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Engineering platform cooperativism: Contributions from the Brazilian solidarity economy

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Abstract: This study explores how engineering can support productive collectives transitioning into platform cooperatives, focusing on Brazil's solidarity economy. Through a case study with the Landless Workers' Movement (MST), we analyse platform cooperativism in family farming, contextualised within Brazil's political-economic landscape. Although such initiatives often reflect capitalist platformisation trends, they also provide opportunities for alternative models rooted in cooperation and solidarity. The research employs action-research and grounded theory, analysing semi-structured interviews to identify recurring organisational and technical challenges. Findings reveal that conventional digital platforms – designed for market efficiency and hierarchical governance – hinder worker collectives by restricting participatory decision-making, collective agency, and the development of immaterial resources like trust and competence. The study engages in a dialogue across disciplines from software engineering and production engineering, each one contributing to the collective construction of the problem and its solutions. This interdisciplinary synergy facilitates a comprehensive understanding of the organisational and sociotechnical challenges these cooperatives face. Our analysis emphasises the need for technologies aligned with Solidarity Technology principles and Solidarity Economy values to strengthen collective autonomy and sustainability. However, it also points to persistent challenges that require broadening the perimeter of the problem. By integrating sociotechnical perspectives, engineering can foster more equitable economic models, offering contributions for Brazil and globally on overcoming platform cooperativism's challenges through cooperation-centred design.

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Introduction

The *platformisation of labour* (Scholz, 2017; Antunes, 2018; Pessanha, 2024) emerges as a new topic for debates about the organisation of associated labour. In Brazil, understanding these new dynamics, which have been accelerated by the Covid-19 pandemic, has become crucial for integrating solidarity economy initiatives into the market.

Workers, in dialogue with research and extension centres, have proposed initiatives to appropriate these technologies for worker-owned collectives, seeking market integration without sacrificing their core values of self-management, cooperation, and democratic governance. This article investigates this tension through a concrete case: an action-research project developing digital tools for platform cooperativism in partnership with the Landless Workers' Movement (MST), a project which was coordinated by one of the authors of this article. We ask a central question: How can engineering contribute to the development of digital platforms that strengthen, rather than undermine, the solidarity economy?

This debate echoes discussions about the need to incorporate the principles of *Solidarity Technology*¹ into the field of the Solidarity Economy (Dagnino, 2019). From

the technological conception stage, it is essential to embed values of self-management and solidarity, leveraging the cooperative advantages that can be generated. Nevertheless, the structural economic challenges of the collective organisations, the multiple crises of our time – stemming from structural impasses of contemporary capitalism – also force us to expand the perimeter of the problem, thinking beyond the borders of collective organisations, towards a transformation of the economic model in the territories where they operate.

The article is structured as follows. First, we outline the Brazilian Solidarity Economy debate, which provides the essential socio-economic context for our study. We then introduce the concept of Solidarity Technology, tracing its origins to the field of social studies of science and technology in Latin America and exploring its critical synergy with Solidarity Economy practices. Having established this theoretical foundation, we delve into our empirical case study, an analysis of the Sementes software. The subsequent section then confronts the central tension between Platform Cooperativism and the Digital Solidarity Economy, exploring the core dilemmas inherent in digitalising solidarity-based initiatives. The paper concludes by synthesising these insights and offering final reflections.

Solidarity economy in Brazil

Economist Paul Singer first coined the term *solidarity economy* in a 1996 article published in the journal *Teorias e Debates* by the Perseu Abramo Foundation. In the text, he proposed solutions to combat mass unemployment caused by neoliberal policies. The term “Economy of Solidarity” (*Economía de la Solidaridad*) had already been used by Chilean sociologist Luiz Razeto (2007), but with a different meaning – one focused on integrating solidarity into economic initiatives, even those under capitalist control.

Singer (2022) highlighted the self-managed organisation of the population into cooperatives, associations, and exchange clubs, emphasising the power of workers’ collective action. While such practices already existed – often under the broader umbrella of cooperativism – internal disputes and actors neglecting the appropriation of labour² demanded the establishment of a better-defined field. Studies on

1. We utilize the term “Solidarity Technology” in line with Alvear & Thiollent (2011), who justify their choice by stating that “*this concept has been developed in Latin America under the name Tecnología Social, which can be translated as Technology for Social Inclusion. We chose not to use the term Technology for Social Inclusion, as the term gives the connotation of charity, a technology geared just for the poor or socially excluded. Thus, we prefer to translate the term as Solidarity Technology, in reference to the Solidarity Economy, that is, a technology that is committed to the construction of another kind of society.*” (Alvear & Thiollent, 2011, pp. 8-9).

popular cooperativism³ focused on incorporating self-managed initiatives centered on self-management as their core principle. This shift led researchers to also examine informal practices – not necessarily structured as formal cooperatives.

