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**Life and resistance in the Northeastern hinterland: cisterns as social technologies for coexistence in the Brazilian semi-arid region**

**Vida y resistencia en el interior del nordeste: cisternas como tecnologías sociales para la convivencia en el semiárido brasileño**

**Vida e resistência no Sertão: as cisternas como tecnologias socioespaciais para a convivência com o semiárido brasileiro**

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**Abstract**

The people of the semi-arid region suffer the hardships of long droughts, when the lack of rain jeopardises their survival. However, this reality has changed, based on the perspective of coexistence with drought, conceived by sertanejo families and social movements, which involves spreading knowledge about the characteristics of this biome, its potential and strategies for living and producing even during periods of scarce rainfall. These strategies involve the creation of socio-spatial technologies to capture, store and reuse water. The aim of this article is to present the process of building coexistence with the semi-arid region through these technologies, which, despite the challenges and the need for expansion, have provided a new reality for the families that have benefited from them.

**Keywords:** Coexistence with the Semi-Arid, Socio-Spatial Technologies, 1 Million Cisterns Program, Access to Water, Northeast.

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**Resumen**

Los habitantes de la región semiárida sufren las penurias de las largas sequías, cuando la falta de lluvias pone en peligro su supervivencia. Sin embargo, esta realidad ha cambiado, a partir de la perspectiva de coexistencia con la sequía, concebida por las familias sertanejas y los movimientos sociales, que implica la difusión del conocimiento sobre las características de este bioma, su potencial y las estrategias para vivir y producir incluso durante los periodos de escasez de lluvias. Estas estrategias implican la creación de tecnologías socioespaciales para captar, almacenar y reutilizar el agua. El objetivo de este artículo es presentar el proceso de construcción de la convivencia con la región semiárida a través de estas tecnologías, que, a pesar de los desafíos y de

la necesidad de expansión, han proporcionado una nueva realidad a las familias que se han beneficiado de ellas.

**Palabras clave:** Convivencia con el Semiárido, Tecnologías Socioespaciales, Programa 1 Millón de Cisternas, Acceso al Agua, Noreste.

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### Resumo

O povo sertanejo sofre pelas dificuldades dos períodos de longas estiagens, quando a ausência de chuvas compromete a sua sobrevivência. Entretanto, essa realidade tem mudado, a partir da perspectiva de convivência com a seca, pensada pelas famílias sertanejas e movimentos sociais, que prevê a difusão do conhecimento sobre as características desse bioma, suas potencialidades e estratégias para viver e produzir mesmo nos períodos de escassez de chuvas. Essas estratégias envolvem a criação de tecnologias socioespaciais para captação, armazenamento e reutilização da água. O objetivo deste artigo é apresentar o processo de construção da convivência com o semiárido por meio dessas tecnologias, que apesar dos desafios e necessidade de ampliação, têm propiciado uma nova realidade para as famílias beneficiadas.

**Palavras-chave:** Convivência com o Semiárido, Tecnologias Socioespaciais, Programa 1 Milhão de Cisternas, Acesso a Água, Nordeste.

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### Introducción

This article is the result of part of a postdoctoral research carried out at the Universidade Estadual do Sudoeste da Bahia (UESB), Vitória da Conquista campus. The research addressed the changes in the lives of female farmers after their families were included in cistern programs. This article will present a bibliographic review of the geographic context that characterizes the semiarid region, the changes in perspective based on the proposal for living with drought, and the potential of social technologies for capturing and storing water.

Access to quality water in adequate quantities is a universal right and is included as one of the sustainable development goals (SDGs) of the United Nations (UN) 2030 Agenda.

Access to land is an essential right for rural families to be able to live and produce, but in some contexts, land is not the only indispensable resource for peasant survival, as is the case in the Brazilian semiarid region, where water is an essential item for life and agricultural production (MELO, 2010).

Access to land is an essential right for rural families to live and produce, but in some contexts, land is not the only indispensable resource for peasant survival, as is the case in the Brazilian semi-arid region, where water is an essential item for life and agricultural production (MELO, 2010).

The semi-arid region is a region that experiences the natural phenomenon of drought. Its extension involves all the states of the Northeast and part of the states of Minas Gerais and Espírito Santo. The semi-arid region covers 1,142,00 km<sup>2</sup>, 1,500 municipalities and approximately 26.4 million inhabitants (15.5% of the population of Brazil), which makes it one of the most populous semi-arid regions in the world (BARACUHY; FURTADO; FRANCISCO, 2017; GOMES, 2018). In the semi-arid region, in addition to the absence of rain for long periods, there are problems such as the scarcity of perennial rivers and in terms of the use of rainwater. A lot of surface water is lost through the evaporation of dams.

According to Suassuna (2007), the semi-arid region of the Northeast belongs to the caatinga biome and has a dry and hot climate. Gomes (2018) explains that the name of the biome comes from Tupi, “caa” meaning vegetation and “tinga” meaning white, clear, white forest. The name alludes to the appearance of the caatinga plants (the most common: amburana, aroeira, umbu, baraúna, maniçoba, macambira, mandacaru and juazeiro) that during the drought, lose their leaves and their trunks become white and shiny. Water shortages and scarcity have caused many difficulties in the lives of the rural population for decades. During periods of intense drought, they suffer from thirst, hunger and poverty, a condition that leads many families to migrate to other regions of the country. Those who remain face many adversities to survive, in addition to the perverse and exclusionary practices of the coronelismo, which for a long time encouraged the drought industry.

