Interações**, v. 19, n. 3, p. 627-641, set. 2018.

PHILLS Jr, JAMES A.; DEIGLMEIR, K.; MILLER, D. T. Rediscovering Social Innovation. **Stanford Social Innovation Review**. 2008.

RODRIGUES, Andrea L. Modelos de Gestão e Inovação Social em Organizações Sem Fins Lucrativos: dvergências e convergências entre Nonprofit Sector e Economia Social. In: Encontro da ANPAD, 30, 2006, Salvador. **Anais...**, Salvador: ANPAD. 2006.

SANTANA, V. L, ARSKY, I.C. Aprendizado e Inovação no Desenho de Regras para a Implementação de Políticas Públicas: a experiência do Programa Cisternas. **Rev. Serv. Público**, v. 67, n. 2, p. 203-226, abr/jun. 2016.

SANTOS, J. E. S.; BORJA, P. C. Captação e armazenamento de água de chuva para consumo humano no semiárido baiano no âmbito do P1MC. **Brazilian Journal of Development**. v. 6, n. 1, p. 5259-5300, jan. 2020.

SOUSA, A. B. et al. Tecnologias Sociais de convivência com o Semiárido na região do Cariri cearense. **Cadernos de Ciência & Tecnologia**, v. 34, n. 2, p. 197-220, maio/ago. 2017.

SUDENE - Superintendência do Desenvolvimento do Nordeste. Nova delimitação Semiárido. 2018. Disponível em:<http://www.sudene.gov.br/images/arquivos/semiarido/arquivos/Rela%C3%A7%C3%A3o_de_Munic%C3%ADpios_Semi%C3%A1rido.>. Acesso em: 05 fev. 2020.