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THE SOCIAL TECHNOLOGY NETWORK

In July 2004, a heterogeneous group of institutions, led by the Bank of Brazil Foundation and including several national ministries such as the Ministry of Science and Technology and the Ministry of Social Development, together with semi-public companies such as Petrobras, met numerous representatives of non-governmental organizations (NGOs), social movements and universities to discuss policies for social and technological development. This meeting led to the creation of the Social Technology Network (STN; Rede de Tecnologia Social [RTS] in Portuguese), a hybrid experiment to promote grassroots innovation in Brazil and seeking to combine the participation and empowerment of civil society actors in technological development with the design of large-scale public policies for social development and poverty reduction.

Created just after the beginning of the administration of President Luiz Inácio Lula da Silva, the STN embodied much of the aims and hopes of the new political scenario of the early 2000s in Brazil. This scenario combined the long-term rise of social movements such as the Landless Movement and the recently created World Social Forum with some restoration of the role of the state and a broad commitment to redistribution of income. The emergence of the STN coincided with a propitious time to experiment with alternative frames of development and new ideas in public policies, such as solidarity economy, fair trade and sustainable development.

From its origins in 2004 until its suspension in 2012, the STN reached more than 900 members, involving a wide range of participants, from academics to activists, trade unions, government representatives, funding agencies and, especially, NGOs, community representatives and social movements.

Over a seven-year trajectory, the STN documented hundreds of grassroots technological developments and selected dozens to be reapplied by the thousands in other communities, through collaboration with funders, technicians, academics,

policymakers and civil society organizations. Innovative initiatives were evident in areas such as water and sanitation, agroecological production, social housing and solid waste recycling. Through these actions STN also fostered a debate, in Brazil and elsewhere, about the need to combine technological development with social inclusion and the democratization of knowledge: a vision that became acknowledged and incorporated among social movements, NGOs and policymakers. However, the network itself was suspended in 2012, owing to irreconcilable differences between civil society organizations and funders over its formal structure, funding and pace of development.

The short story of Brazil's STN raises questions about the best strategies in the pursuit of grassroots innovation, the role of the state, funders and civil society actors, and how to combine the urge to scale up solutions to poverty situations with the aim of empowering marginalized social actors.

In order to understand these issues, this chapter will try to answer the following:

- how and why the STN was created;
- how social technology advocates mobilized support and activities in grassroots innovation;
- what challenges and dilemmas the STN faced.

This work is based on a qualitative approach that benefits from the great amount of documentation and interest around the STN, along with a set of interviews with relevant actors in this process. The chapter is organized as follows. The first section explores the origins and background of the STN, including some considerations of the political landscape in the 2000s. The second section analyses the diverse framings of social technology (ST). The next section describes the main spaces where ST was able to develop, followed by a section providing some relevant examples of reapplied technologies. The following section discusses some results and lessons that can be learnt for path construction from the history of the STN. The chapter concludes with some final remarks on the contribution of the STN to understanding grassroots innovation in Latin America.

Origins and background

In 2002 Luiz Inácio Lula da Silva and the Workers' Party (PT) won the Brazilian presidential election in what was regarded as a watershed moment for the country. After three consecutive defeats, the PT's rise to government represented a change of political tone, as compared to the neoliberal policies prevalent among governments in the region, and signalled a shift towards more socially inclusive policies oriented towards fighting poverty, inequality and exclusion. Furthermore, the PT, the largest left-wing party of Latin America, would finally have an opportunity to implement, on a national scale, what it was doing locally in several cities and states and what was being called PT's 'way of government' (*modo petista de governar*). This involved the commitment to redistributive policies in favour of the poorest part of

the population and the ‘democratization of the state’ through increasing forms of participation in setting public agendas including, for instance, participatory budget schemes (Hochstetler, 2004; Paes de Barros and Carvalho, 2003; Samuels, 2004).

In this political scenario, the construction of new public policies that could target social development and at the same time build bridges with social movements was keenly favoured by the government. As Hochstetler argues, there was a genuine effort to include social movements and NGOs in some areas and initiatives of the government. This involved the inclusion of several activists among its staff and the call to support government social programmes (Hochstetler, 2004). In this sense, the changes that the PT was implementing in Brazil signalled a shift from a state-centred managerial approach to a different one, more permeable to public participation and social movements, in particular regarding areas of social assistance. This scenario thus combined the aim of implementing new policies of poverty alleviation with the commitment to public participation. It also provided the opportunity to experiment with innovative policies of social inclusion and science and technology development at a national scale.

However, the PT faced huge challenges in translating the experiences of some pioneering local policies to the national level. In part, the PT was tied to alliances with other political parties, and it also needed to deal with a looming debt crisis, all of which left little space for radical policies and constrained the simultaneous implementation of the goals of inclusion and democratization. The PT government did indeed privilege the construction of massive social inclusion programmes, such as Bolsa Familia, a social security programme of direct cash transfer based on existing initiatives of the previous administration that was inspired by the United Nations Millennium Goals and later received worldwide recognition (Graziano da Silva, 2009; Hall, 2006).

However, there was also room for more experimental policies on public participation and social inclusion, such as the creation of the Solidarity Economy Secretariat (SENAES) within the Ministry of Employment in 2003. One of those initiatives was the Social Technology Network.

Early antecedents of social technology

The drive towards ST started at the end of the 1990s and beginning of the 2000s. In the beginning it involved a diverse set of public and semi-public institutions that were experimenting with different concepts and visions of technology for social development.

In the early 2000s a small group of people at the Ministry of Science and Technology started to explore the possibility of launching a revamped version of the old appropriate technology programmes that were implemented by the National Council of Science and Technology Development (CNPq) during the late 1970s through to the 1990s. Having reconsidered ideas and experiences underpinning appropriate technologies, they later joined and contributed to the discussion of the concept of social technology.