In addition to this introduction, conclusions and references, this article is organized into two more sections: “Between the discourse of combating drought and the proposal for coexistence with the semi-arid region” and “Water in the hands of

rural families: social technologies and the democratization of access to water resources”.

### **Between the discourse of combating drought and the proposal for coexistence with the semi-arid region**

In the Brazilian semiarid region, there is little rainfall and the rainfall is poorly distributed over time, with successive rainfall occurring at short intervals being rare. Furthermore, this is an area that is influenced by El Niño, which blocks cold fronts coming from the south of the country (SUASSUNA, 2007).

Because it is close to the equator and has low latitudes, the semiarid region has high temperatures and a high number of hours of annual sunshine, with high levels of evapotranspiration. 70% of the semiarid region is located under crystalline basement, with shallow soils and low infiltration capacity, with reduced surface runoff and natural drainage, and its aquifers are discontinuous, with water stored in rock crevices, which are not suitable for human consumption (SUASSUNA, 2017).

The water limitation of the semiarid region is aggravated by the region's water balance. There is precipitation of around 600mm to 800mm, however, evapotranspiration reaches 2,000mm, so it is essential to have ways to maintain the trinomial of water, capture/conservation and efficiency of its use (BARACUHY; FURTADO; FRANCISCO; 2017).

According to Borja et al (2022), in the case of Bahia, perennial surface waters are composed of three rivers, São Francisco, Parnaíba, Paraguaçu and Contas, in addition to the state having other temporary watercourses that contribute to economic activities, human use and for animals.

Baracuhy, Furtado and Francisco (2017) explain that the Northeast has eutrophic soil and has no sunlight limitation, despite being shallow, the soil has conditions for production as long as there is technical/scientific effort to find ways to capture, conserve and reuse water.

What puts the semi-arid region at risk of desertification, ecological imbalance and losses for its inhabitants is the inadequate and insufficient distribution of water during periods of scarcity. Rural areas suffer greatly from the lack of water transportation and distribution infrastructure such as canals and pipelines, which compromises the production and reproduction of these families (BORJA et al, 2022).

Water is a food and resource that is part of the fundamental rights of Brazilians. Access to quality water in sufficient quantity is a component of the National Policy for Food and Nutrition Security (PNSAN).

Some periods of drought during the 20th century were more intense and had major consequences for the lives of the sertanejos, such as: the drought of 1915, 1919, 1952 to 1958, in addition to the droughts of 1970, and more recently, that of 1993 (MELO, 2010).

Melo (2010) highlights that in order to combat drought, the semi-arid region underwent several government actions, including the creation of the Inspectorate for Works Against Droughts (IOCS), currently the National Department for Works Against Droughts (DNOCS). The works involved in this policy consisted of infrastructure and dam construction. After the creation of the Superintendence for the Development of the Northeast (SUDENE), emergency actions were created to assist the population affected by droughts. Between 1989 and 1999, the Federal Government invested more than one billion to donate basic food baskets to families in the backlands.

In this context, the São Francisco Valley Hydroelectric Company (CHESF) and the São Francisco Valley Commission (CVSF) were also created. The former was responsible for producing, transmitting and selling electricity to the Brazilian Northeast. The CVSF aimed to regulate the river regime of the São Francisco River and improve the urban and rural transportation, communication, irrigation, and sanitation systems (SANTOS, 2020).

Santos (2020) states that the DNOCS worked on the construction of dams, roads, power transmission lines, water supply systems, and the implementation of irrigation systems. However, such works did not eradicate drought, which is a natural phenomenon, nor did they solve the problem of thirst and hunger. They only served to strengthen the power of local elites.

Another institution with significant activity was SUDENE, which, according to Santos (2020, p. 69):

The prominent presence of SUDENE was consolidated as an attempt at state intervention for the socioeconomic development of the Northeast. Celso Furtado, one of its founders in 1958 and superintendent, sought effective regional awareness and proposed a development model that would strengthen the Northeastern economy through industry through intensive capital from the center-south of the country and agriculture. However, only the second productive sector grew, as coronelistic forces emerged in the countryside that framed the rural space, concentrated and poor.

In many media representations and even in textbooks, the sertão has been portrayed as a place of extreme vulnerability and poverty. This fact, combined with the broadcasting of images of cracked soil and white vegetation, which are natural characteristics of the caatinga biome, reinforced the stigma that this region is plagued by poverty and mass migration, and that, therefore, it required emergency policies to combat the effects of drought.

In Brazil, the term sertão has always been associated with cracked earth, hunger, thirst, scorching sun, bandits, dead cattle, among other images that are always related to suffering. Some facts contributed to the dissemination of this image, among them the great drought of 1877 to 1879, which was responsible for the death of 500 thousand people, with Ceará being the most affected state (GOMES, 2018, p.30).

The semi-arid region has a high land concentration, there are historical hierarchies in the semi-arid region, so that a social and economic elite led to the plundering and unequal use of natural resources (BORJA et al, 2022).

According to Santos (2020, p. 68):

These socioeconomic relations in the Northeast and Bahia are linked to the historical legacy of production patterns linked to land concentration that have been present in the region ever since, as this process is anchored, above all, in existing political pillars. Due to this problem correlated with climate circumstances, marginalized Northeasterners tend to submit to the sale of their small properties, migration and consequent rural exodus, and those who persist do not have access to production technologies that would allow them to be included and remain in production circuits. Consequently, years go by and the Northeast region still needs benefits or welfare projects, since, as long as there are no policies that change the living conditions of the population, this practice of blaming only climate phenomena will continue.