As studies on the solidarity economy advanced, researchers and workers have driven practical initiatives that sparked a social movement. State Forums and the Brazilian Solidarity Economy Forum (FBES) were established, and the 2003 World Social Forum was used as a platform to coordinate this field nationally (Gaiger, 2004). Through coordinated efforts, the movement successfully pushed for the founding of the National Secretariat for the Solidarity Economy (SENAES) in 2003, operating within the federal Ministry of Labour and Employment.

Organised civil society actively contributed to structuring Brazil's solidarity economy, which now involves the collaboration between solidarity economy enterprises, support institutions, and government. At the federal level, municipal and state secretariats were incorporated into the national structure to advance the solidarity economy through public policies, technical support, and market access programmes. In Rio Grande do Sul State, the Workers Party administration of Olívia Dutra (1999–2003) implemented pioneering public policies for the solidarity economy. With this institutional architecture and active forums across all 27 Brazilian states and numerous municipalities, the solidarity economy achieved significant progress.

Two national surveys of the solidarity economy were conducted, identifying over 20,000 enterprises and more than one million individuals involved. However, according to the Latin American researcher Luiz Inácio Gaiger (2014), both the first National Survey (2005–2007) and the second (2009–2013) reveal significant gaps in knowledge about Brazil's solidarity economy. Gaiger argues that these studies simultaneously provide valuable empirical material to help address such shortcomings. Regarding the surveys, Gaiger (2014) contends that they challenge pre-conceived notions:

2. The rise of sham worker cooperatives, as an example, greatly distorted the sector's figures and generated extensive critique, further fueling skepticism toward cooperativism itself. As statistics fail to differentiate between legitimate cooperatives and sham ones, this responsibility has shifted to regulatory agencies.
3. The term *popular cooperativism* emerged to distinguish these practices, naming initiatives like the Popular Cooperatives' Technological Incubators and the Popular Cooperativism Forum—one of Brazil's first solidarity economy forums, founded in Rio de Janeiro.

(...) self-management and cooperation in these enterprises ensure their efficiency and viability without contradicting equity principles or members' expectations of well-being. This rule does not apply uniformly but correlates directly with the degree of success and survival of the enterprises. Thus, it establishes a standard whose observance in a representative number of cases provides decisive support for theories interpreting these practices as expressions of an alternative economy. (Gaiger, 2014, p. 19)

FINEP (Brazilian Innovation Agency) created the National Incubators Program (PRONINC), which helped establish over a hundred incubators linked to the UNITRABALHO network and the Technological Incubators of Popular Cooperatives (ITCPs). The latter, solidarity economy has become a transversal agenda in other ministries, such as the Ministry of Agrarian Development and the Ministry of Science and Technology.

The 2016 parliamentary coup in Brazil⁴ and the following political crises unfortunately dismantled the federal structure overseeing solidarity economy policies. After being downgraded to a sub-secretariat under the president Michel Temer administration, SENAES (National Secretariat for the Solidarity Economy) ceased to exist in 2019, when it was absorbed into the Secretariat of Urban Social and Productive Inclusion under the Ministry of Citizenship. In 2022, President Lula's electoral victory generated significant expectations for the revival of solidarity economy policies. Debates emerged about creating a presidential-level body, such as a special secretariat. However, the decision reinstated SENAES within the Ministry of Labor and Employment (MTE), now under Gilberto Carvalho's coordination.

After nearly 30 years of structuring the solidarity economy movement and over 20 years of public policies targeting the sector, we now face a significantly altered scenario, marked by profound transformations in capitalism's structure. During this period, Brazil has endured intense economic crises and a pandemic spanning over two years, which accelerated the adoption of digital platforms for commercializing goods and services.

The advancement of neoliberal agendas has driven the flexibilisation of labour rights, fostering new forms of labour precarisation. From this context, Big Tech companies took advantage of the situation to roll out new technologies, alongside

4. The term 'parliamentary coup' is used here to describe the impeachment of President Dilma Rousseff, which critics argue was a politically motivated process lacking legal grounds. See Santos, 2017; Singer, 2018.

a lobbying push to dismantle regulations that provided worker protections, offering immediate income-generation solutions to the unemployed population (Antunes, 2018).

