Advancement in Social Technologies in Brazil: Regional Concentration and SDG Representation

Paulo van Noije and Julia Swart

Contents

1 Introduction 2
2 Social Technologies 3
2.1 Social Technologies: Concept Definition and Characteristics 3
3 Brazilian Bank Foundation Database 9
3.1 Bank of Social Technologies of Banco do Brasil 9
4 Statistical Analysis 11
4.1 Methodology and Data 11
4.2 Social-Economic Data 11
4.3 Findings and Discussion 14
5 Conclusion 19
Appendix 22
References 22

Abstract

Social technologies encompass technologies and knowledge which facilitate social development and can lead to the improvement in several social indicators such as inequality, access to clean water, health, and housing. The Brazilian Bank, Banco do Brasil, provides access to data containing social technologies which were analyzed and certified by the Brazilian Bank Foundation. The social technologies are an important mechanism towards reaching the Sustainable Development Goals because they are developed by the agents who understand the challenges and the improvement needed the most. The database contains information about the location, the related SDGs, and the theme and sub-theme of the social technologies. It also offers a description, the identified problem, the

P. van Noije (✉)
School of Applied Sciences, University of Campinas, Limeira, Brazil
e-mail: noije@unicamp.br

J. Swart
Utrecht School of Economics, Utrecht University, Utrecht, The Netherlands
e-mail: j.swart@uu.nl

W. Leal Filho et al. (eds.), *Handbook of Sustainability Science in the Future*,
https://doi.org/10.1007/978-3-030-68074-9_151-1

resources needed, and the achievements already obtained. Based on this online data, this chapter describes a dataset to map the initiatives of social technologies. This chapter analyzes which SDGs are mostly represented, the problems addressed, and the locations of implementation and the locations where the institutions responsible for the social technologies are located. This chapter analyzes possible mechanisms behind concentration of social technologies by crossing this data with social-economic data at the state level, such as education, urbanization rate, and economic development. Finally, the chapter discusses the importance of social technologies to foster sustainable actions in developing countries in a long-term perspective.

Keywords

Social technology · Appropriate technology · Sustainable Development Goals · Brazil

1 Introduction

The Covid-19 pandemic which started in December 2019 resulted in a world crisis and exacerbated many societal problems throughout the world. The still ongoing war in Ukraine since February 2022 worsened some of these problems even further by, among other things, imposing a high pressure on prices. Developed and developing countries are confronted with increasing social demands to improve the standards of living, while environmental problems urgently need to be addressed. Brazil is an upper-middle-income economy which faces many socio-economic and environmental challenges, in areas such as poverty, education, health, and access to clean energy. While needing coordinated and effective development policies, the country is also marked by high corruption levels, ranking 96 and scoring 38 (0 being highly corrupt and 100 very clean) in the World Bank's 2021 Corruption Perceptions Index (Transparency International 2022). The insufficient effort from the government's side to tackle these diverse issues creates a pressing call for individual and collective action.

Simultaneously, the unsatisfactory delivery of (quasi-) public goods such as schooling, health services, and access to clean water implied the increase of private participation in these services which in many countries are delivered by the state. For example, approximately 24% of the population in Brazil possessed private health insurance in 2020 (Agencia Brasil 2020) and close to 19% of children attended primary education in a private institution in the same year (Agencia Brasil 2021).

Relying on private services, however, is not a reality for the majority of the Brazilian population. As one of the most unequal countries in the world, most Brazilians cannot afford paying private insurance, education, and even basic services such as access to energy. When the state fails to provide these services, the poor often rely on services provided by voluntary work organized under foundations and NGOs. In 2016, Brazil had close to 237,000 private foundations and NGOs

(IBGE 2022). While a large part (83000) constituted religious foundations, all others (65% from the total) were concerned with socio-economic and human rights development. The NGOs with the highest representation were classified in the following groups: "culture and recreation" 13.62%; "development and protection of rights" 12.77%; "employers, professionals, and rural producers associations" 12.22%; "social assistance" 10.16%; "education and research" 6.68%; "health" 1.99%; "environment and animal protection" 0.71%; "housing" 0.07%; and "others" 6.72%).

In Brazil, NGOs are not only supporting the poor, the environment, economic development, and increasing inclusiveness, but many NGOs are also actively interacting with local communities, to better understand their reality and specific needs. This close contact with the local communities empowers the communities to solve many of the challenges they face. Often, the changes implemented through these united efforts are based on innovations designed for one particular community, which can however be replicated in other places and time. Similarly, other types of institutions, such as research institutes and universities, contribute with their work to solve problems specific to certain communities. These solutions can also potentially be replicated to other situations and places. The Brazilian Bank, Banco do Brasil, provides an online dataset of social technologies, to facilitate access to information about the social technologies. This online platform, therefore, fosters replication to other places. This chapter describes the concept of social technologies in the Brazilian context and presents data and discusses the relevance for improving sustainability in the near future. Moreover, many other countries around the world experience similar challenges and also rely on non-governmental organizations and institutions to help face socio-economic and environmental challenges. As such, this chapter also discusses how the social technology concept can be applied to other countries.

2 Social Technologies

2.1 Social Technologies: Concept Definition and Characteristics

This section will (*i*) point out a definition for social technologies, (*ii*) provide a brief description of the origin of the concept, (*iii*) explain some of the characteristics of the concept, and (*iv*) analyze how social technologies can relate to public policies and the Sustainable Development Goals. The concept of social technology has been used differently in the literature. This section shows that the definition of the concept of social technologies by Nelson and Sampat (2001) is different from the definition by the Brazilian Bank.

Starting with the definition to the Brazilian context, according to Dagnino (2009, p. 8), the concept of social technology was created in Brazil and it is defined by the Brazilian Bank as: "replicable products, techniques and/or methodologies, developed in interaction with the community and that represent effective solutions for social transformation" [1].

With respect to the origin of the concept of social technology, one can resume debates on previous concepts that ended up supporting it. According to Fonseca and Serafim (2009), social technology is related to that of appropriate technology, a concept which was introduced in the 1960s and 1970s (Schumacher 1973; Kaplinsky 2011).

Appropriate technology can be understood as a set of production techniques that are used in a way that maximizes the welfare of society, making optimal use of available resources (Schumacher 1973). According to Novaes and Dias (2009), some of its characteristics are simplicity, small or medium scale, low investment cost, low cost of final products or services, community participation in the decision-making process of technology choice, and the positive effects that its use would bring to some areas (environment, income generation, food production, housing, nutrition, employment, social relations, and health).

During the 1970s and 1980s, there was an expressive propagation of groups of researchers who relied on the concept of appropriate technology, especially in the most economically advanced countries. Some technological artifacts with appropriate technology characteristics were then developed. It is worth noting that these researchers already expressed an environmental concern and argued for better use of alternative energy sources, despite the fact that the main objective of these researches was to reduce poverty in the poorest countries (Novaes and Dias 2009).

According to Stewart (1987), some criticisms of the appropriate technology framework had already been mentioned in the places where it entered the political agenda. This criticism included generating fears within science and technology policy analysts, as well as raising concerns in Latin America (Herrera 1981; Dagnino 2009). As a positive outcome, these critiques were helpful in understanding what social technology is and how it differs from appropriate technology. Several public policies and non-governmental organizations continue to support ideas based on the concept of appropriate technology, despite the conceptual advance proposed by the framework of social technology.