Water use in the country is unequal: 70% of this resource is used for irrigation, industry uses about 6%, and only 6% is used for human consumption. The excessive use of water by agribusiness intensifies conflicts in the countryside over land and water. The Pastoral Land Commission has been publicizing and denouncing the growth of these conflicts and the actions of resistance against the private appropriation of water resources and the charging for their use, against the construction of dams and reservoirs (in this case, there is the aggravating factor for those affected by dams) (GOMES, 2018).

The oligarchies of the semi-arid region have consolidated the drought industry, a network that benefits from the scarcity of water, either by garnering votes to perpetuate themselves in power, or by diverting resources to the construction of large-scale projects that are far from solving the problem, such as the construction of reservoirs and pipelines, the distribution of food baskets and water by means of water tanker trucks (GOMES, 2018).

This process has fostered what is now known as the drought industry, when agribusiness entrepreneurs, regional politicians and other segments are interested in profiting from the phenomenon of water scarcity in the semi-arid region, either by garnering votes or encouraging the construction of large-scale projects.

Unfortunately, this still occurs, but with new perspectives on how to think and implement actions in the semi-arid region, it has decreased.

This is the case of coexistence with the semi-arid region, which is based on the cultural appreciation of regional knowledge and practices, the recognition of the heterogeneity of the sertão, and the spatial understanding of the local population throughout the transformations that the landscape in question has undergone. And this knowledge of the sertanejos themselves drives alternatives and solutions for life and production in this place.

According to Vale (2018), coexistence with the semi-arid region presupposes 8 premises:

1. The development of social technologies for collecting rainwater, such as cisterns, dams, small and medium-sized underground and river dams; 2. Intelligent use and conservation of xerophilous biodiversity, involving the conscious use and planting of fruit, ornamental and phytotherapeutic plants from the region;

3. Contextualized education, which enables the construction of a new sociability and cultural relationship between the inhabitants of the semiarid region and the place, demystifying the idea that drought is responsible for the existing social and economic problems;

4. Stockpiling, as an essential strategy for the survival of rural families, to save, care for, manage and thus ensure greater tranquility in periods of scarcity. In the semiarid region, human and animal food, water and seeds are stockpiled;

5. Technical assistance and contextualized rural extension, which is a right and basic tool for rural families, provides for technical monitoring of the public policies implemented, in addition to encouraging production for survival and to supply local markets; 6. Agrarian reform, an indispensable policy of reparation and a right of the Brazilian people, but which remains an unfulfilled demand, encouraged only by palliative measures, such as the creation of rural settlements;



7. The agroecological production process, a perspective of respectful and conscious use of natural resources; and

8. Subsidy to family farming, which provides for the expansion of credit lines for families of small farmers.

According to Santos (2020), coexistence with the semi-arid region is today the best way to encourage rural families to remain in the region, since the implementation of decentralized public policies through civil society organizations presents new perspectives for the people of the sertão and includes them as actors in local development and in facing adversities, whether climatic or socioeconomic.

Social participation and the formation of a collective conscience play a fundamental role, as they can define the priorities and needs that will be interfered with by public policies, especially those that affect access to water. However, social participation in the discussion of public policies aimed at the issue of water is a challenge, since the population, in general, is not aware of its power in the process of formulating and managing public policies (SANTOS, 2020, p. 71).

Rapid actions to mitigate thirst and hunger are important, especially during periods of intense drought. However, over time, such actions have strengthened corrupt and coronelistic practices that already existed, placing the population at the mercy of landowners and local politicians. Furthermore, drought cannot be combated; it is a natural phenomenon and, as such, has intrinsic characteristics.

It was in this sense that, from the articulation of social movements active in the region, the proposal for actions to live with drought emerged, understanding that drought is a natural phenomenon and, therefore, cannot be combated, but alternatives must be sought so that the rural population lives in these areas and learns to store and preserve water for consumption and production.

In general, it is possible to trace a brief history of the actions and public policies created for the semi-arid region, according to Pinheiro (2019):

Table 1- Programs for the Brazilian semi-arid region

Year of creation	Public policies and programs
1877-1879	Construction of dams and wells

1948	The Department of Public Works against drought created the São Francisco Valley Commission, with a new method of combating drought
1952	The Banco do Nordeste is created to provide financial support to the drought polygon
1958	The Superintendence for the Development of the Northeast was created to propose regional development policies. It was dissolved in 2001 and replaced by the Northeast Development Agency (ADENE).
1970	New programs were created: National Integration Program (PIN), Land Redistribution Program incorporated into the I National Development Plan (I PND) and the Northeast Integrated Land Program (1974), incorporated into the II National Development Plan (II PND) – they boosted irrigated agriculture.
1976	Sertanejo Project - aimed to make the local economy more resistant to drought.
1979-1983	Northeast Water Resources Program (Prohidro) – aimed to increase the supply of water resources through the construction of public and private dams and wells. The Provárzeas Program aimed to help small producers financially.
1987	Small producers continue to receive assistance from the Support Program for Small Rural Producers in the Semi-Arid Region.
1990-1993	The Emergency Food Distribution Program (Prodea) is created, aiming at distributing food in the semi-arid region.
1998	Start of federal government emergency programs to help the population during the critical phase of the drought.
2001-2006	Creation of the One Million Cisterns Program, created through coordination in the semi-arid region with the aim of creating a management model that integrates civil society.

Source: Pinheiro, 2019.