The Bank of Brazil Foundation (BBF) is the private foundation of the flagship bank and one of the largest in Brazil. Its interest in ST arose from recognition of the limits that its own social development programmes faced and its acknowledgement of the need to include technological solutions in the fight against poverty (de Olivera Pena and Mello, 2004; Fonseca, 2011). As a result, in 2001 the BBF created the National Prize on Social Technology, with the aim of publicizing the then fairly unknown technological solutions for social demands in themes such as water supply and sanitation, food production, energy, education, income generation, health, social housing and environment (de Olivera Pena and Mello, 2004).

Another important actor at the beginning was the Institute of Social Technology (ITS – Instituto de Tecnologia Social), created in 2001 and aimed towards linking social needs with the scientific knowledge available in the country. Between 2001 and 2004, the ITS developed a series of workshops and debates on how to build bridges between the third sector and public science, technology and innovations institutions that led to the first discussions of the concept of ST (Instituto de Tecnologia Social, 2004).

On a smaller scale, the STN's early setting also involved a small number of academics directly involved with earlier research on appropriate technologies and other complementary themes, such as solidarity economy, agroecology and permaculture and Freire's 'pedagogy of the oppressed'.¹

From the beginning the STN was also supported by several social movements and NGOs, such as the Semi-Arid Association (Articulação no Semiárido Brasileiro), the Amazonian Working Group (Grupo de Trabalho Amazônico), the Brazilian Association of NGOs, Abong (Associação Brasileira de Organizações Não Governamentais). Therefore, to help the creation of this network along with public institutions was advantageous for the new government, not only because it would aid in the empowerment of its own political base, but also because of its potential creation of challenges for the incumbent monopolies in public policy (Hochstetler, 2004). The alliance between social movements, public and semi-public institutions also proved to be fruitful, helping to install the idea of social technologies at the national level and to promote support for social technologies programmes. The network organization helped to create spaces for the flourishing of ST.

However, as with other initiatives involving civil society organizations in the Lula administration,² these heterogeneous institutions were not easy to coordinate. The actors and institutions in Brazil's STN comprised very different knowledge and practices, as well as aims and spaces of intervention that represented an institutional challenge for every participant and ultimately turned into a limitation for some of its members.

Framing for social technologies

At the beginning of the new century, some Brazilian institutions and social movements realized the need not only to challenge market-driven strategies of economic growth but also to search for new approaches to tackling poverty and social inequality.

The work of framing and the vision of the STN resulted from the encounter between these different actors. It was an explicit attempt to bridge the role of the state and its public policies with the mobilization of social movements and NGOs. Acknowledging previous experiences and debates (such as earlier ideas about appropriate technologies and discussions about science, technology and innovations policies for social inclusion), the framing of the STN included concerns and aims from different positions including: (a) the new drive to redirect resources from public and semi-public institutions towards inclusive social development in conjunction with social movements; (b) social movements' and NGOs' previous experience in programmes and approaches in the fight against poverty and exclusion; and (c) the aim to engage with scientific institutions in a different arena, that of social development problems and policies.

Between 2000 and 2004, these actors held a series of debates that would result in a definition of ST: 'Social Technology comprises products, techniques and/or re-applicable methodologies developed in the interaction with the community and that must represent effective solution in terms of social transformation' (RTS, 2014).

'Reapplication' is arguably the main idea present in this concept. It implies that successful experiences and technologies should be multiplied, but in a way that allows them to connect properly to the local contexts in which they would be implemented. Thus, for the STN, scale-building was just as important as respect for the local culture, economy and environment. Therefore, the mandate of the STN was as follows.

The STN has the aim of fostering:

- the adoption of Social Technology as public policies;
- the re-appropriation by the communities' stakeholders of re-applied Social Technologies;
- the development of new Social Technology in those cases where there is not Social Technology for its re-application.

(RTS, 2014)

Although these concerns were complementary, they were not always coherent and tensions between different frames sometimes remained. In this section we explore the framings of social technology, focusing on the following issues: public policies; income generation, empowering and public participation; and the interpellation involved in the creation of a network that ultimately led to a process of identification with ST.

An alternative strategy of development

The framing of ST offered a fresh view into the demanding problems of inequality and poverty. In that sense, the basic framing of ST attempted to bridge some ideas

that, although related, were not explicitly connected, such as social inclusion, income generation and sustainability and social empowerment, with long-term goals of structural transformation. Two themes in particular that were supported by actors would become very relevant for ST: solidarity economy and sustainable development.

Advocates of solidarity economy³ participated from the beginning in the debate about ST. For solidarity economy advocates, ST initiatives were important in order to upgrade and adapt technologies used in cooperatives or occupied factories in areas such as urban disposal recycling, renewable energies, sustainable food production and open software for social inclusion (Alves da Silva and Sardá de Faria, 2010, p. 70).

Similarly, sustainable development was very much present in the imaginary and practices of ST's actors and institutions. Ecological ideas were used to challenge the advance of agribusiness, which involved massive monoculture, with heavy use of agrochemicals, and displaced local farmers. Since the bulk of stakeholders and experiences that were promoted by the STN were mostly rural, it was not surprising that there were clear affinities with sustainable methods of production and development. Moreover, in the long term, the STN's vision was keen to create a whole strategy of development that was 'more sustainable' than available technological systems (RTS, 2005).

Beyond mainstream notions of science and technology (S&T)

In the early 2000s an incipient counter-hegemonic discourse sought to modify the Brazilian S&T orientation from market-driven innovation to the resolution of pressing problems of poverty, hunger and inequalities (Dias, 2011). This diagnostic was based on two main issues. First, ST advocates claimed that S&T in Brazil had achieved a high level of development and expertise that was oriented by the international scientific agenda and thus was unable to attend to local problems (Suarez Maciel and Castilhos Fernandez, 2011). Second, there was an untapped reservoir of technological and knowledge solutions to social problems developed by publicly funded institutions such as Embrapa (the Brazilian Agricultural Research Corporation),⁴ or by federal universities, which had generally lain idle on the shelf of these institutions. So, there was a feeling of 'why didn't we think of social technologies before?' (Lassance Jr. and Pedreira, 2004, p. 65). There were two issues that differentiated ST from the frame of mainstream science, technology and innovation: juxtaposing ST with conventional technology, and creating knowledge and technology from the grassroots.