For some authors, such as Pessanha (2024), the process now termed platformisation of labour bears similarities to Taylorism and Fordism, structurally transforming the capitalist organisation of work. Within this context, it is important to analyse how this shift impacts initiatives within the solidarity economy. Given that such experiences are characterised by scarce financial resources, how might they appropriate Information and Communication Technologies (ICTs), which remain largely dominated by capitalist enterprises? Or going forward, once this access is achieved, do these technologies align with the self-management principles pursued by these initiatives?

Solidarity Technology: A Latin American perspective of Appropriate Technology

Since the 1960s, the relationship between science and society has sparked growing academic interest. Building on philosopher Thomas Kuhn's (1962) work, critiques of the perceived neutrality of science and technology gave rise to the field known as Science, Technology, and Society (STS). However, from the 1970s–1980s, a technological turn emerged within STS, primarily in Europe and the United States, driven by scholars such as Bruno Latour and Steve Woolgar (1979), Langdon Winner (1980), Michel Callon (1984), Donald MacKenzie and Judy Wajcman (1985), and Wiebe Bijker, Thomas Hughes, and Trevor Pinch (1987).

A central element in STS is the critique of hegemonic views on the relationship between technology and development, conceptualised as the linear development model (Palacios, Galbarte & Bazzo, 2003). According to this naïve perspective, technology is seen as a driver of development, wealth, and social well-being. STS scholars began highlighting the social impacts of science and technology – sometimes unintentional, as in technologies that excluded people with disabilities, or deliberate, such as overpasses built to restrict access to public parks for Black and low-income communities (Winner, 1980).

Debates on negative social impacts expanded to critiques of technology transfer from developed to underdeveloped countries. From this discourse, the Appropriate Technology movement emerged, resisting dominant models of technological progress and advocating alternative development frameworks. Analysing this movement, Dagnino, Brandão, and Novaes (2004) criticise the colonial relationship

established when researchers from “first world” countries design low-cost technologies for “third world” countries⁵. For the authors, such technologies have proved inadequate because they were conceived in contexts vastly different from their intended use (Dagnino, 2004). Technology, they argue, must be developed *in situ* by the actors who will use it.

Latin American critiques of technology transfer processes underscored the non-neutrality of technological instruments. Studies on Latin American Thought on Science, Technology, and Society (PLACTS) (Auler & Delizoicov, 2015) further pursued alternative society models. Amílcar Oscar Herrera (1973), Jorge Sábato e Michael Mackenzie (1982), and Oscar Varsavsky (1976), led PLACTS studies to a national-developmental perspective, advocating for national science and technology policies committed with the welfare of Latin American communities.

In Brazil, the concept of Solidarity Technology (ST) gained traction through the Technological Incubators of Popular Cooperatives (ITCPs) – new university groups that began providing technological advisory services to solidarity economy enterprises. It is within this context that research and extension centres started re-examining the foundational principles of new technology development.

Scholarly foundations of this research argue that technologies must be constructed through socio-technical methodologies. Technologies, therefore, should result from the collective action and reflection of producers on a labour process shaped by socioeconomic contexts (fostering collective ownership of the means of production) and social agreements (which legitimise associative activity). These processes must enable (self-managed) control and cooperation, grounded in autonomy and participation. Crucially, such technologies must permit product modification and collective appropriation. Dagnino outlines elements distinguishing Solidarity Technology (ST) from Conventional or Capitalist Technology (CT):

TABLE 1: Comparison between CT and ST according to Dagnino (2004)

CONVENTIONAL TECHNOLOGY (CT)	SOLIDARITY TECHNOLOGY (ST)
Segmented: does not permit control by the direct producer;	<i>Geared towards collective management or promoting collective control;</i>
Maximises productivity in relation to the use of labour (it saves labour more than might otherwise be	Adapted to small physical and financial units;

5. The terms “first world” and “third world” are retained as per the original text. Contemporary scholarship, otherwise, often replaces these with “Global North” and “Global South” to avoid hierarchical connotations.