Significant parts of these programs were based on the construction of large-scale projects that were not effective in solving problems in the region. Only after the implementation of cisterns and other technological alternatives, with the work of the Brazilian Semi-Arid Articulation (ASA) and the Ministry of Development and Social Assistance, Family and Fight against Hunger (MDS) did there come an improvement in the lives of the caatinga population (COSTA; DIAS, 2013). According to the authors:

Diagnoses regarding the failure of policies already implemented to combat drought generally cite constraints in the implementation of the policy, such as lack of resources, difficulties in coordination

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between states, and corruption. Without denying these factors, several organized civil society entities in the Northeast suggest that the policies implemented in the region to “combat drought” also fail because they are based on an erroneous formulation of the problems experienced in the Semi-arid region (COSTA; DIAS, 2013, p. 35).

ASA emerged from the strengthening of civil society in the early 1990s. In 1993, there was an occupation of Sudene, which aimed to draw attention to coexistence with the semi-arid region, in contrast to the State's policy at that time, which was based on combating drought. In 1999, the 3rd Conference of the Parties to the Convention to Combat Desertification and Drought (COP3) took place in the capital of Recife. At that time, the organizations that were part of ASA released the Declaration of the Brazilian Semi-Arid Region (GOMES, 2018).

Gomes (2018) explains that after the creation of the Peasant Leagues in the 1950s, thousands of peasants mobilized in the fight for agrarian reform. With the military coup in 1964, the leagues were extinguished and rural workers began to organize themselves into unions, with the support of libertarian sectors of the Catholic Church. These movements and non-governmental organizations formed the ASA.

The Articulation in the Brazilian Semi-Arid (ASA) is a network formed by different civil society organizations, rural unions, farmers' associations, cooperatives, NGOs, Oscip, etc. ASA defends, disseminates and puts into practice, also with public policies, a political project of coexistence with the Semi-Arid (GOMES, 2018, p. 32).

Vale (2020) states that ASA is a network that integrates more than 3,000 civil society organizations, resulting from union, religious, academic and social movement ideals, which seek to overcome the discourse of combating drought.

According to the author mentioned above, ASA has a structure that unfolds into four different scales, which are mutually articulated, without necessarily obeying a hierarchical order. ASA at the Brazilian level, as already explained, is a network of organizations on a national scale. At the state level, ASA works with each

state to mobilize different sectors of society to defend and implement policies for coexisting with the semi-arid region. There are organizations that monitor these actions at the micro-regional and territorial levels. And finally, there is ASA at the municipal level, a collective that works in each municipality, for social control of the process of implementing actions and discussing new possibilities (VALE, 2020). Since 1990, social movements and organizations involved in the issue of access to water in the semi-arid region have been working to encourage another perspective in the region: living with drought, or living with the semi-arid region. Currently, ASA brings together more than 700 civil society organizations, combating the previously widespread idea that the semi-arid region is inhospitable and unsuitable for human existence. Unlike large-scale projects, ASA encourages the creation of simple, cheap, sustainable solutions that include family participation. Drought is then understood as a manageable situation, a rainfall condition that can be lived with, without necessarily depending on government interference (COSTA; DIAS, 2013).

For decades, attempts to “overcome” the drought were in vain. Such initiatives did not solve the problems to which the local population was subjected. Many found no other way out than to abandon the land where they lived and migrate towards large urban centers, where they often found themselves in a situation of poverty and exclusion not very different from the one they intended to escape. The notion of coexistence with drought, which guides the new paradigm that gives rise to P1MC, offers a perspective that allows actions to break with this perverse dynamic (COSTA; DIAS, 2013, p. 60).

It is important to mention the decline in resources allocated to public policies that the region in question suffered during Bolsonaro's government. There was a successive dismantling of programs that were and are very important for the population of the semi-arid region, such as Bolsa Família, the One Million Cisterns, One Land and Two Waters Program (P1+2), Brazil without Poverty, Water for All, and Harvest Guarantee (BORJA, 2022). It is expected that with the recently reelected

government of Lula, which has a progressive bias, there will be a resumption and greater investment in these policies.

According to Gomes (2018, p. 20):

Historical problems related to drought (coronelismo, drought industry, etc.) began to have another connotation with the Lula government and with the public policies implemented by this government. The rise of the Articulation in the Brazilian Semi-Arid (ASA)<sup>11</sup>, as the main articulator of a new vision of the semi-arid region where dealing with drought became the main guideline for new public policies, abandoning the old idea of combating drought.

Drought, as many researchers have pointed out, is not the main contributor to poverty in the semi-arid region; it is a natural phenomenon; rather, underdevelopment and local exploitation by the northeastern elite and groups from other regions are the cause. The exploitation of land and production relations are social problems.

Historically, drought has been accompanied by the actions of traditional politicians from the Northeast, who have always thought of access to water in the semi-arid region through the practice of coronelismo. Coronelismo is a way of maintaining power and doing politics. This concept refers to a reality that is highly prevalent in the Brazilian Northeast, especially in the semi-arid region (GOMES, 2018, p. 24).

The coronelismo was established in the agreement of exchange of advantages between the public power and the declining local leadership, who owned land, a patent received by the national guard, and in some cases even the media. Most of the dams and wells were built on their properties, thus forming the well-known vote of halter, which took electoral advantage of the vulnerable situation that the drought creates for the poorest population (GOMES, 2018). It is worth remembering that this issue is still recurrent, since the control of water remains in the hands of a few, currently with the emphasis on large companies that, upon establishing themselves in the region, begin to use the available water for large irrigation projects. The case of the municipality of Correntina, in the interior of Bahia, recently gained international

prominence, when its inhabitants demonstrated against the abusive capture of water from the Arroja River, carried out by transnational agribusiness companies, occupying the Igarashi and Curitiba farms (GOMES, 2018).