The idea of ST was built upon previous debates about appropriate technology (Dagnino et al., 2004). In particular, ST was opposed to what were regarded as conventional technologies, namely those artefacts and innovations that were designed for maximizing profit, assuring control over production and limiting social participation. It was claimed that conventional technologies not only did not attend to the social needs of the poorest population or environmental problems but also largely increased them (Dagnino, 2004).

At the same time, this critique had further ideological implications, since the rejection of conventional technology implied a critique of the market-driven vision of S&T where public knowledge and technologies were privatized through commercial innovation. Challenging conventional innovation implied changing focus, away from firms as exclusive innovators (and profiteers) and towards the grassroots via a more open participatory model.

Thus, instead of talking about innovation, ST members stressed the idea of technological development, public access to knowledge and technology and the possibility of reapplication of technology by the communities without the constraints of commercial patents. Avoiding paying fees or licences helped, in turn, to lower the cost of devising and implementing public policies on a large scale.

A second, interrelated element was the idea that local knowledge was key to the development of suitable social technologies:

The principal aspect is that this change [i.e. sustainable development] is produced by a solution generated from the alliance between local knowledge and scientific knowledge; that is why it is acknowledged and appropriated by the communities. Therefore, this is an endogenous solution, one of the key elements of any process of local development.

(RTS, 2011, p. 6; our translation)

By highlighting the local dimension of knowledge creation, the STN not only challenged conventional ideas about innovation but also made an explicit call to democratize access to technology design, technological evaluation and policy-making of S&T.

Empowerment and participation

From the beginning, the definition of ST was based on the recognition of the new role that third sector organizations could play in the development of technological solutions for their own problems (Baumgarten, 2006).⁵ Giving voice to third sector organizations also implied the recognition of other forms of knowledge, such as popular knowledge, indigenous knowledge and visions of technological development alternative to those most predominant in the mainstream science, technology and innovation system (Instituto de Tecnología Social, 2004).

The goal of ST was to empower people and seed wider social transformation through the capabilities acquired during a particular project, and then drive initiative in subsequent projects in the locality. Therefore, the STN advocated a complex vision of participation that rejected an a priori division between technology developers and users. Stakeholders such as local communities, NGOs, cooperatives and social movements had a central role in the process of replication of technology. It was assumed that they should intervene in the design and implementation, but they should also have a voice in the process of policymaking. In practice, the partnerships that were formed were about making sure that immediate solutions were locally

fitting, but also about empowerment in the process of the development of technology. However, aspirations for grassroots influence over broader technology policy agendas proved elusive.

A second aspect to participation in the technological process was that of appropriation of technologies in a double sense. On one side, it implied the ability of local communities to control their technological solutions as a key element of autonomy and self-management. On the other side, the same process of participation and autonomous technological development was assumed to guarantee the adaptation of technologies to local context, allowing redevelopments to include local and traditional knowledge in a sensible way. In contrast to market-based understanding of the term, appropriation for ST did not mean exclusive ownership but, rather, the ability to build capabilities and learn from others (technicians, scientists, neighbours and politicians) in a process of cooperative development.

Finally, social technology was also intended to improve the ability of the community to organize and solve further problems, develop and exploit economic opportunities and create the capacity to mobilize resources from others. Grassroots innovation capabilities were seen as requiring political and economic capabilities whose capacity increases through successions and networks of projects. Therefore, each project needs innovations to adapt to local contexts and hence build innovative capabilities that help to create a voice for these communities in larger debates on S&T agendas and economic development (Instituto de Tecnología Social, 2007).

Social technologies as public policy

The STN frame on public policy was based on lessons about the problems that appropriate technologies faced in Brazil. The 'isolated' character of appropriate technology solutions was particularly highlighted. To avoid this, the STN aimed to connect particular social technologies with public funding in order to gain national-scale reapplication (RTS, 2010).

The strategy to transform ST into public policies involved the mobilization of important state resources (from knowledge to funding and public procurement) but also required some degree of institutionalization in order to achieve stability or even irreversibility for long-term policies. So it was important to identify and connect the diversity of ST initiatives around Brazil and to select certain experiences that could be scaled up (Instituto de Tecnología Social, 2004). Central to this vision was the concept of reapplication that was aimed to promote certain technologies and artefacts at a large scale. According to Fonseca (2011), the reapplication of technologies implies: (a) reproduction adequate for the local space, (b) appropriation by the local population and (c) assessment of results for new reapplications.

Driving S&T capabilities towards the solution of social and environmental problems was one of the ideas for public policy, but it was not the only one. Grassroots innovations were considered as a creative force based on local solutions, sometimes retrieving knowledge in ways that contrasted with expectations arising from linear

conceptions of R&D. Thus, the STN aimed to provide recognition, support and technical validation to grassroots initiatives, and to translate those initiatives into systematic schemes or models that could be reapplied later elsewhere.

The complex challenge of how to translate known ST into public policies and how to develop new solutions required a strong effort of coordination and advocacy. It also required network members and activists to challenge incumbent policies and practices in S&T institutions and state bureaucracies that were not used to negotiating knowledge with local actors or were reluctant to assume the risks of unproved technologies (Lassance Jr and Pedreira, 2004). In order to achieve that, the strategy of the STN was to create a powerful and hybrid network between semi-public companies, public institutions, universities, social movement and NGOs.

Spaces for social technologies

From the beginning, the STN involved a heterogeneous mixture of civil society organizations and public and semi-public institutions. The spaces of ST constituted an effort to mobilize social actors and communities, fostering participation in grassroots innovation while at the same time requiring the protection of the public policy umbrella. In this section we describe how the construction of these spaces helped to expand the STN, and how this expansion also took the STN to its institutional limits.