CONVENTIONAL TECHNOLOGY (CT)	SOLIDARITY TECHNOLOGY (ST)
necessary);	
Alienating: does not use the potential of the direct producer (the pace of production is given by the machines).	Frees the direct producer's creativity and potential;
Has patterns responding to the high income external market;	Oriented to the mass internal market;
Monopolised by big companies in rich countries (has an always-growing scale of production);	Capable of making self-administrated projects and small businesses economically feasible.
Within a hierarchy: demands the image of the owner, the boss, etc. (has coercive controls which reduce productivity).	Non-discriminating (boss vs. employee).
Environmentally unsustainable (intensive in synthetic inputs).	<i>Use of local raw material in a sustainable way;</i>

Dagnino (2004) also outlines seven modalities of the Socio-Technical process. These modalities, rooted in a Marxist and emancipatory framework, reflect a continuum from incremental adaptations to transformative innovations, emphasising that technology must be shaped by – and reshapable for – social relations. The modalities include: (1) adjusted use, modifying the operation of existing technologies for collective contexts; (2) technical reconfiguration, such as altering machinery to enable self-managed control; (3) repurposing, to readapt underutilised tools for social purposes; (4) hybridisation, such as combining technical and traditional knowledge; (5) incremental innovation, as on adjusting productive processes to prioritise cooperation; (6) participatory development, involving users in technological creation; and (7) radical reinvention, enabling the creation of technologies based on solidarity principles.

Andrew Feenberg's Critical Theory of Technology (1991, 1995, 1999, 2002) also enabled the integration of new perspectives into the Solidarity Technology (ST) concept. Celso Alvear and Michel Thiollent (2011) analyse ST through a concrete case of information technology development for a community movement. From a policy-oriented perspective, Felipe Addor and Aline Mendonça Santos (2022) examine ST as a contested field within public science and technology policies. Bocayuva and Varanda (2009) and Fraga (2011) explore ST's relationship with the solidarity economy and self-management. Souza and Pozzebon (2020) analyse ST's role in profound social transformations.

Varella (2023) explores in a critical perspective the TS approach, employing mainly

the Simondon's theoretical framework (2020) to argue that the social relations, the social form of technique and the core of the technique itself interrelate in a complex and always situated manner, giving rise to the 'social form of technology'. This would be what defines, in the end, for example, the possibility for worker's control, even in the case of seemingly Conventional Technology, such as a conveyor belt. Expanding ST perspectives, Vasconcellos (2023) reinterprets ST through a gender lens, while Saldanha et al. (2024) build dialogues between ST and decoloniality. Finally, many Latin American authors reflect on ST within their national contexts (Cejás et al., 2018; Guerrón, 2022; Thomas, 2009).

Notably, since 2003, ST has been integrated into multiple Brazilian public policies. During this process, the *Rede de Tecnologia Social - RTS* (Solidarity Technology Network) was established, uniting government bodies, companies, NGOs, universities, and others, expanding the concept to include heterogeneous initiatives unrelated to solidarity economy. Thus, ST was defined as "technologies comprising 'replicable products, techniques, or methodologies, developed in interaction with communities, that represent effective solutions for social transformation'" (FBB, 2021, p. 1).

Within this context, the National Meeting of Engineering and Social Development was created. Since 2004, this annual event brings together university groups engaged in technological outreach for social movements – such as ITCPs – in order to integrate university extension, solidarity economy, and ST. In 2014, these groups formed the Oswaldo Sevá Popular Engineering Network (REPOS) (Fraga, Alvear, & Cruz, 2020). It develops and exchanges methodologies for engineering-led technical advisory services to solidarity enterprises nationwide, grounded in the ST concept.

Mirroring the fate of the Solidarity Economy, public policies for Social Technology were effectively dismantled in the wake of the 2016 parliamentary coup. With the election of Lula in 2023, a Department of ST was established under the Ministry of Science and Technology, and the *Brazilian Association for Teaching, Research, and Extension in Solidarity Technology* (*Associação Brasileira para o Ensino, Pesquisa e Extensão em Tecnologia Social – ABEPETS*) was created. Former RTS articulations are being restructured to support new public policies for the solidarity economy.

Sementes: Platform cooperativism initiatives in the Landless Workers' Movement (MST)

The attempt to reconcile the agendas of the Solidarity Economy and Social Technology fields has always encountered barriers and the practice of working with

grassroots experiences has allowed some of these barriers to be identified. Based on the report of an extension project developed by the Technical Solidarity Center of the Federal University of Rio de Janeiro (SOLTEC/UFRJ), which is linked to ABEPETS, we seek to highlight the challenges of the process of building a digital platform for using and marketing the production of rural workers.

SOLTEC is an interdisciplinary lab founded in 2003 at UFRJ's Production Engineering Department, focusing on technological extension, solidarity economy, and solidarity technology. It currently runs 11 extension projects developing technologies for social movements. *Sementes* – our case study on Solidarity Technology-Solidarity Economy articulation – is part of the *Information and Communication Technologies, Democracy, and Social Movements (TICDEMOS)* project, which since 2018 has created e-commerce systems for family farming collectives of the Landless Rural Workers' Movement (MST).