While there is a lack of water for the poor population, the water market is advancing in the semi-arid region through the power of agribusiness and hydrobusiness. Irrigation for fruit farming is advancing in the semi-arid region and with it the dispute for large volumes of water by transnational capital, which invests in export agriculture (GOMES, 2018, p. 29).

The water colonels have never been interested in managing water resources through decentralization and democratization of access to water resources. Therefore, despite the problems and the importance of expanding and improving policies for coping with drought, the use of social technologies in this context has been a revolutionary action.

### **Water in the hands of rural families: social technologies and the democratization of access to water resources**

Sociospatial technologies acquire a geographic meaning because they are designed by people who live in a given space and are well aware of local problems and difficulties. They become sociospatial because they resonate in the places where they are applied, each in its own way, imbued with cultural aspects, thus generating a unique sociospatial context.

A social technology is a tool produced from popular knowledge and local problems, and is built with the participation of the population, which uses creativity and existing resources. For these reasons, social technologies are economically viable and easy to reapply in different realities (SEBRAE, 2017).

The term “social technology” is broadly understood for the different layers of society. The adjective “social” is not intended to only affirm the need for technology for the poor or underdeveloped countries. It also criticizes the conventional model of technological development and proposes a more sustainable and supportive logic of technology for all layers of society. Social technology implies participation, empowerment and self-management of its users [...] given the reality

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of Latin America, its conceptual potential has been debated and expanded to concrete strategies for social inclusion (JESUS; COSTA, 2013, p. 18).

According to Jesus and Costa (2013), social technology is realized when solutions to problems are found based on observation and creativity, formulated by people who experience such situations. This is not about denying technical knowledge, but about removing it from a hegemonic position, valuing the empirical knowledge of civil society. It is worth mentioning, as the authors suggest, that social technologies are not neutral, since in historical situations they were used as tools for both domination and resistance in countries involving European colonization.

Analyzing a social technology also implies understanding it politically. According to biological determinism, all technological development is positive for society, linear and efficient, which does not always correspond to reality. Furthermore, the search for technological solutions does not refer to a standardized idea; each context has its specificities. Therefore, “technological construction and formulation must involve social movements, the beneficiaries themselves and the actors of specific contexts” (JESUS; COSTA, 2013, p. 22).

Social technology also discusses criticisms of science, technology and innovation policies and the Brazilian research agenda, in the sense of having inclusion as a priority, involving subjects who are legitimately capable of thinking about urban problems, drought in the semi-arid region, disasters in times of rain, and the difficulties of rural work. The idea that only technicians, scientists and specialists have the skills to build technologies to solve these problems is questioned and challenged. Citizens, neighborhood associations, solidarity economy organizations, non-governmental organizations, social movements, unions and other civil society institutions can develop, appropriate and adapt social technologies to benefit their reality (JESUS; COSTA, 2013). Thus, a social technology can be defined as Dagnino (2012, p. 2) apud Jesus and Costa (2013, p. 22), as:

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...artifacts or processes that result from the action of an enterprise in which ownership of the means of production is collective, where workers carry out economic activities in a self-managed manner and the management and allocation of results is decided in a participatory and democratic manner.

According to Francisco, Baracuchy and Furtado (2017), there are a considerable number of validated technologies for agricultural exploration in the semiarid region that are incorporated based on the appropriation and adoption of peasant families. The authors call them alternative technologies for coexisting with the semiarid region and explain that some of these technologies are also known as appropriate technologies, as they are adapted to the reality of the rural population.

With the emergence of rural extension in Brazil in 1949, and the participation of extension agents in the task of passing on technologies and bringing the demands of rural men and women to the research sector, and in this case, farmers in the semiarid region, a process of studying/developing technologies aimed at solving the region's problems began, with an emphasis on those in coexistence with climatic limitations. The characteristics that determine the viability and functionality of technologies are: being able to adapt to the most varied environments, being easily replicable, having low implementation and maintenance costs, and being easily appropriated by farmers (BARACUHY; FURTADO; FRANCISCO, 2017, p. 12).

The aforementioned authors highlight a very interesting aspect, according to them, the main demand of rural families in the semi-arid region is not necessarily agriculture, but citizenship, such as schools, health units, roads, among others. Every project undertaken in the region that truly aims to improve the lives of the population must have this issue as one of its objectives.

The construction of infrastructures involving social technologies is generally carried out in collective efforts and includes exchanges beyond financial ones. It is possible to define social technologies as:



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a set of techniques, transformative methodologies, developed and/or applied by it, which represent solutions for social inclusion and improvement of living conditions. [...] They aim at sustainable development based on important factors such as social protagonism, environmental care, economic solidarity, cultural respect, work and income, and education (SEBRAE, 2017, p. 7).

Since the 1970s, social technologies have been disseminated, but under other names, being known as appropriate technologies, it was only in the 1980s that they gained the name known today. Some social technologies are well known to people, an example is homemade serum, a mixture of sugar, salt and water used to combat dehydration and infant mortality (SEBRAE, 2019).

social technologies are for the common good, that is, they are not patented by companies or produced on a large scale, since their character is that they arise from the creativity of people who know their problems and realities and can be disseminated to similar situations by people interested in contributing to a more sustainable world (SEBRAE, 2017, P. 9).

When a Social Technology is developed in another region, it will have the same function and principles, but it will use some local knowledge or different material in order to be improved and involved in that reality, by the people of that place.