The social technology movement originates from the debates on appropriate technology and overcomes it by criticizing the neutrality of science and the determinism of technology, in order to point out that science and technology are based on the dominant values and interests of the place where they were developed and when criticizing the deterministic view of technology, disagreeing that its development follows a unique and inexorable trajectory (Fonseca and Serafim 2009). As such, the development of social technology must take into account that science and technology are not neutral. As this chapter will show below, this aspect is essential in shaping the concept of social technology and justifies the essential need for user participation in the development of technology. Thus, the values and interests of users can be taken into account when designing this technology, once their participation is in fact effective.

Despite the criticisms mentioned above, the debate on appropriate technology had promoted important reflections and criticisms on conventional technology. According to Novaes and Dias (2009), there was a perception in the 1960s that conventional technology could not solve environmental and social problems and

could even worsen them. Similarly, Day and Croxton (1993) show that there is a link between appropriate technology and environmental concerns. According to this literature, many activists and environmentalists started at that time to emphasize that the poor are the best protectors of the environment, because their lives often depend on it.

The criticisms regarding the conventional technology model are a fundamental element to explain the emergence of the concept of social technology in Brazil. Stakeholders concerned with various socio-economic and environmental problems participated in this debate. Among the problems emphasized was the informalization of work, its precariousness and the growing social exclusion, and the perception that a technology would be necessary to meet the social objectives and interests of society (Dagnino 2009). However, according to Dagnino (2009) this perception is incorrect, as conventional technologies tend to be labor-saving. Social technology, on the other hand, adapts to the needs of small producers and to solving local problems. Thus, an important step is to show the characteristics of conventional technology. Novaes and Dias (2009) point out that conventional technology is:

- Disseminated by companies from more developed countries and absorbed by companies from underdeveloped countries, often uncritically, since it often requires underdeveloped countries to use standards that are oriented to the markets of developed countries – or to the elites of the underdeveloped countries.
- Hierarchical, as it depends on the private ownership of the means of production and the control over the work exercised by these owners.
- Labor-saving, with the permanent search for the replacement of human work.
- Its main goal is to maximize productivity with the objective of accumulating capital, not taking into account the likely negative effects on the unemployment rate.
- Segmented, causing the direct producer to lose the ability to control production. Complementarily, therefore, it would be alienating, since the direct producer does not understand the process as a whole and it is still possible to perceive the suppression of the direct producer's creativity throughout the production process.

The above aspects suggest that conventional technology perpetuates asymmetries in the capitalist system, submitting underdeveloped countries to the developed countries, as well as submitting workers to the interests of the holders of the means of production, expanding the differences in power within political and social relations. Therefore, conventional technology can be seen as one of the factors that can generate the gradual erosion of democracy, as it reinforces these power asymmetries. On the other hand, social technology presents as one of its main objectives to change this situation, seeking to change this tendency inherent to conventional capitalist technology (Novaes and Dias 2009; Dagnino 2014).

The reason that social technology can improve the power dynamics between different countries is that social technology, unlike conventional technology, has some characteristics, among which that it (Novaes and Dias 2009; Dagnino 2014):

- Is adapted to small consumers and producers, including low-income ones
- Does not generate capitalist control, which is based on hierarchization, segmentation, and domination over workers
- Is oriented towards the satisfaction of human needs
- Boosts the potential and creativity of the direct producer, as well as its users
- Is suitable for making smaller enterprises economically viable, such as family farming, small businesses, agrarian reform settlements, and popular cooperatives

In short, generally, conventional capitalist technology is suitable for large corporations and multinational companies, while social technology is more appropriate for collective and non-market production, since it is more tied to the reality of local societies, in a way that it manages to generate more appropriate answers to the problems inherent to a given context (Novaes and Dias 2009; Dagnino 2014).

To explain why this occurs, it is worth mentioning that the approach that characterizes social technology assumes that the path that goes from a very good idea to a successful application is extensive and uncertain, that is, interspersed with several viable alternatives, with some of them ending up being left aside for reasons linked to values and interests and not for a technical superiority inherent in the final choice. In this way, theories and technologies would not be determined by technical and scientific criteria, since there would be a wide set of feasible solutions for any given problem, making it the social actors who make the final decision on a series of technically possible alternatives. Going further, the very meaning of the problem tends to change throughout the process of its solution, that is, the technologies would constitute themselves socially in the sense that the various actors involved interfere not only in the final form of the technology, but also in its content (Novaes and Dias 2009).

A different approach from the Brazilian definition for the concept of social technologies is presented by Nelson and Sampat (2001). For these authors, social technologies take in "patterned human interaction rather than physical engineering" (p. 40). They suggest to associate the term institutions with the concept of social technologies, considering it in the manner how knowledgeable people act and cooperate in the place where the real coordination of interaction is central for the realization of some purpose – or that have been considered by the pertinent social group as standard in the situation.

In other words, not all social technologies are institutions. Social technologies would be considered institutions only if they "have become a standard and expected thing to do, given the objectives and the setting" (p. 40). In this sense, their concept of institutions as social technologies is compatible with the idea that institutions are the rules of the game, defining relatively closely what people do when they play the game, but being consonant with some discretionarily (Nelson and Sampat 2001).

Social technology is related to the coordination of human action, including the program built into a routine to organize the division of labor and its mode of coordination – that's different from the concept of technology used in the conventional sense, related to the routine of the "physical" technology involved. The circumstance that some social technologies are standardized also restricts effective

routines inside organizations, and a significant reason for counting on standardized social technologies is that actors can use one's experience as a resource, enjoying the cumulative public knowledge convenient for the procedure of these routines (Nelson and Sampat 2001).

The authors considered that broad organizational forms (i.e., Fordism and Toyotism) can be supposed as institutions or generally available "social technologies." In these organizational forms, a wide theory explaining why the method was efficient came to be extensively accepted, and the main outlines of the organizational format became eminent, yet it was not always easy to make work in practice.

Finally, this chapter shows that Nelson and Sampat's (2001) definition for the concept of social technologies is close to the Brazilian one in one respect, but gets very far in another respect. On the one hand, Nelson and Sampat (2001) consider that social technologies have to have some degree of flexibility, allowing it to be applicable in a variety of specific contexts and to deal with a range of specific needs, an aspect that is very close to the Brazilian definition.

On the other hand, it is virtually the opposite when they point out that the cases they use in their study are examples of:

> [...] developments in economies at the technological frontier that the coevolutionary perspective **also is useful for analysis of the development process of countries far away from the frontier**. From this point of view, the **key development problem is to reform institutions** — operative social technologies — **so as to encourage and support the adoption of superior physical technologies that are in use elsewhere**, and to facilitate climbing the technology ladder. (Nelson and Sampat, p. 52, our italics, 2001)

As explained above this definition of social technology approximates to the conventional technology one, in the sense that the technology is absorbed, mostly uncritically, by companies from underdeveloped countries and they use standards that are oriented to the markets of developed countries (our underdeveloped countries' elites), in a movement that is propagated by companies from more developed countries. The Brazilian definition of social technologies precisely criticizes this movement and shows the essential need for users to participate in the development of technology.