Building the STN

Following a call from Luiz Gushiken, the then head of the Social Communication Office of the Lula administration, a group of public and semi-public institutions (including the Bank of Brazil Foundation; the State Oil company Petrobras; the Financing Agency for Studies and Projects (FINEP), a state S&T funding agency; the Ministry of Science and Technology; the Brazilian Service of Assistance to Micro and Small Enterprises (SEBRAE); and the Secretary of Communication and Strategic Management of the Presidency of the Republic) started to organize a series of meetings that would eventually lead to the creation of the STN.

The first of these meetings was held in July 2004 in Brasilia and was attended by thirty participants. These included NGOs from the Northeast region of Brazil (RTS, 2005). This meeting revisited the discussion on the concept of social technology and began a debate about the possibility of devising alternative strategies of development. At the same time it was argued that the network would not get legal status as an institution (this was a decision that would have further consequences for the management of the STN). Thus the network was proposed as open, democratic, dialogic and inclusive in order to encourage the participation and collaboration of heterogeneous actors (RTS, 2011). After a series of further meetings (including the First International Conference of Social Technologies) the STN was created in January 2005 with 100 participants (RTS, 2005).

The structure of the STN consisted of an Executive Secretary with a staff of five and a Coordinating Committee, which included representatives from the STN's funders, up to four network enablers from NGOs and social movements and a representative from academia.⁶ The Committee's main tasks were to select and coordinate the reapplication of technologies, assess its implementation and set goals for the communication and dissemination of the STN. A further layer of decision making was the forum of the STN, which involved all the other members and participants and had a consultative role.

From the beginning it was established that the STN would not limit its task only to the communication and dissemination of ideas but would also implement actions and develop social technology programmes. Its aim was also to coordinate the capacities of state institutions (i.e. large-scale projects and funding) and NGOs and social movements (i.e. creativity, plurality, local knowledge and implementing capacity) (RTS, 2005). These requirements called for a very delicate balance and coordination between 'social diversity' of grassroots and the 'need for scale', as well as between funders, network coordinators and stakeholders (all of which have, in fact, very different backgrounds).

From 2005 until 2012 the network reached out to other actors and really spread the idea of social technology, thus extending the original frame of knowledge and allowing new ideas and problems to be included. Over its seven-year trajectory, the STN incorporated a total of 928 institutional affiliations, of which a large majority were NGOs and social organizations (546), followed by private foundations (110), while there were only sixty-three public research institutions and universities. By 2012 the STN had reached institutions from Peru, Colombia and Venezuela and its ideas had triggered discussions in Argentina and Uruguay. Activities of the STN included the promotion of major events, such as international conferences on ST and two national forums (2006 and 2009) in which issues were discussed such as agroecology and food security and sustainable development (RTS, 2011). At the time, the STN had constant participation in other forums and activities including S&T meetings, university extension and outreach, solidarity economy meetings and a presentation at the World Social Forum in 2010.

As a result, civil society organizations and public institutions in Brazil started to reflect upon and to experiment with ST's ideas and frames. These 'network effects' seemed to indicate that the STN managed to spread beyond its original institutional arrangement. As Larissa Barros, the former Chair of the STN, argued, the STN had succeeded in creating a debate around S&T and social development that included actors traditionally regarded as outsiders; for example, NGOs and social movements such as agroecology and solidarity economy.

On the other hand, the relationship with mainstream S&T institutions remained ambivalent. While ST was enthusiastically adopted by knowledge extension units at federal universities, attempts to introduce the debate into S&T forums such as the National Week on Science and Technology received lukewarm responses. And despite the fact that the term 'social technology' has appeared in a few documents released by state organizations such as the National Secretary of Science and

Technology for Social Inclusion, there was never a clear federal policy for promoting ST in Brazil.

Social technology and public policies

From the beginning, both public institutions and social actors were keen to promote new public policies on ST. The construction of ST as public policy was assumed to guarantee continuity of efforts and to avoid isolated initiatives, and it was aligned with the aim of promoting alternative forms of sustainable development. There was, therefore, a conscious effort first to identify experiences and problems and then to translate grassroots initiatives into reapplying technologies that were able to gain scale.

At the same time, through debates at the STN, it was decided to prioritize ST projects that favoured income generation among beneficiaries, an issue that coincided with the overall aim of social policies in Brazil. The STN also selected as priorities the semi-arid and Amazônia Legal regions and urban peripheries. At the same time, the STN selected a wide range of technologies for its reapplication. These included water collection, solid recycling, small agroecological farm methods, forestry techniques, fish farming, cashew nut-processing plants, small oil-processing plants, social housing techniques, platforms for cooperative incubation and pedagogical techniques. Some of these projects, such as the water-collection systems that came to be a core aspect of the One Million Cisterns Programme (P1MC), grew to quite a large scale and became a national endeavour for social development state agencies. During its existence the STN helped to manage funds for developing social technology experiences amounting to more than R\$440 million (approximately US\$200 million) (RTS, 2011, p. 3).

One of the particularities of the hybrid institutional arrangement of the STN was that, since it did not have legal status, it did not fund any projects (or events) directly. There was no central management and instead it was the responsibility of funding institutions to implement the projects in collaboration with the social organizations and NGOs. Thus, for example, some smaller programmes such as Basic Sanitation Technology for Rural Areas were funded by only one institution, the BBF. However, more complex and larger programmes were generally funded complementarily by several different institutions. For instance, the total investment in the Sustainable and Integrated Agro-Ecological Production (PAIS) Programme for agroecological small farms, of approximately R\$113 million (approximately US\$50 million), was jointly funded by the BBF, SEBRAE, Petrobras, the Ministry of National Integration, the Ministry of Social Development and the Ministry of Science and Technology (RTS, 2011, p. 16). Coordination between different funders was not easy to achieve and there were questions of which institutions enjoyed most the symbolic benefits of their association with each project. Other difficulties of coordination involved different expectations around results and what the pace of the implementation of technologies should be. In a general sense this was a product of the clash of different rationales and organizational cultures, mainly

between the more rigid public structures (i.e. the national ministries) and the more fluid patterns of the emerging social organizations.