This means that when it is implemented in another region, despite having the same function, other local knowledge or some different material will be used, so that the social technology will gain an improvement that is favorable to the people of that place. This is why the term reapplication (reproduction) is not used, but rather reapplication (doing it again in a different way) (SEBRAE, 2017). Still in this sense of adapting social technology to different realities, Jesus and Costa (2013) attribute another term to the reapplication of techniques, that of sociotechnical adaptation.

the social technology proposal defends the development and use of technologies for social inclusion, based on the understanding that men and women must be involved in a constant process of action and reflection, so that the interaction between the individual and

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technology allows the expression of actions that value a more just, inclusive and sustainable society (JESUS COSTA, 2013).

Social technologies can be divided into five main types: 1. Products, devices or equipment; 2. Processes, procedures, techniques or methodologies; 3. Services; 4. Organizational social innovations; and 5. Management social innovations. They are developed in different areas, which often intersect: environment, education, health, food security, energy, accessibility (SEBRAE, 2017).

Among the social technologies applied in the semi-arid region, cisterns are the most common, especially pre-cast plate cisterns. To implement a cistern like this, some essential elements are needed to collect rainwater. First, essential knowledge is to define where the cistern will be installed. The cistern should be close to the house and away from corrals, septic tanks, landfills and other points that could compromise water quality.

According to Vale (2018):

Between 2000 and 2002, ASA organizations developed a pilot project, which resulted in what is now considered a program that revolutionized the semi-arid region – the Training and Social Mobilization Program for the Construction of Rural Cisterns - One Million Cisterns (P1MC). During this period, the Ministry of the Environment (MMA) acted as a financier for the development of P1MC, by subsidizing the construction of 500 cisterns. These initial cisterns were a kind of “experiment” so that the network could identify, analyze, systematize and improve the action plan of the desired program. Later, the National Water Agency (ANA) provided financing for the construction of 12,400 cisterns, with the aim of training the network organizations and other social subjects involved in the process; in other words, consolidating a capable and efficient management body with regard to the program's resources (VALE; 2018, p. 54).

For Costa and Dias (2013)::

The P1MC is a program that basically involves three types of actors: the MDS, the ASA and the communities and families that receive the cisterns. The MDS is the financing, control and coordination body of the policy; the ASA, and mainly the CSOs that comprise it, are the policy implementers and the communities and families involved are

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the public, responsible for certain counterparts in the process of building the cisterns (COSTA; DIAS, 2013, p. 45).

The cistern program aims to support the implementation of social technologies that expand access to water for human consumption (1st water and schools) and animal consumption and for food production (2nd Water). The target audience is low-income families (who are part of the Single Registry of Social Programs – CadÚnico and have a Social Identification Number - NIS), affected by drought or lack of regular water; families scattered in rural areas and families headed by women, with children aged 0 to 6 years old; with children and adolescents attending school, with elderly people aged 65 or over, and people with special needs.

The cistern is a type of rainwater reservoir, it is a tool that has been used for a long time, but it has been disseminated and popularized in recent decades through public policies based on coexistence with the semi-arid region.

The cisterns operate simply: water reaches the container through gutters placed on the roofs of houses. When the roof of the house is too small and cannot capture enough water for the family, cisterns are built with plates, like a sidewalk, with a cement floor, which receives the water and directs it through plates to the cistern (MELO, 2010).

According to Gomes (2018), the cistern was created by the farmer from Sergipe, Manoel Apolônio de Carvalho:

The farmer from Sergipe in the 1950s, when he was 17, went to “try his luck” in São Paulo and there he soon got a job in construction. In one of his jobs, Manoel was building a swimming pool and imagined how great it would be if in his house, in the Bahian municipality of Jeremoabo, “there was a huge tank full of water”. From there, Manoel conceived the idea of the rainwater collection cistern, which today is undoubtedly a heritage of families in the Brazilian semiarid region. Rainwater collection cisterns became famous in the semiarid region and are considered very important in the lives of women in rural areas (GOMES, 2018, p. 34).

The cistern program covers the entire semi-arid region, which, as already explained, includes, in addition to the northeastern states, parts of Minas Gerais and Espírito Santo. The main objective is to serve families in rural areas in situations of vulnerability or extreme poverty, with a per capita income of up to half the minimum wage, who do not have drinking water near their homes (BORJA; LORDELO, 2022).

The Program was planned to be implemented in 5 years, with a total cost of 424.3 million US dollars (ASA, 2002). In 2003, this Program was incorporated by the Federal Government through the Access to Food Program of the then Ministry of Social Development and Fight against Hunger (MDSCF), in order to guarantee access to water in the Semi-Arid region through rural cisterns and social mobilization (BORJA; LORDELO, 2022, p. 146).

There are several models of social technologies for access to water supported by the cistern program: 1. 16,000-liter plate cistern; 2. 16,000-liter ferrocement cistern; 3. School cistern; 4. 52,000-liter sidewalk cistern; 5. 52,000-liter flood cistern; 6. Multipurpose roofed cistern; 7. Underground dam; 8. Tarpaulin dam; 9. Trench dam; 10. Traditional dam; 11. Small dam system; 12. Stone tank; 13. Popular water pump; 14. Micro-dam; 15. Shallow wells; 16. Autonomous multipurpose rainwater system; 17. Community multipurpose rainwater system. The One Land, Two Waters Program (P1+2) was created by ASA in 2007, with the objective of increasing the water supply of families, rural communities and traditional populations to meet the needs of planting and raising animals. The name of the program is a testament to the minimum structure that families need to produce – space for planting and raising animals, land, and water to cultivate and maintain the life of plants and animals. P1+2 is part of the Training and Social Mobilization Program for Coexistence with the Semiarid Region. This umbrella program also includes the One Million Cisterns Program, P1MC (ASA, 2020).