Having made these explanations about what social technology is in the Brazilian context definition, this chapter discusses next how public policies interfere in the constitution of social technologies. The State has a central role in the process of construction of social technology. However, public policies hardly tend to open space for the theme (Fonseca and Serafim 2009). According to Dagnino (2014), the analysis of science and technology public policies in less developed countries shows that they follow the logic of developed countries, with a capitalist orientation, hindering initiatives related to social technologies.

Alternatively, for social technologies to be successful, policies associated with the engineering of construction of technologies are necessary, such as awards for innovations, the systematization and elaboration of manuals of construction processes, and mechanisms for the protection of intellectual property. In this sense, local

policies aimed at communities are fundamental, something inherent to the very nature of social technology. Local policies aimed at communities stimulate democratization, which needs to be an integral part of the process of building social technology. In this way, users can insert their values and interests during the initial building stages of technological systems (Lassance and Pedreira 2004).

Lassance and Pedreira (2004) point out two possible obstacles to the increase of social technology as a public policy. The first obstacle is the occurrence of resource capture within the State, especially when these resources are directed to the financing of policies and sectors related to conventional technology. Therefore, policies related to social technologies can be discarded, even if they are an appealing option for the desired objectives (Fonseca and Serafim 2009). The second obstacle is the tendency towards a conservative preference on the part of public administrators, inhibiting the adoption of creative and innovative attitudes, such as those required by social technologies.

An issue that points to the difficulties of carrying out public policies related to social technologies is discussed by Dias (2013), who shows that Brazil's condition of dependence on developed countries generates a tendency for the country to adopt a science and technology policy that is based on the experiences of policies in developed countries and therefore sanctioned by a theoretical framework built from a different reality. This creates problems, as the attempt to stimulate the generation of national technology ends up not taking into account local specificities. The adoption of more coherent institutional arrangements to try to stimulate innovation in high-tech sectors makes it difficult for the science and technology policy to deal with issues focused on solving more immediate problems for a large part of the population.

Two other points can be related to this previous critic on adopting imported technology. Fonseca and Serafim (2009) question the conception of policies like the science and technology policy, which has as a hypothesis that the development and increase of technology will solve all society's problems. Dagnino and Thomas (2001) criticize the fact that the research community is guided almost entirely by criteria dictated by researchers from developed countries, causing them to fail to take into account the relevance of their research topics, often displaced from the realities' locations. Such elements point to the low democratization observed in the country in relation to the process of formulation and implementation of public policies related to technological issues.

The above discussion of the debate on the definition of social technologies and the description of the origin of the concept and its characteristics, including relating them to public policies, suggest that the social technologies are an important mechanism towards reaching the Sustainable Development Goals (SDGs). Social technologies are developed by the agents who understand the challenges and the improvement needed the best and do not have as their main goal profit maximization, opening space to reach other goals, as those in the SDGs. In the next section this chapter presents a databank containing social technologies which were analyzed and certified by the Brazilian Bank Foundation and that uses the SDGs as one of its main indicators.

3 Brazilian Bank Foundation Database

3.1 Bank of Social Technologies of Banco do Brasil

This section aims to present the Bank of Social Technologies [2] from the Banco do Brasil. The Banco do Brasil has a Foundation (Fundação Banco do Brasil), which is responsible for promoting solutions for socio-economic and environmental transformation in Brazil. This Foundation is responsible for the social technology project, through Transforma!, which is a collaborative tool, organizing and making accessible the Databank of Social Technologies. Next, this section will explain in more detail what this Bank of Social Technologies created by the Fundação do Banco do Brasil is.

According to Pena and Mello (2004), the social investment made by the Foundation – Fundação Banco do Brasil – aims at improving the living conditions of communities that participate in the social programs carried out by it, in addition to promoting social inclusion. In 1988, the Banco do Brasil carried out social actions, with financing for research and development funds, with the objective of carrying out interventions focused on major Brazilian problems.

The Banco do Brasil established its Foundation to collaborate with the country's sustainable development and the social transformation of Brazilian society. The scope of the projects and programs, spread throughout the Brazilian territory, was enhanced by the articulation of support and partnerships in social investment. Over the last 10 years, more than 3.6 million people have had their lives impacted, through R$ 2.7 billion in social investments (FBB 2022).

To achieve its purpose, the Banco do Brasil Foundation is guided by values and principles that are fundamental conditions for its performance, such as integrity and ethical performance, effectiveness for socio-environmental transformation, social empowerment for sustainability, social sensitivity with respect to diversity, efficiency and innovation for inclusion, and seeking to be recognized by society as a multiplier and promoter of solutions for socio-environmental transformation in Brazil (FBB 2022).

The Banco do Brasil Foundation is based on supporting social projects that encourage socio-productive inclusion, sustainable development, and the reapplication of social technology. Non-refundable investments are made, through partnerships with non-profit institutions, with at least 2 years of existence, through the execution of contracts or agreements. The process begins with the presentation of a proposal based on public calls [3] for proposals or specific actions by Banco do Brasil's branches in partnership with its Foundation (FBB 2022).

The Banco do Brasil Foundation's priority is to carry out its socio-environmental investment in five structured programs focused on volunteer actions, productive inclusion and income generation allied to sustainable development and environmental care, social assistance, reapplication of social technologies, and education for the future (FBB 2022). It is precisely the item "reapplication of social technologies" that the current research is covering, through the analysis of data from the Social Technologies Bank – an aspect that will be carried out in the next section.

In 2001, Fundação Banco do Brasil instituted the Social Technologies Bank program, with the aim of disseminating experiences of social technologies developed in other institutions, stimulating the approximation of real solutions to some of the Brazilian social problems, especially in the areas of job generation and income, education, culture, environment, and health (Pena and Mello 2004).

According to Pena and Mello (2004), the Social Technologies Bank is the way used by the Banco do Brasil Foundation to disseminate solutions that cause social transformation, making several of these initiatives public. It starts from the assumption that social technology is any method, process, or instrument capable of solving some type of social problem and that is imbued in the requirements of easy reapplication, low cost, proven social impact, and simplicity.

The aforementioned Social Technologies Bank is formed by a wide database of social technologies in Brazil, through the website Transforma! (Transforma 2022), which is a collaborative and simple-to-use tool, with the aim of expanding the reach of social technologies and generating an environment for sharing and reapplication of knowledge for the whole society. In all, there are 673 certified technologies covering the entire national territory.

On the aforementioned website Transforma! the social technology pages are supported by the institutions that created them and present information about the problem raised, the solution adopted, the way of community involvement, the municipalities covered, and the resources needed to implement the social technology used, among other aspects. The social technologies contemplated in the project can combine technical-scientific knowledge, social organization, and popular knowledge. It is fundamentally important that they are effective and re-applicable, resulting in social development at scale (Transforma 2022).

It is worth mentioning that the project encompasses an innovative development proposal, since it uses a constructivist approach, encouraging collective participation in the organization, development, and implementation process. The social technologies that appear on the website promote solutions for demands related to the following topics: food, education, energy, housing, environment, water resources, income, and health (Transforma 2022).

As of 2001, the Fundação Banco do Brasil Social Technology Award began to be distributed, which identifies and certifies the social technologies that make up Transforma!. Held every 2 years since 2001, the award aims to identify, certify, reward, and disseminate social technologies already applied. There have already been 10 editions carried out and 1476 technologies registered (Transforma 2022).