At face value, during its existence, the STN had a huge success in mobilizing public funds for technology and social development. Nevertheless, to what extent the goal of building long-term public policies was achieved remains a matter of debate. Since the funding was obtained on a project basis, ultimately the STN was caught, as were other grassroots innovation movements, in the dilemma of working on project-based solutions to situations that ultimately required more structural answers, that is, public policies (Costa and Dias, 2013).

As will be shown in the next section, attempts to overcome these issues through the construction of long-term public policies within the national government were caught between the limitations of the institutional structure of the STN and the inertia of incumbent elites in the state.

Illustrative examples

In a similar way to other examples of grassroots innovation networks and movements, STN started by surveying and acknowledging a wide reservoir of local ingenuity. Grassroots technologies were mainly mapped by the BBF and documented at the Bank of Social Technologies. In 2013 the Bank of Social Technologies recorded 696 examples (Interview with Jefferson D'Avila de Oliveira, Brasilia, 13 November 2013). However, only a handful of these technologies were selected for reapplication and funding by the STN. From those cases we analyse two of the most representative cases: the agroecological production method known as the PAIS Programme and the P1MC. These cases are relevant not only due to their scale of implementation but also because they show alternative forms of linking grassroots participation, poverty reduction and technology to mainstream science, technology and innovation institutions.

The PAIS Programme

The STN has supported a wide variety of agroecological farming and food production methods (Faria et al., 2011). However, one of the best-known and most widespread examples of ST has been the PAIS Programme. The PAIS Programme is a low-cost technology designed to be implemented on small farms (up to 2ha) and favours the use of local materials and knowledge, while avoiding the use of pesticides and external inputs. As the programme's description highlights, PAIS

Is a solution for the production of healthy food that seeks the achievement of food security and the generation of a marketable surplus capable of ensuring a supplementary income. This is a sustainable model of production that combines the creation of small animal farms, cultivation of short-cycle

vegetable species and cultivation of agroecological gardens with long-cycle or permanent vegetable species. The model also seeks the production and use of local materials and recycling of available biomass.

(RTS, 2009a, p. 9)

The design of PAIS was based on a previous project, named Mandalla due to its shape of concentric rings. Based on that design, the technology was then upgraded through the use of localized drip-irrigation and the incorporation of a central henhouse. Farmers who use the technology receive a kit for reapplication that includes components of a water irrigation system, wire fences, seed, small plants and even hens, along with a user's manual and a training course. The idea is that the design of the garden allowed farmers a simple routine of circulation from the henhouse through the rest of the crops, while also promoting a rational use of land, water and organic fertilizers. The design also sought to promote diversity of crops, including the possibility of selecting those vegetables that were best adapted to the soil or had better prospects for commercialization. In 2004, PAIS was selected by BBF, SEBRAE and the Ministry of Integration for reapplication in twelve states. While BBF funded the reapplication kits, SEBRAE and the Ministry of Integration, along with municipalities, funded the training and the creation of networks of technical assistance (Faria et al., 2011). Later, other funders such as Petrobras, Banco Nacional do Desenvolvimento and the Ministry of Science and Technology were also included. In 2011 the STN affirmed that the general investment in PAIS was over R\$113 million, with an approximate unit cost of R\$10,000 (RTS, 2011).⁷

PAIS was praised as a 'silent revolution' in sustainable farming on the cover of the magazine *SEBRAE Agronegocios* and regarded as a tool that combined simple technology with direct results and had the potential to be included in the rising market of organic products in Brazil (*SEBRAE Agronegocios*, 2007). Today PAIS units are often found on small rural properties in several regions of Brazil. The strong point of the technology lies in its capacity to promote income generation and foster association between farmers. As some authors have described (de Olivera Pena, 2009; Souza Costa et al., 2013), a family could make a surplus of between US\$200 and US\$400 by selling at local fairs or through public procurement schemes, such as the National Fund for Education Development within the National Programme of Food for Education (Fundação Banco do Brasil, 2013). This represents a significant increase in family income. However, at the same time, PAIS was regarded as a 'static' technology, with enough flexibility to allow a choice of crops, but not too much, in the different components of the kit (Faria et al., 2011). In this sense, PAIS was very different from other, much more dynamic technologies that were focused on empowerment, such as P1MC.

The One Million Cisterns Programme

A second illustrative technology supported by the STN is the P1MC. P1MC aimed to build a massive number of water cisterns in a large, semi-arid region in Northeast

Brazil with a population of around 25 million. This region is characterized by low rainfall and scarce groundwater sources. Water scarcity and poverty were usually attended by an instrumental state approach that favoured huge infrastructure projects for massive agriculture schemes combined with aid solutions, such as water-tank trucks (*caminhões-pipa*), for the poor. These aid schemes ultimately reinforced local patronage and increased inequalities (Alves da Silva, 2003), since water, food and money have traditionally been used to buy votes for politicians.

The programme was originally devised by the Semi-Arid Association as an answer to these practices, known as the ‘industry of drought’ (*indústria da seca*). The Semi-Arid Association, a network of more than 700 institutions, social movements, NGOs and farmers’ groups, has its origins in popular mobilization against the ‘industry of drought’ and later become an important actor of the STN. Instead of relying on water supplied by water tanks, the Semi-Arid Association proposed to build simple, cement-layered containers that collected rainwater from the roof, with a capacity of around 16,000 litres, enough to sustain a family’s needs through the region’s drought season. This proposal was part of a significant change in how these organizations approached one of the region’s core problems: instead of seeking ways to ‘fight’ or even ‘eliminate’ the drought, they began designing strategies for living with the drought. This shift in the rationale created a whole new tranche of possible actions that could be implemented.

With the start of the Lula administration in 2003, the Semi-Arid Association found an opportunity to insert this programme into national development policies, to be funded by the Ministry of Social Development. Later, in 2005, the programme also became part of the reapplied technologies of the STN.