P1+2 aims to promote sovereignty and food and nutritional security for farming families and to foster the generation of jobs and income for them. The

strategy to achieve these objectives is to encourage the construction of participatory processes for rural development in the Brazilian Semiarid Region (ASA, 2020).

In research conducted by Santos (2020) in a small municipality in the backlands of Bahia, the author confirmed that families benefiting from this program were able to have another alternative to resist and produce food in the semi-arid region, by growing vegetables, for example, which contributes to self-consumption and the sale of products, in addition to having water for animals cared for on the property.

In addition to domestic and productive cisterns, the Cisterns in Schools Program was created in 2009. This is an action that aims to provide access to quality water in sufficient quantity to meet the needs of students and teachers in rural schools in locations with difficult access to water (MDS, 2019). The social technology implemented in this case is the cement slab cistern with the capacity to store up to 52 thousand liters of water, with rainwater collection from the school roof. The collected water meets the school's needs - drinking and cooking - for up to eight months (MDS, 2019).

Community participation is therefore essential for the success of the action. In this way, teachers and students are trained in water management, coexistence practices and contextualized education. In addition to implementing technology and carrying out training processes, improvements are made to the water collection and distribution structures at the school unit if necessary (MDS, 2019).

Santos (2020) explains that the Cisterns in Schools Program is a strategy for valuing and maintaining the school space, with improvements in the conditions of school activities and conservation of the school, in addition to offering good quality water to students. Its methodology involved teachers, staff, students and their respective families in workshops and training sessions addressing coexistence with the semi-arid region. According to Borja and Lordelo (2022), ASA's choice to use

cylindrical cisterns is justified by the fact that they are a technique applicable to all types of soil in the semi-arid region, are economical, provide political independence for beneficiary families, and do not generate negative impacts on the environment, since they contribute to surface runoff, preventing rain from carrying solid waste. The construction of the plate cistern begins with the marking and excavation of a hole in which it will be placed. This helps to protect the cistern and maintain a mild temperature of the stored water. A storage tank for rainwater is then built; this container can be made with different types of materials, from pre-molded plates to wire mesh and cement. It is important to have a collection area, which is usually the roof of the house itself, through which the water will pass until it is filtered by gutters and taken to the storage tank (BRITO et al., 2007).

It is ideal for the cistern to be surrounded by a wire fence, to prevent accidents with children, or contamination by animal waste. It is also necessary to have a sidewalk, to prevent leaks. A drain should be added to the tank, allowing the excess stored water to drain. The cistern should also contain aerators to renew the oxygen dissolved in the water; they need to be covered with a screen to prevent the entry of small animals and coarse materials; in addition, a door that allows access to it for cleaning, and to avoid direct contact with water, it is advisable for the cistern to have a manual pump (BRITO et al, 2007).

The water collected from the first rain should be completely discarded, as it serves to clean the entire system. Subsequent rains are collected, stored and consumed during dry periods (COSTA; DIAS, 2012).

In this sense, Brito et al. (2007) explain that the quality of water is just as important as the quantity of water consumed, since contaminated water can cause several infectious diseases, such as: typhoid fever, paratyphoid fever, bacillary dysentery, cholera, acute gastrointestinal diseases and diarrhea, which are of

bacterial origin; hepatitis A and F, poliomyelitis, acute gastrointestinal diseases and diarrhea, of viral origin; amoebic dysentery and gastroenteritis, of parasitic origin.

The sidewalk cistern was developed specifically to meet the demand for water for productive use by families in the semiarid region. The structure of this type of cistern involves a sidewalk that is used to collect rainwater that will be stored in the reservoir. The water reaches the reservoir through a pipe. The sidewalk has multiple functions, since when it is not raining, it can be used to dry beans, corn, and to feed animals (JESUS, COSTA, 2013).

Another widespread project in the semiarid region is the cisterns built in schools, which in addition to mitigating drought in the regions where they are installed, serve as a pedagogical tool, involving students and their families in the construction of the units (JESUS; COSTA, 2013).

Social technology is not the technique developed, the method used or the artifact produced, seen in isolation. It is always about the interaction between the elements present in the environment (values present in the community, regional economic dynamics, climatic factors) in which one wishes to act, that is, social technology is closely linked to its form of implementation and to the actors involved in its conception and execution, that is, it is shaped by the sociotechnical dynamics in which it takes place (JESUS; COSTA, 2013, p. 29).

The cisterns follow an implementation methodology, the selected families go through a process of training and mobilization of civil society leaders through municipal councils and commissions. Family members take courses on the management of stored water in water management technology and techniques, at this stage the exchange of experiences is encouraged.

According to Borja and Lordeli (2022, p. 150):

Community involvement in the construction of fundraising systems aims to stimulate participatory processes and the strengthening of social bonds of belonging, trust and solidarity, which present themselves as an alternative to the clientelist, welfare and dependency-based political practices that were previously predominant.

The construction of the cistern generally focuses on purchasing materials from the local market to stimulate the economy. There is interaction between the local workforce and the beneficiaries. In addition to water, the program also provides incentives of a productive nature, such as the distribution of seedlings, seeds, small animals, and water technology infrastructure for food production.