The registered technologies are qualified at three levels each year: Certified, Finalist, and Winner [4], according to the criteria and parameters established in the Award Regulations. Social technologies that have been implemented at the local, regional, or national level, which are effective in solving issues in the areas/themes already mentioned above, are considered for certification. Legally constituted, non-profit, public, or private institutions can participate in the Fundação Banco do Brasil Social Technology Award (Transforma 2022).

Finally, each of the social technologies registered in the Social Technologies Bank receives a classification on which SDGs can be related to that technology, that

is, allowing inferring which of the 17 objectives are being pursued. In this way, it can be said, as pointed out in the previous section, that this proposal to map social technologies can be an important initiative for the fulfillment of the SDGs. In the next section, some analyses of descriptive statistics about the Social Technologies Bank will be carried out.

4 Statistical Analysis

4.1 Methodology and Data

We use statistical analysis to identify and map the initiatives of social technologies certified by the Brazilian Bank Foundation, from 2001 to 2021. We create a dataset with all social technologies, including the "Theme(s)" (food, education, energy, housing, environment, water resources, income, and health), the SDG(s), place of implementation, number of places of implementation, name of the company/NGO/governmental organization, and place of origin (termed in the dataset "place of the accountable"). Based on this unique dataset we provide summary statistics and discuss these statistics in relation to social-economic data at the state level, such as education, urbanization rate, and economic development.

4.2 Social-Economic Data

Brazil is a big (over 8.5 million km^2) and diverse country in various dimensions: cultural, climatic, economic, and social, among others. In this section we focus on the main economic and social indicators, at the state and regional level. Figure 1 presents data for GDP per capita at the state level for the year 2019. The Federal District (DF) has the highest GDP per capita (more than 3 times the Brazilian

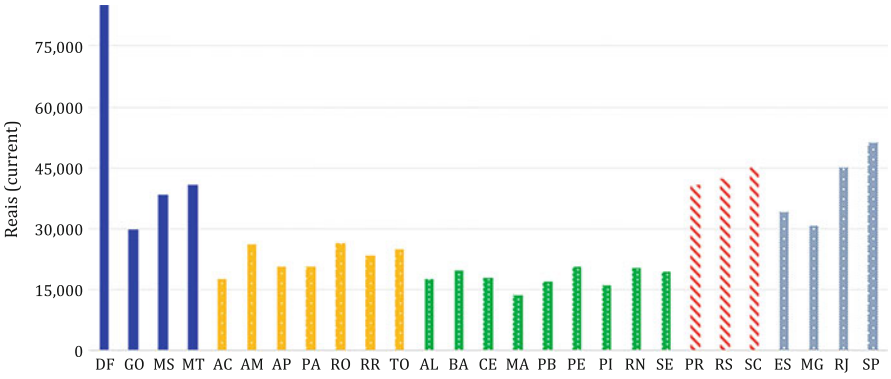

Fig. 1 GDP per capita (current Reais) in 2019: Brazilian states. (Note: Data source: IBGE (2022). See the Appendix for the states' names and corresponding regions)

average, and about 6.5 times the poorest state, Maranhão – MA). Taking the state average on a regional level for the year 2019, the poorest to highest regions are Northeast, North, Southeast, South, and the Central-West. The Central-West has a relatively high GDP per capita mainly because of the Federal District, where the capital, Brasília, is located, whose economy is driven by the service sector. For the other states within the Central-West region, the agricultural sector is the most relevant one. The Southeast and South regions have a higher participation of the industrial sector in the GDP composition and are as consequence relatively wealthier. The Southeast and South are also the most urbanized regions in Brazil (see Fig. 2b). The state of Rio de Janeiro (Southeast) is the most urbanized state in Brazil (Fig. 2a) and has over 97% of the population living in an urban area. The second in this ranking is the state of São Paulo (Southeast) with slightly more than 96%; and the third is the Federal District with slightly more than 95%. The less urbanized state is the state of Maranhão (Northeast) with only approximately 60% of the population living in urban areas.

Figure 3 shows that despite the improvement in education level (Fig. 3b) throughout the period 1990–2015, there is *i.* significant differences across states (Fig. 3a) and regions (Fig. 3b), and *ii*. there is still significant progress to be done in

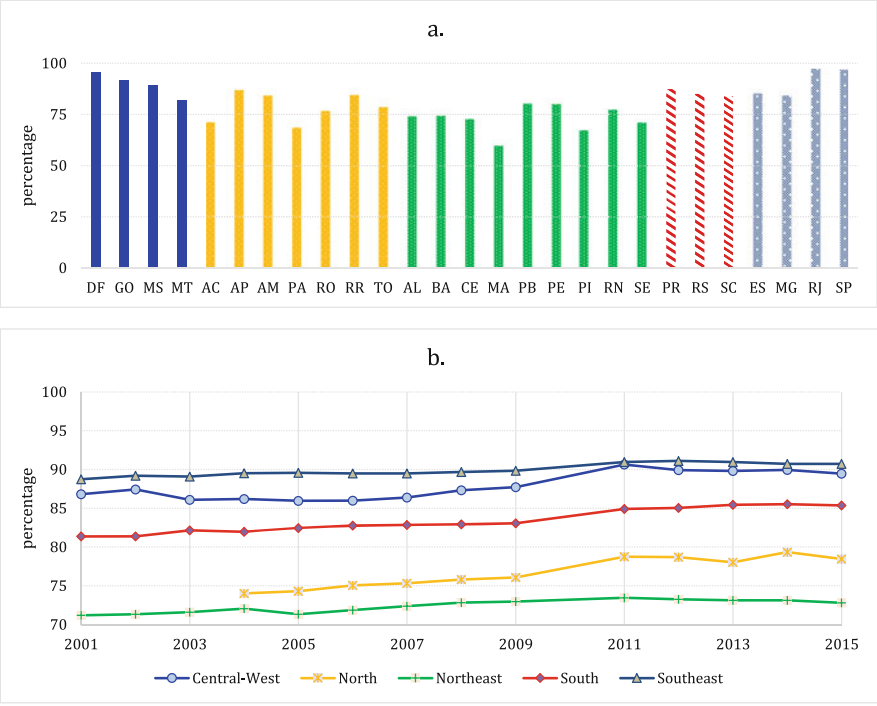

Fig. 2 Urbanization rate (percentage). (**a**) Brazilian states, 2015. (**b**) Regions, 2001–2015. (Note: Data source: IBGE (2022). Data for the regions were computed using simple averages for the states within the region)