From its start in 2003 to 2015 almost 590,000 water cisterns were built and put in place by local inhabitants with the support of the STN and the Ministry of Social Development (Ministério do Desenvolvimento Social e Combate à Fome, 2015). The main feature of the technology is that it is built by its ‘users’. The self-building aspect of the cisterns is intended to foster relationship building in the community through the process of learning to build, use and modify the technology, indicating a strong link with the empowering and participatory framing. The water system empowers local people in the building process, while also providing autonomy from local governments and water suppliers.

P1MC was one of the most successful experiences with which the STN was involved, particularly in terms of scale. It was paradigmatic in the way that most of the ST framing in terms of participation and negotiations of knowledge between local people and technicians was embodied in it. The model of horizontal participation in the construction of the cistern was explicitly positioned as an alternative to aid schemes and big infrastructure programmes, both of which excluded poor farmers from the decision-making process. Participation empowered the people and strengthened the link with the mobilization of the Semi-Arid Association in the search for alternative forms of development. Furthermore, this participation shaped a learning process that led to the creation of technological variants such as the Uma Terra e Duas Águas (one land and two waters) project, a scaling up of the

cistern that seeks to collect water for farming production and combines with other technologies such as PAIS (Barbosa, 2010).

However, the insertion of this model into a government programme became problematic in early 2012, when the Brazilian government announced a plan to speed up the implementation of the programme through the purchase of 300,000 plastic water cisterns at almost twice the price of the original cement scheme. Focused on outcomes, this policy change disregarded the process of participation and empowerment that was central to the design of the programme. Private, profit-oriented firms displaced social movements and NGOs as the main partner of the Brazilian federal government in this programme (Dias, 2012).

The narrowing of the model's scope by the Brazilian government led, on 20 December 2011, to a public rally of about 15,000 farmers in the city of Petrolina in Pernambuco, marching against the plastic cistern initiative (Passos, 2011). Protestors claimed that changes in management disempowered people from participation in the construction. Another element of the controversy included concern that introduction of the plastic cisterns would enable the local political elites to regain power over the control of water, by controlling the market in water cisterns. By the time this occurred, however, the seed of empowerment had already been planted. Banners waved at the rally contained phrases such as 'We do not want water at any price. We want to participate.' While the government's approach was built around the artefact and the accomplishment of policy goals, the users' approach was mostly concerned with the process and the inclusive dynamics it generated. In the end, access to clean water seemed to be tightly interwoven with empowerment and the strengthening of community bonds.

The cistern example shows how the Semi-Arid Association and the STN managed to draw power from mobilization in order to renegotiate a model of innovation and social inclusion. For almost a decade this model was very successful in building several hundreds of thousands of cisterns and empowering the population of the semi-arid region. However, as the government attempted to strip the programme of its empowerment element and focus instead on inclusion as the outcome, the mobilizations by the movement pushed the government to reinstate the self-build cistern programme. Though they continued to install some plastic cisterns for some time, in the end the P1MC was transformed into a national public policy through the programme Water for Everyone of the Ministry for Social Development (Costa and Dias, 2013).

Path construction and the Social Technology Network

In less than a decade the STN was able to put the idea of social technologies onto the public agenda in Brazil. Social movements and NGOs around the country appropriated the ideas and values of the STN and started to discuss social technologies. The STN was able to recognize hundreds of STs and to support experimentation in the reapplication of a few of them at a massive scale, covering the huge territory of Brazil. In the universities, 250 research groups have stated that they work with ST and related themes.⁸

More importantly, the debate around ST went well beyond the original extension of the STN and is still strong in 2014, reaching other networks and movements such as the Agroecology Movement and the Network of Extension Units in federal universities in Brazil. In that sense, the STN was able to create a specific framework of knowledge around ST, a sense of identity and a long-lasting debate that goes beyond the network itself. But what does the demise of the STN mean in terms of strategies for grassroots innovation movements and alternative pathways of development? In this section we explore this question, focusing on the issue of public policies, the politics of knowledge and forms of social inclusion.

The limits of the network strategy

In 2009, about five years after its creation, the STN held its Second National Forum of Social Technology and the Second International Conference on Social Technology in Brasilia. This was an opportunity to discuss the achievements of the STN so far and to look at the challenges it now faced (Barros, 2009). For example De Paulo (2009) stated that the STN had already developed an identity, received significant support from funders and was able to introduce ST into the public agenda. According to de Paulo, it was now time to forge new alliances with local development and sustainable movements and to focus on the construction of a new agenda of development. This was a question of how to gain momentum and strengthen the influence of the STN by extending the scale of experimentation and transforming its projects into long-term public policies. However, this was not an easy task, since, as the STN grew, the complexity of the network also increased, leading to further requirements in terms of communication, participation and funding (RTS, 2009b).

As a result of these debates, at least three courses of action were outlined. First, the network widened its focus from income generation to a set of goals around sustainability, including: sustainable food production; sustainable water and forestry management; clean energy production; sustainable social housing; income generation through sustainable business schemes; and learning and education (RTS 2011, p. 10). Second, there was a clear aim to create a regional space for STN, especially with regard to the Mercosur.⁹ By 2009 the STN had already gained members from other South American countries such as Colombia and Venezuela. Attempts to include the STN debate into the regional agendas of South American blocks included a discussion about STN at the Social Mercosur meeting in 2010 and a series of meetings held along with academic supporters in Argentina and Uruguay.

A third strategy was aimed at the institutionalization of ST in order to consolidate its experience into public policies. One such initiative was the proposal of a National Law for Social Technologies in 2008. The proposed law aimed at the creation of a national policy of social technologies and the creation of a national institute of social technology.¹⁰ In 2011, some of the funders within the Coordinating Committee aimed at the creation of a national inter-ministry panel of public policies on ST which would include open public participation.

Plans for the expansion of the STN showed that the maturity and strength of the idea and vision of the ST was not matched by the formal structure of the network and its level of insertion into the state. Some actors in the STN became aware that the expansion of the network and the creation of new spaces for ST depended on the integration of projects and the creation of national public policies (*SEBRAE Agronegocios*, 2007; Suarez Maciel and Castilhos Fernandez, 2011). Meanwhile, the policy of increasing the scale of experiences required further funds, and also more coordination, technical support and so on. All of this has put some extra pressure on funders and implementing institutions in terms of assessment and has raised the issue of who got the symbolic rewards.