The results over the years of implementation of the policy have been positive, although there are still many families in the semi-arid region who have not benefited from the cisterns, whether for consumption or production, which points to the need for the program to continue and expand.

Through the purchase of construction materials and the use of local labor (mostly young people), there is a process of dynamizing the economy. In addition, training is provided for men and women in this construction industry, the so-called cistern builders.

The construction period of a cistern takes about two weeks. The cistern has an average cost of R\$2,100, of which R\$1,100 is used to purchase materials and the rest to pay for travel expenses for labor and educators, as well as administrative costs.

By having their own water for consumption and productive activities, families become more autonomous, breaking away from local political dependencies, such as coronelismo and clientelism, which provides these people with citizenship. Local social organizations are being strengthened (co-responsible for implementation at the local level), and there are also cases of new organizations and associations emerging, based on knowledge and unity among beneficiaries.

Among these public policies, the most notable is the 1 Million Cisterns Program (P1MC), which was largely implemented by the Articulação do Semiárido (ASA). The P1MC has its origins linked to the Conference of the Parties to the United



Nations Convention to Combat Desertification and Drought (COP-3), held in Olinda, Pernambuco, in 1999 (COSTA; DIAS, 2013).

There was an experimental phase that began in 2000 with resources from the Ministry of the Environment (MMA), which contained three lines of action: 1. Systematization of cistern experiences developed by organizations involved with ASA; 2. Construction of 500 experimental cisterns; 3. Development of a more expanded project, which later became the P1MC (COSTA; DIAS, 2013).

What would ultimately explain the success of P1MC? On the one hand, these are the characteristics of tank technology itself. It is cheap, it is simple, it is suitable for small scale and it can be easily reapplied. It is an efficient system that guarantees water and contributes to the health and dignity of people living in the Semi-Arid region. It does not eliminate traditional knowledge – on the contrary, it makes use of it. The cistern is built with materials available in the localities and has no harmful effect on the environment. It is, in short, the materialization of all the characteristics that one would expect to find in a social technology (COSTA; DIAS, 2013, p. 60).

Civil society organizations (CSOs) in the Northeast played a fundamental role in changing the paradigm of combating drought and in consolidating social technologies that today make up the project for living with drought. In addition to the cistern, the program includes support for the families benefited, with courses in which they receive instruction on how to build the structure, how to care for the container and how to use water correctly.

The incentive to live with the semi-arid region through programs such as P1MC has led to the decentralization and democratization of water. The families benefited are no longer dependent; they have become water managers. Studies show that the cisterns have led to an increase in school attendance, a reduction in diseases caused by drinking contaminated water and a decrease in the workload of women.

Despite the significant progress made with the program, the amount of water made available (16,000 liters for a family of 5 people during the 8-month dry season - 13L/person per day) is low (BORJA; Lordelo, 2022).

Borja and Lordelo (2022) explain that in addition to having to travel long distances to fetch water, the water they found was often unfit for consumption, which was more harmful to women and children. Women are generally responsible for fetching water and caring for children.

Families have improved their diets, being able to consume more diverse foods, and sometimes, with the surplus generated, they can sell it and generate a source of income. They have improved the quality of the water they consume, reducing the frequency of illness among children and adults. With the reduction or elimination of the need to fetch and transport water, women and children can have more time available for leisure and other activities.

### **Final considerations**

The semi-arid region of the Northeast is not limited to the long-held idea that it is a dry place marked by thirst, hunger and poverty, a region from which everyone wants to leave. As Belchior, the composer and singer from Ceará, sang, “No! I am not from the place of the forgotten! I am not from the nation of the condemned! I am not from the backlands of the offended! You know well: I know my place!”

To know the backlands implies recognizing its past. A region whose people were subjected to plunder, oppression and domination by local elites, who used their economic and political power to keep these people even thirstier and hungrier; thirsty for citizenship and hungry for dignity.

This process fostered the well-known drought industry, which met, with delay, the emergency demands for water during the most severe drought periods. The creation of large, overpriced projects only caused environmental damage and increased land concentration; it was not effective in solving the problems.

The problem is that the people of the backlands did not accept this situation. Since the peasant leagues, they have formed organizations that have proposed to reflect and act in the search for a less unequal semi-arid region with more opportunities, where its inhabitants can live and produce based on strategies that respect the physical and natural conditions of this region.

This is how the philosophy of living with drought was created, which, unlike the old approach, did not seek to combat a natural phenomenon, but to create adaptive tools to live in it. It is in this sense that social technologies for living with drought emerged, the most notable of which are cisterns, which capture and store rainwater.

Social movements supported by a progressive government have taken this experience to a national level, ensuring that families in the semi-arid region have water for domestic use, drinking, food, hygiene, and also for cleaning, raising their animals and agricultural production.

The families of the backlands found themselves with more dignity and freedom, being able to exercise their political decisions without fearing the arbitrariness of the colonels. Living in their homes, producing, planning dreams without having to succumb to migration to other regions.

The social technologies of water collection and storage have also changed the lives of women. The women of the backlands are in fact responsible for fetching water, feeding their families and taking care of their hygiene and health. These women lived and unfortunately, in many cases, still live under oppression and machismo, which are more intense in rural areas.

The ASA's training processes, their inclusion in civil society organizations, and their participation in programs that implement technologies such as cisterns, have revolutionized their lives. They now have time for themselves and for other activities that they consider relevant, and they have begun to occupy new spaces in decision-making and management. It is expected that the cistern programs will expand their

reach with new investments, in order to cover a greater number of families and provide empowerment and quality of life for more rural families.

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Author 2: Text review