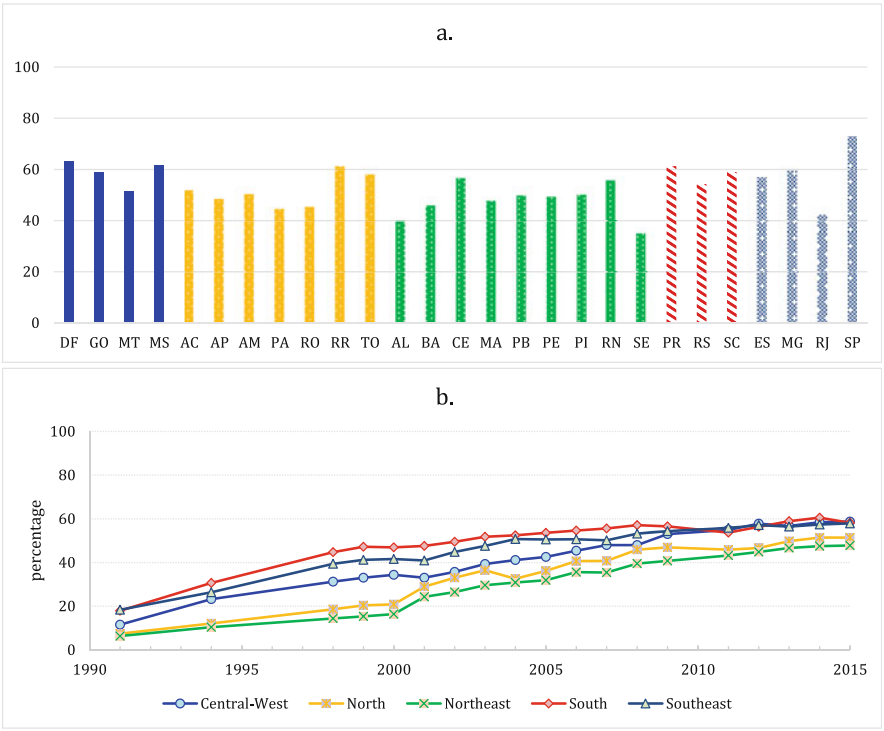

Fig. 3 Secondary education (percentage of the population in the age group of secondary education which is enrolled in secondary education). (**a**) Brazilian states, 2015. (**b**) Regions, 1990–2015. (Note: Data source: IBGE (2022). Data for the regions were computed using simple averages for the states within the region. See the Appendix for the states' names and corresponding regions)

terms of education. The state with the highest percentage of the age group of secondary education which is enrolled in secondary education is the state of São Paulo (73%), followed by the Federal District (63%). Ten out of the 27 states had less than 50% of the age group of secondary education enrolled in secondary education. The worse performers in this respect were Sergipe (SE, 35.2%), Alagoas (AL, 29.7%), and Rio de Janeiro (RJ, 42.2%). Rio de Janeiro stands out because it is one of the wealthiest states of Brazil (see Fig. 1).

Finally, the regional discrepancies are also evident in terms of health. Figure 4a shows data for rate of maternity mortality (RMM) for the Brazilian states in the year 2020 and Fig. 5b shows the same data for the Brazilian regions in the period 2009–2020. The regions which perform better in this respect are the South (RMM of 45.6 in 2000) and the Southeast (RMM of 65.1 in 2000). The worst performers are the North region (RMM of 98.9 in 2000) and the Northeast (RMM of 91.8 in 2000). Taking the whole 2009–2020 period, all regions except the South had an increase in this indicator, implying a worsening of the health situation. The data for the states also illustrate discrepancies. The biggest gap occurs in the North region.

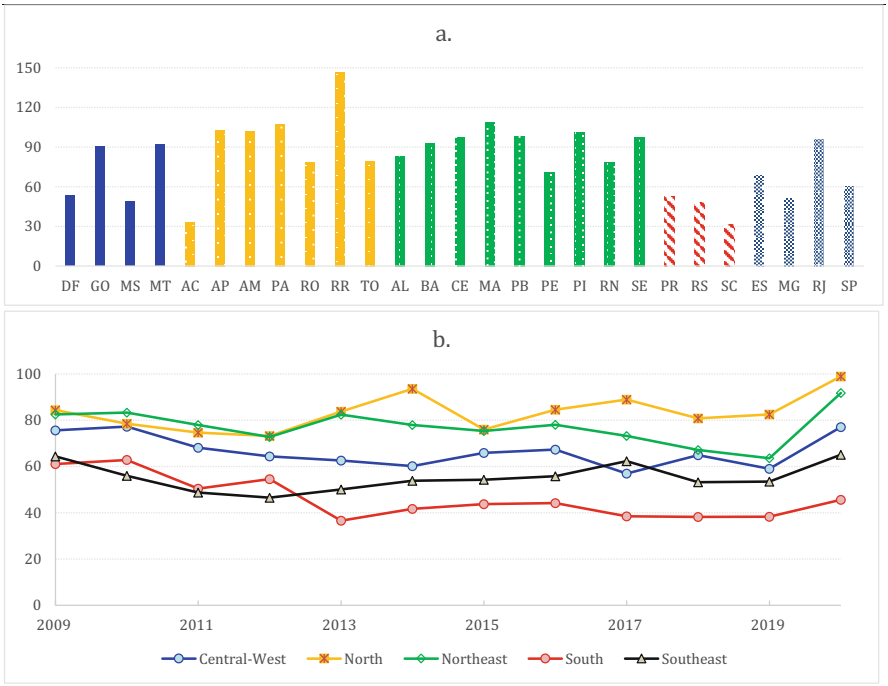

Fig. 4 Rate of maternity mortality (RMM). (**a**) Brazilian states, 2020. (**b**) Regions, 2009–2020. (Note: Data source: IBGE (2022). The maternity rate is defined as number of maternity mortality over 100,000 live births. See the Appendix for the states' names and corresponding regions)

Whereas the state of Acre (AC) had a RMM of 33 in 2020, the state of Roraima (RR) had a RMM of 146.4 in the same region, which is well above the Brazilian average.

4.3 Findings and Discussion

4.3.1 Geographical Distribution

The number of certified social technologies increased throughout the period 2001–2019 and fell back in 2019 to a level similar to the one from 2015/2017 and fell even more in 2021 (see Fig. 5). In 2001 there were 10 certified social technologies, implemented in at least 19 cities. The year recording the maximum number of certified social technologies was 2017, with 169 certified social technologies, implemented in at least 957 cities. In total, 673 social technologies have already been certified by the Banco do Brasil. Some of those originated in other Latin American countries, but the majority in Brazil. There is also one case, in 2003, of a social technology originating in Brazil, implemented in 27 municipalities – one of them being outside of Brazil, in Lisbon (Portugal). Starting in 2017 we also observe

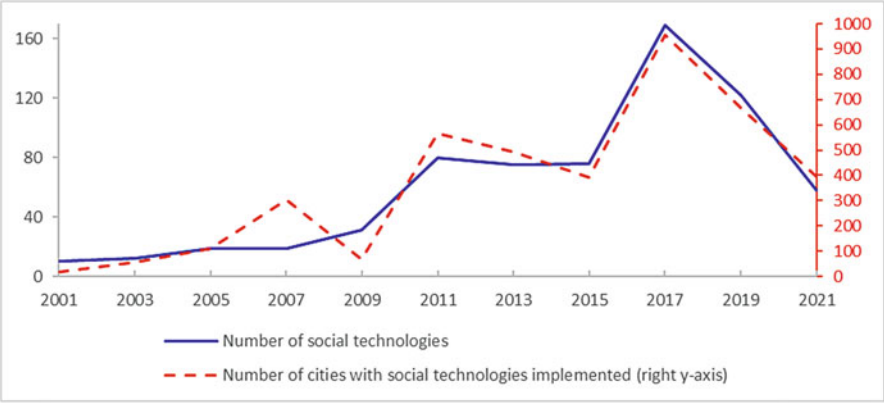

Fig. 5 Number of social technologies certified by the Banco do Brasil, 2001–2021. Note: The data with respect to the number of cities with social technologies implemented needs to be interpreted with care. We considered only the city level, but there are social technologies which were implemented in different communities and neighborhoods (these cases are treated as one). Additionally, a small number of cases did not report the city, and they were treated as one (e.g., an online social technology which reaches the whole country or beyond)

certified social technologies originating in other countries. In total there were ten foreign originated social technologies in 2017 – five from Peru and one from each of these following countries: Honduras, El Salvador, Costa Rica, Argentina, and Chile. In 2019 there was one social technology originated in the Dominican Republic, one from Guatemala, one from Colombia, and one from Argentina, adding up to four foreign originated social technologies.