As the STN grew in partners and experiences it was increasingly clear that the original informal arrangement between NGOs, social movements and funders was becoming inadequate. There was tension between the need for insertion into the public agenda and the will to maintain mobilization capabilities. However, it was not clear how to solve the institutional challenge. Ultimately, differences about how to formalize the hybrid structure of the STN and how to give the network a more stable form of governance were impossible to overcome, and in 2012 the STN was suspended by its Coordinating Committee.

From network to public policies

The question of how to build public policies for STs was an early goal of the STN and remains an issue of discussion to this day. In a broader context, this was a question of how to challenge monopolies of public policy that were colonized by a market-driven agenda during the 1990s in Latin America. To challenge incumbent bureaucracies was regarded as instrumental in order to create an incipient alternative frame of development. This idea was present in the Workers Party's vision for 2003 (Samuels, 2004), and also in social movements such as the Landless Workers Movement and the Social World Forum.

The alliance between social movements, NGOs and state agencies was a hybrid institutional experiment that sought to create new public policies of social development and new forms of knowledge democratization. In that sense, the success of the STN depended on two linked goals: the aim to mobilize and empower social organization to participate in social technology and the subsequent drive to create long-term public policies. For a while, this alliance had great success in the diffusion of the frame of ST to almost a thousand organizations and the mobilization of more than R\$440 million in resources for the reapplication of technologies. But, as the STN started to grow it also faced the limits of its own institutional arrangement and increasing resistance to its policy demands and other activities by incumbent actors.

The loose, informal structure of the STN started to crumble under crossed pressures, different expectations and different forms of assessment. Since the STN lacked any formal capacity to manage projects, this tension grew with the increment in scale of the projects it proposed. Furthermore, as the P1MC example

showed, this tension quickly became a clash between claims of participation and network creation and claims of accountability and efficient ways of delivering technological solutions. The broad framework and ideas and wide array of institutions that had once allowed the STN to grow rapidly shaped the network in an arena where different interests, rationales and political projects frequently clashed.

At the same time, the dispersal of funding from donors and the fact that these funds were provided on a programme-by-programme basis conspired against the early goal of avoiding partial solutions and seeking long-term public policies. Overall, the suspension of the STN by the Coordinating Committee came at the moment when the debate around ST was growing and including more and more organizations and the idea of ST was becoming widespread among social movements. However, just when the debate started to heat up, funders and civil society representatives were unable to get a suitable institutional arrangement and, as a result, the STN was suspended in 2012. As Larissa Barros put it, 'it failed because it got it right' (Personal interview with L. Barros, November 2013). Meanwhile, the strategy of institutionalization and creation of long-term public policies of ST has also not been successful.

It is interesting to note that, despite the suspension of the STN, many of the projects, including the P1MC and PAIS Programme, continued to receive funding through the different supporting institutions. Furthermore, Banco do Brazil continues to support the Social Technology Prize and the database of ST and has started to build centres of demonstration for ST, partnering with a few universities and municipalities.

As the momentum of the STN seems to be lost, there remains the question of whether the STN has been able to overcome the tension between insertion and mobilization, while at the same time promoting long-term public policies.

Questioning S&T and creating a new politics of knowledge

A second space where the STN achieved mixed results was around the issue of democratization of knowledge. From the beginning, the debate about ST focused on the need to reorient domestic S&T capabilities and put them to better use for the resolution of local social needs. At the same time, the STN seeks the empowerment of social movements as active agents in the development of technologies and S&T policies. Both actions combined represented a powerful critique of the political economy of S&T. However, this process of questioning incumbent elites also presented the dilemma of how to engage with the institutions and actors of mainstream S&T while criticizing its goals, practices and values.

The STN was able to enrol the network of federal universities with extension activities and received significant support from the Ministry of Science and Technology and the entrepreneur funding agency FINEP. These institutions carved out a small niche for ST that nevertheless represented an intense experiment in grassroots participation and technological creativity that led to the implementation of huge social programmes.

However, the amount of funding was very small when compared with funding for mainstream S&T.¹¹ It was mostly used for low-tech initiatives and did not require important R&D capabilities. Neither did it interest mainstream scientific groups. Thus the amount of support from universities and R&D groups was small, leading to the disconnection of ST from mainstream S&T agenda and capabilities. Ultimately, ST as a policy was insulated from mainstream S&T, thus reaching a position very similar to the place that previous appropriate technologies had occupied in Brazil (Brandão, 2001). For STN advocates, ‘future expansion of ST is, in part, related with the chance of altering the incumbent policies of S&T in the country and turning [ST] into public policies’ (Castilhos Fernandez and Suarez Maciel, 2011, p. 40; our translation).

Indeed, the challenge to enrol S&T actors raised further questions about institutional change, such as how to create an endogenous agenda of S&T for social inclusion, how to balance the requirements of scientific relevance with those of local social needs and how to enable social organizations to engage with the restricted areas of expertise of S&T. Some of these issues were already present in the debate of the STN, but during its short life the practicalities of this sea change had not even begun to be considered.

What kind of social inclusion?

From the beginning, the goal of the STN was to combine concrete technological solutions to tackle issues of poverty with democratic participation and autonomous management of the initiatives. In this context, the question of social inclusion was deeply embedded in the constitution and framing of the STN. But what kind of inclusion was promoted by the STN? In order to tackle this issue, the STN experimented with at least three framings of inclusion (Smith et al., 2014): (a) inclusion as ingenuity through the acknowledgement and assessment of grassroots technological solutions; (b) inclusion as empowerment by encouraging participation and appropriation of technologies in the field; and (c) inclusion as structural transformation by fostering the debate on alternative forms of development. At the same time, these framings had been built as part of a hybrid alliance whose actors attributed different meanings to inclusion over time. During the first years there was a general consensus that inclusion needed to be framed as outcome, for instance in the form of income generation, and also as a process in terms of empowerment, capacity building and strengthening communication and learning through the network. However, as the network grew and new challenges of insertion into public policies were presented, this accord shifted over time.