Figures 6 and 7 show the total number of social technologies certified by the Banco do Brasil in the period 2001–2021 according to the state (Fig. 7) and the region (Fig. 6) where the social technologies have been implemented. The region which implemented the largest number of social technologies was the Northeast (1177) followed closely by the Southeast region (1107). The North region has implemented the least, 423. These findings reveal that there is not a clear association between the level of development of these regions (see Fig. 1) and the number of certified social technologies in the particular region. The Northeast is the region with the largest number of social technologies, but one of the worst performing regions in Brazil in terms of the socio-economic indicators.

Figures 8 and 9, on the other hand, focus on the location of the accountable. It shows that the most developed regions, the Southeast in particular, are the ones which are mostly responsible for the social technologies. That implies that many social technologies are created in partnerships between municipalities in poorer states and regions with institutions from more developed regions in Brazil. Together, the Southeast and South regions were responsible for close to 65% of all social technologies in the period 2001–2021. The state of São Paulo alone was responsible for over 26% of all social technologies in the period 2001–2021.

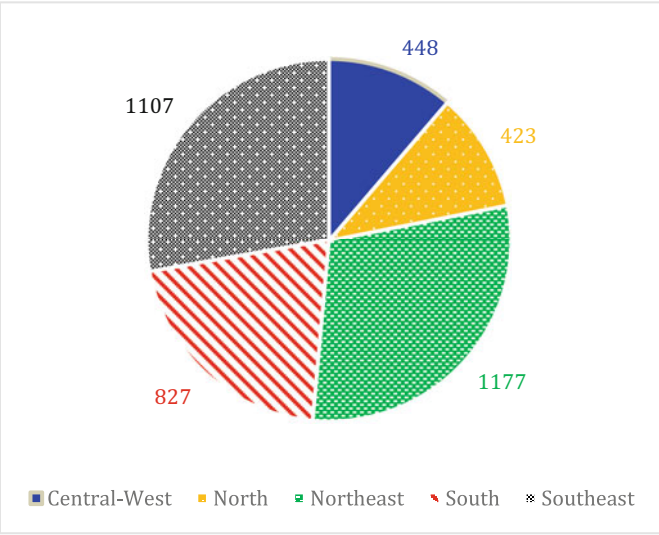

Fig. 6 Total number of social technologies certified by the Banco do Brasil in the period 2001–2021, based on the location of implementation: regions

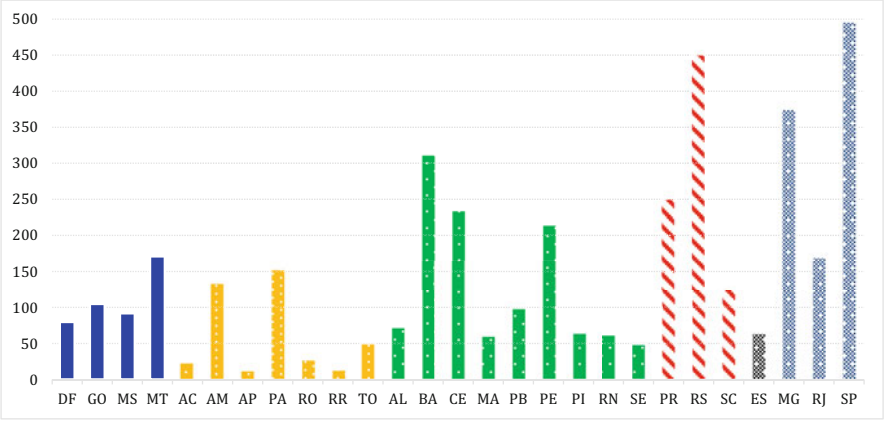

Fig. 7 Total number of social technologies certified by the Banco do Brasil in the period 2001–2021, based on the location of implementation: states

4.3.2 Themes and SDGs

Social technologies are classified in a minimum of one theme to a maximum of three themes. Table 1 presents the distribution of social technologies in the eight possible themes. The table provides two types of information: *a.* $x_{i,1}$ = the number of social technologies with a particular theme i and *b.* $x_{i,2}$ = the number of municipalities with a social technology implemented in a particular theme i. To make this clear, consider

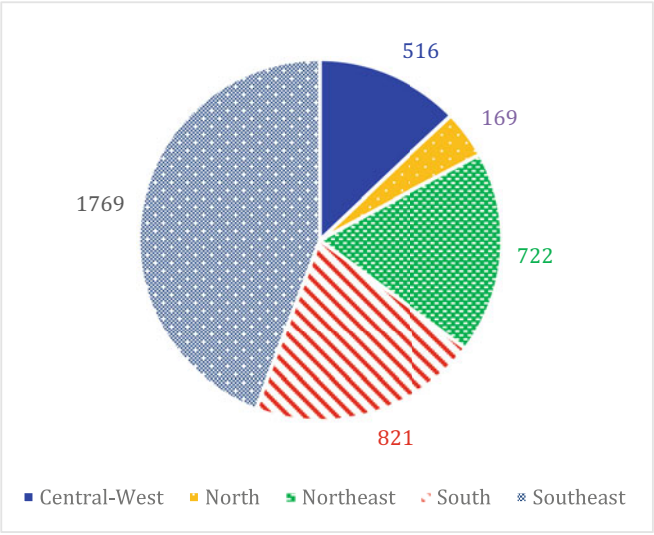

Fig. 8 Total number of social technologies certified by the Banco do Brasil in the period 2001–2021, based on the location of the accountable: regions

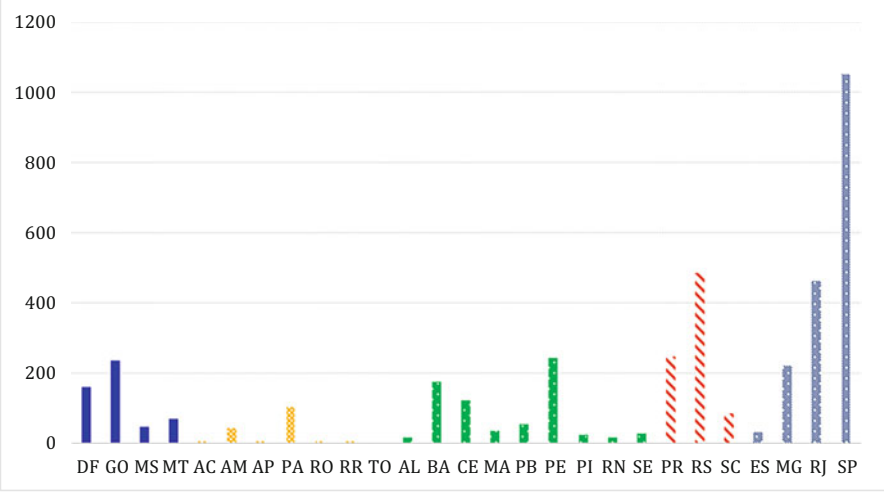

Fig. 9 Total number of social technologies certified by the Banco do Brasil in the period 2001–2021, based on the location of the accountable: states

as an example that there are only two social technologies in the theme $i =$ Food. One of them, "Social technology A" has been implemented in two municipalities, São Paulo and Campinas, whereas the other one "Social technology B" has been implemented in only one municipality, Campinas. Then $x_{\text{Food},1} = 2$ (two social technologies with the

Table 1 Social technology distribution across themes. Note: Social technologies can be classified in more than one theme; as such the sum per year (horizontal sum in the table) is not equal to the number of social technologies in that year

	Themes							
Year	Food	Education	Energy	Housing	Environment	Water resources	Income	Health
2001	1 | **5**	8 | **13**	0 | **0**	0 | **0**	1 | **1**	1 | **1**	3 | **7**	1 | **1**
2003	1 | **4**	4 | **30**	1 | **1**	1 | **1**	4 | **14**	2 | **12**	3 | **6**	2 | **6**
2005	4 | **47**	10 | **77**	0 | **0**	0 | **0**	4 | **65**	2 | **15**	4 | **23**	3 | **3**
2007	4 | **202**	9 | **58**	0 | **0**	1 | **2**	5 | **43**	0 | **0**	6 | **46**	2 | **2**
2009	1 | **4**	15 | **38**	1 | **1**	0 | **0**	7 | **10**	2 | **2**	6 | **17**	10 | **27**
2011	11 | **45**	43 | **453**	4 | **11**	4 | **77**	28 | **102**	9 | **26**	33 | **183**	10 | **46**
2013	10 | **25**	33 | **292**	1 | **14**	5 | **32**	26 | **74**	11 | **27**	41 | **256**	11 | **98**
2015	10 | **68**	35 | **132**	3 | **29**	0 | **0**	37 | **165**	13 | **74**	33 | **167**	9 | **53**
2017	32 | **179**	91 | **623**	1 | **5**	4 | **4**	68 | **482**	17 | **96**	67 | **285**	25 | **98**
2019	18 | **77**	76 | **449**	2 | **22**	3 | **12**	46 | **254**	6 | **16**	50 | **200**	16 | **127**
2021	9 | **39**	30 | **297**	1 | **1**	3 | **4**	29 | **91**	4 | **11**	24 | **308**	9 | **21**
Total	101 | **695**	354 | **2462**	14 | **84**	21 | **132**	255 | **1301**	67 | **280**	270 | **1498**	98 | **482**
Total IR	6.88	6.95	6.00	6.29	5.10	4.18	5.55	4.92

theme Food – "Social technology A" and "Social technology B"), whereas $x_{\text{Food},2} = 3$ (two social technologies with the theme Food in Campinas and one social technology with the theme Food in Campinas). Note that the names of the municipalities in this example do not matter ($x_{Food,2}$ would still be equal to 3 if "Social technology B" was implemented in the municipality Rio de Janeiro). In Table 1, $x_{i,1}$ is presented as the first number (number to the left) for each theme i and year, while $x_{i,2}$ is presented after the vertical bar (number to the right). Using the data for the whole period, the sum from 2001 to 2021, we compute the index Total Intermunicipal Replicability, Total IR, based on the Intermunicipal Replicability Index IR:

$$\text{IR}j = x_{j,i,2}/x_{j,i,1} \qquad \text{if } x_{j,i,2} > 0, \text{otherwise IR}j = 0$$

by "Income" where j stands for year. In the table Total IR is computed for the whole period; thus j = 2001–2021. It provides an indication of how often social technologies have been replicated to other municipalities.

Throughout the whole period, "Education" has been the most prevalent theme, followed by "Income" and "Environment." The themes with less social technologies were "Energy," "Housing," and "Water resources." The theme which had social technologies being more often replicated was Education, $\text{IR}_{2001–2021,Education} = 6.95$. Table 2 provides similar information as Table 1, but with the distribution across SDGs instead of Themes. The top three covered SDGs in the period 2001–2019 were SDG 4 "Quality education," SDG 13 "Climate Action," and SDG8 "Decent work and economic growth." Despite being less represented, SDG 15 "Life on land" had the highest Intermunicipality Replicability, $\text{IR}_{2001–2021,15} = 11.8$.

5 Conclusion

This chapter presented the concept of social technologies by discussing the definition, the origin, and a comparison to other similar terms in the literature. Additionally, the chapter analyzed how social technologies can relate to public policies and the Sustainable Development Goals. The chapter showed that social technologies are more appropriate for collective and non-market production. Because social technologies are co-created by the communities facing the socioeconomic problems, and are thus tied to the reality of local societies, they are more successful in answering the problems faced by the local societies. As such, social technologies can be an important instrument to achieving the Sustainable Development Goals.

Offering online information about the available social technologies is an important instrument to allow replicability to other contexts and places. The Brazilian Bank Foundation certifies every 2 years social technologies in Brazil since 2001. The Foundation has an online platform, Transforma!, which contains detailed information about each social technology, separated by year, theme, and SDGs.

Table 2 Social technology distribution across Sustainable Development Goals (SDGs). Note: Social technologies can be classified in more than one SDG; as such the sum per year (horizontal sum in the table) is not equal to the number of social technologies in that year. The databank does not provide information about the SDGs in the year 2021

	Sustainable Development Goals – SDGs																
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
2001	0 **0**	1 **5**	4 **12**	8 **13**	0 **0**	1 **1**	0 **0**	3 **7**	0 **0**	1 **1**	0 **0**	0 **0**	1 **1**	0 **0**	0 **0**	0 **0**	0 **0**
2003	0 **0**	1 **4**	3 **10**	4 **30**	0 **0**	2 **12**	1 **1**	3 **6**	0 **0**	1 **4**	1 **1**	1 **1**	4 **14**	0 **0**	1 **11**	0 **0**	0 **0**
2005	1 **20**	3 **10**	6 **13**	10 **77**	1 **1**	3 **16**	0 **0**	3 **22**	1 **20**	3 **60**	0 **0**	1 **1**	3 **48**	0 **0**	0 **0**	1 **1**	2 **2**
2007	1 **1**	4 **202**	6 **204**	10 **84**	0 **0**	0 **0**	0 **0**	7 **47**	0 **0**	3 **4**	1 **2**	2 **34**	4 **39**	0 **0**	2 **34**	1 **1**	3 **15**
2009	3 **6**	3 **6**	11 **31**	17 **44**	0 **0**	2 **2**	1 **1**	8 **19**	0 **0**	3 **13**	1 **7**	0 **0**	8 **19**	0 **0**	2 **3**	1 **5**	1 **8**
2011	9 **35**	12 **51**	19 **89**	45 **457**	2 **7**	9 **26**	5 **18**	32 **177**	2 **4**	13 **70**	3 **76**	10 **37**	32 **168**	0 **0**	6 **37**	0 **0**	8 **123**
2013	8 **51**	11 **26**	23 **166**	35 **273**	1 **2**	10 **26**	1 **14**	42 **257**	1 **14**	16 **104**	4 **18**	21 **58**	26 **85**	1 **2**	7 **16**	1 **1**	3 **5**
2015	5 **27**	12 **71**	21 **120**	40 **167**	1 **1**	12 **65**	3 **29**	35 **195**	8 **34**	13 **55**	0 **0**	16 **85**	39 **184**	1 **3**	2 **8**	1 **2**	4 **5**
2017	7 **32**	34 **181**	54 **257**	100 **682**	1 **1**	17 **96**	1 **5**	69 **297**	5 **43**	19 **71**	5 **5**	26 **107**	71 **504**	0 **0**	7 **245**	1 **2**	12 **127**
2019	2 **11**	20 **91**	17 **128**	78 **461**	7 **36**	5 **15**	2 **22**	53 **216**	1 **6**	11 **36**	6 **19**	4 **9**	43 **235**	0 **0**	6 **37**	2 **2**	1 **2**
Total	36 **183**	101 **647**	164 **1030**	347 **2288**	13 **48**	61 **259**	14 **90**	255 **1243**	18 **121**	83 **418**	21 **128**	81 **332**	231 **1297**	2 **5**	33 **391**	8 **14**	34 **287**
Total IR	5.1	6.4	6.3	6.6	3.7	4.2	6.4	4.9	6.7	5.0	6.1	4.1	5.6	2.5	11.8	1.8	8.4