As we have seen in the case of P1MC, when public institutions pushed for an increment of scale in the reapplication of technologies they faced tensions with civil society organizations and stakeholders in the field that resisted this reduced form of implementation. As Costa and Dias (2013, p. 237) pointed out, to scale up initiatives in a very short time risked harming the process of mobilization and disrupting the characteristics of social technology, transforming the original vision

into a much simpler scheme of ‘simple implementation’ of technologies. The issue of scaling up not only divided different interests and goals within the STN, but was also symptomatic of the difficulties in transforming incumbent elites within the state. This was a problem that ST advocates had envisioned from the beginning, and yet they struggled to find alternatives. Thus, like the larger tensions between commitments towards democratization and economic redistribution within the PT government, and public institutions, in the case of the STN, advocates were tempted to favour inclusion as an outcome over empowerment and participation through process. It was only when social movements and NGOs committed to the aim of inclusion as empowerment that they could resist the tendency to simplify the idea of inclusion.

Conclusions

Born at the beginning of the Lula administration, the STN carried many of the expectations and challenges of the new government about social inclusion and participation that were mixed with a long-standing practice of mobilization and a will to experiment with alternative models of development. The STN was in that sense an interesting example of hybrid networks that combined a new direction in public and semi-public institutions with the capacity of NGOs and social movements to translate new ideas and vision about technology and social development (Ely et al., 2013).

For a while, the STN was very successful in creating a large network of support and reapplication of technologies that tapped into new public resources. It also helped to create an alternative framing of sustainable development and social inclusion that highlighted the role of technology. As a result, social movements, NGOs and practitioners realized that they could also be part of the discussions about pathways of development, while at the same time experimenting with their own solutions. However, at the same time STN faced at least two challenges that have resulted from its very achievements.

The first challenge was related to the difficulties in widening the space for engagement with S&T mainstream institutions. After a decade of S&T and market-driven innovation, the STN again managed to place technology and participation on the agenda of development. This action helped to open up a new debate on the directions of S&T research and innovation. However, this movement was not enough to mobilize further support from public laboratories and universities beyond extension activities. Thus, the process of learning and tinkering with scientific knowledge was limited and remained marginal in relation to mainstream activities of S&T.

The second challenge points to internal tensions in the network and beyond in terms of mobilization and inclusion in public policies. As the STN grew and some of its projects gained visibility, differences between scaling up and empowerment also increased. Some projects, such as P1MC, resisted a reduced inclusion into public policies and gained more space as a result of mobilization. However, this

was not the case for the rest of the STN, where tensions between the plurality of civil society actors and the constraints of public policy eroded the structure of the network.

The suspension of the STN showed the difficulties and the limits of this kind of strategy and the problems that alternative grassroots innovation faces when dealing with mainstream institutions. Even with the support of powerful institutions within the government and a wide array of NGOs and social movements, the STN struggled to overcome these challenges. This difficulty highlights that the underlying differential of power between grassroots movements and incumbent elites in Brazil (and South America in general) is still huge.

And yet, despite these shortcomings, what the STN achieved is huge, not only in terms of reapplication of technologies but fundamentally by opening the space for a new debate on the democratization of technological development in at least two ways. First, by expanding the limits of social development to include the technological dimension, and second, by questioning pristine notions of conventional technological change and innovation and proposing social technology as a new agenda for science, technology and development. Overall, these ideas contributed to redrawing the debate about science, technology, democracy and development. Whether new social movements pick up the baton and develop these ideas further, only time will tell.

Notes

- 1 Some researchers involved with these early efforts were professors Renato Dagnino (UNICAMP), Paul Singer (University of São Paulo and then National Secretary for Solidarity Economy), Ladislau Dowbor (Catholic University of São Paulo), Jacqueline Rutkowski (Federal University of Ouro Preto) and Sidney Lianza (Federal University of Rio de Janeiro).
- 2 PT's strategy of including civil society organizations did not always work so well. Some initiatives sponsored by the government, such as the Economic and Social Development Council, were embraced eagerly at the beginning by civil society organizations, only for them to wonder later if this kind of space was suitable for their demands (Hochstetler, 2004).
- 3 The concept of solidarity economy includes issues in areas such as economic and solidarity relations, work economy and alternative economic arrangements in civil society. There is some consensus among groups and movements that a solidarity economy entails the search for economic alternatives to a full-fledged capitalist market economy.
- 4 Embrapa is linked to the Ministry of Agriculture and probably one of the bigger research institutions in Brazil.
- 5 As Baumgarten (2006) describes, the reconsideration of the role of the third sector, in particular NGOs, was already debated during the 1990s in Brazil and was included in White Paper on Science, Technology and Innovation (Ministério da Ciência e Tecnologia, 2002).
- 6 In its last annual report (RTS, 2011) funders included Caixa Econômica, BBE, Petrobras, FINEP, SEBRAE and four national ministries: Science and Technology, Social Development and Fight Against Hunger, National Integration, and Employment. The social organizations were the Semi-Arid Association, Abong, the Amazonia Task Group and Cerrado Network. Finally, the academy was represented by the Forum of Deans of Extension Activities at Public Universities in Brazil and communication was under the charge of the Secretary of Social Communication of the Republic.

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- 7 It is estimated that there may be as many as 10,000 PAIS units in eighteen states in Brazil (CIAAT, 2015).
- 8 See <http://dgp.cnpq.br>.
- 9 Mercosur refers to the community of nations of South America including Argentina, Brazil, Uruguay and Paraguay.
- 10 The law was proposed by Rodrigo Rollemberg of the Brazilian Socialist Party in 2008 in the Chamber of Representatives but was never approved. A second presentation was made, now in the Senate House, in 2011 but its approval was still pending at the time of writing.
- 11 For instance, the funding allocated to social inclusion in the Ministry of Science and Technology (where ST was included along with other programmes) was only 2 per cent of its budget (Brito Cruz and Chaimovich, 2010).