Based on this databank, this chapter established a database with all relevant information to analyze the main trends in social technologies. There is an overall increasing trend in the social technologies implemented, which can be an important means to helping Brazil to reach the Sustainable Development Goals. The regions which implement most social technologies are both the wealthier and poorest regions. However, the regions which are mostly responsible for the social technologies are the most developed ones, mainly the Southeast and the state of São Paulo in particular. Finally, our findings showed that some themes (education, income, and environment) and SDGs (4, 13, and 8) are more represented in the social technologies than others. This might imply that in the short run social technologies will be more successful in tackling a few of the SDGs, and therefore other less represented ones might need a further incentive.

Because social technologies target specific demands and problems, they are more successful in matching people to the solutions brought by these social technologies. Additionally, lack of financial resources from private enterprises and insufficient attention by the public sector open the necessity for collection action, which are facilitated by social technologies. As such, social technologies are important to foster sustainable actions in developing countries from a long-term perspective. However, to maximize on the benefits from the existing social technologies, access to information via online platforms is essential. This chapter showed that most social technologies have been replicated to various municipalities and states within Brazil. Other Latin American countries have in more recent years also been certified by the Brazilian Bank Foundation. Some social technologies are also available online, which allows dissemination across national borders. Other cases of cross-national replicability are far less common. This suggests that more countries should disseminate and exchange examples of social technologies.

Finally, social technologies are fundamental in achieving the Sustainable Development Goals. As such, the databank links all social technologies to one or more Sustainable Development Goals. In this sense, it facilitates for other interest parties to access social technologies by searching for particular Sustainable Development Goals. It also allows the visualization of Sustainable Development Goals which have been more or less included in social technologies. Having it as an open source databank could potentially benefit different communities throughout the world looking for solutions to local problems and for reaching the Sustainable Development Goals.

1. Authors' translation.
2. The definition used by the bank for Social Technologies is "Social technologies are products, techniques or re-applicable methodologies, developed in interaction with the community and which represent effective solutions for social transformation" (Transforma 2022, p. 1).
3. Public calls can be accessed at www.fbb.org.br/editais.
4. The Winner category receives more than one nomination per year.

Appendix

See Table 3.

Table 3 List of Brazilian states and regions

State	State abbreviation	Region
Distrito Federal	DF	Central-West
Goiás	GO	Central-West
Mato Grosso do Sul	MS	Central-West
Mato Grosso	MT	Central-West
Acre	AC	North
Amazonas	AM	North
Amapá	AP	North
Pará	PA	North
Rondônia	RO	North
Roraima	RR	North
Tocantins	TO	North
Alagoas	AL	Northeast
Bahia	BA	Northeast
Ceará	CE	Northeast
Maranhão	MA	Northeast
Paraíba	PB	Northeast
Pernambuco	PE	Northeast
Piauí	PI	Northeast
Rio Grande do Norte	RN	Northeast
Sergipe	SE	Northeast
Paraná	PR	South
Rio Grande do Sul	RS	South
Santa Catarina	SC	South
Espírito Santo	ES	Southeast
Minas Gerais	MG	Southeast
Rio de Janeiro	RJ	Southeast
São Paulo	SP	Southeast

References

Agencia Brasil (2020) Número de beneficiários de planos de saúde fica estável em 47 milhões. https://agenciabrasil.ebc.com.br/saude/noticia/2020-03/num

Agencia Brasil (2021) Censo escolar 2020 aponta redução de matrículas no ensino básico. https://agenciabrasil.ebc.com.br/educacao/noticia/2021-01/censo-

Dagnino R (2009) Tecnologia social: ferramenta para construir outra sociedade. Unicamp, Campinas

Dagnino R (2014) A tecnologia social e seus desafios. In: Tecnologia Social: contribuições conceituais e metodológicas [online]. Campina Grande, EDUEPB, pp 19–34. ISBN 978-85-7879-327-2

Dagnino R, Thomas H (2001) Elementos para una renovación explicativa-normativa de las políticas de innovación latinoamericanas. Avaliaçao 6(1)
Day G, Croxton S (1993) Appropriate technology, participatory technology design, and the environment. J Des Hist 6(3):179–183
Dias RB (2013) Tecnologia social e desenvolvimento local: reflexões a partir da análise do Programa Milhão de Cisternas. Rev Brasileira Desenvolvimento Reg 1(2):173–189
FBB (2022) Fundação Banco do Brasil (fbb.org.br)
Fonseca R, Serafim M (2009) A Tecnologia Social e seus arranjos institucionais. In: Dagnino R (ed) Tecnologia Social: ferramenta para construir outra sociedade. Instituto de Geociências de Unicamp, Campinas, pp 154–183
Herrera AO (1981) The generation of technologies in rural areas. World Dev 9(1):21–35
IBGE (2022) IBGE | Portal do IBGE | IBGE
Kaplinsky R (2011) Schumacher meets Schumpeter: appropriate technology below the radar. Res Policy 40(2):193–203
Lassance A, Pedreira JS (2004) Tecnologias sociais e políticas públicas. In: Lassance A et al (eds) Tecnologia social: uma estratégia para o desenvolvimento. Fundação Banco do Brasil, Rio de Janeiro
Nelson R, Sampat BN (2001) Making sense of institutions as a factor shaping economic performance. J Econ Behav Org 44:31–54
Novaes H, Dias R (2009) Contribuições ao marco-analítico conceitual da tecnologia social. In: Dagnino RP (ed) Tecnologias sociais: ferramenta para construir outra sociedade. Unicamp, Campinas, pp 17–53
Pena JO, Mello CJ (2004) Tecnologia social: a experiência da Fundação Banco do Brasil na disseminação e reaplicação de soluções sociais efetivas. In: Lassance Jr AE et al. (eds) Tecnologia Social uma estratégia para o desenvolvimento. Fundação Banco do Brasil, Rio de janeiro
Schumacher EF (1973) Small is beautiful: economics as if people mattered. Blond & Briggs, London
Stewart F (1987) The case for appropriate technology: a reply to R.S. Eckaus. Issues Sci Technol 3(4):101–109
Transforma (2022) Transforma! – Rede de Tecnologias Sociais (fbb.org.br)
Transparency International (2022) Corruption perceptions index 2021. Berlin. 2021 Corruption Perceptions Index - Explore the. . . – Transparency.org