MST and the *Armazém do Campo* strategy

Founded in 1984, MST operates in 24 Brazilian states, advocating agrarian reform, land rights, and healthy food production. Its activism has settled ~450,000 families. Its main strategy is Popular Agrarian Reform, implemented through occupations of unproductive land (public or private) that does not fulfil its social function, as well as mobilisations such as marches and protests (Miranda, 2023).

To enable settlement production, MST organises families into agricultural cooperatives, associations, and agro-industries. Collective structures like Agricultural Production Cooperatives (CPAs) allow resource/knowledge sharing, strengthening family farming and agroecology. Cooperation helps overcome commercialisation challenges, combat agro-industrialisation, generate income, and improve settlers' quality of life.

In order to guarantee a fair market for its products, the MST created the *Armazém do Campo* stores: points for marketing agro-ecological food produced by cooperatives in the territories of the settlements. Located in 14 Brazilian states, the 31 stores opened not only help to sell the produce, but also contribute to the visibility of the struggle for agrarian reform. In the city of Rio de Janeiro, the store was inaugurated in 2018, functioning as a point of sale and as a political space, bringing rural producers and urban consumers closer together.

During COVID-19, stores closed, and MST adopted digital platforms for sales. However, e-commerce posed new challenges for workers managing sales systems. In 2021, SOLTEC was tasked (via parliamentary amendment funding) with developing

an e-commerce system tailored to MST Rio de Janeiro 's *Armazém do Campo*.

The evaluation carried out by the TICDEMOS project team found that many of the challenges faced by MSTs were similar to those faced by other small commercial enterprises. However, the producers' cooperatives in the settlements had alternative forms of economy and work organisation, based on strategies specific to MSTs. In this sense, the problems of *Armazém do Campo* went beyond the operational dimension (logistics, sales, inventory) and extended to the construction of service relationships of a different nature – where digitalisation poses dilemmas that are central to this article.

Digitalisation in *Armazém do Campo*: Between accessibility gains and weakened bonds

Workers operating *Armazém do Campo* face multiple challenges, many common to small commercial ventures. However, embedded in alternative economic/organisational forms with strong political dimensions, the stores confront issues transcending operations, overflowing into the construction of relationships and links of a different nature between the people who operate and access the space, its goods and services. And in this construction, digitalization brings out dilemmas.

For the research conducted at *Armazém do Campo* in Belo Horizonte, we employed Grounded Theory (GT) as our methodological framework. Data were gathered through semi-structured interviews, utilising a guide designed to explore activities mediated by the digital platforms integral to the enterprise's operations. We processed the qualitative data by applying GT techniques, including coding – defined as the process of analysing and cross-referencing collected data with the emergent theory (Tarozzi, 2020). This was conducted at multiple levels: initial, focused, and theoretical coding. From this process, intermediate categories emerged, and the core category, “digitalization dilemmas: between market efficiency and co-operation” was identified to guide the subsequent analysis.

Interviews with *Armazém do Campo* workers in Belo Horizonte (here anonymised as P. and AC.) clarify these problems from their daily perspectives. In order to understand them in all their complexity, we can start by understanding the *Armazéns do Campo* as devices that materialise a double strategy of the MST: 1) the first as a space for the permanent commercialisation of the products of the movement's settlements and cooperatives within the cities; and 2) the second as a space for ideological debate, mainly focused on the struggle for popular agrarian reform, by allowing a more concrete perception of this political agenda by the city's inhabi-

tants. The agrarian reform is thus materialised in the products sold and the service relationships established within the framework of the Armazéns. Although these are two different elements of the overall strategy, each with its own problems, in practice they are intertwined and integrated, reinforcing (or weakening) each other.

The ideological strategy manifests in practical decision-making criteria. For example, “fostering collective organization”, as a strategic criterion, influences external partnerships: priority goes to agrarian reform products, but partnerships with other collectives exist. Partnerships with individual producers are an exception, and even when they do happen, one of the criteria generally adopted is that, in addition to organic or agroecological production, the individual producer must also be part of a social movement. However, in operationalizing digital sales (e.g., deliveries), stores struggle to meet the “collective organization” criterion, often resorting to precarious labour (e.g., app-based delivery workers).

Another guiding principle derived from the “ideological dispute” strategy is the promotion of agrarian reform itself, which, while on the one hand has the potential to be materialised in bringing customers and producers closer together through agrarian reform products, on the other hand is also strongly promoted through the cultural front. This front organises and holds events and parties at the Warehouses to promote meetings between supporters and sympathizers of the movement. These events, in turn, usually make a big contribution to the rentability of the spaces.

The commercial dimension of the strategy (“*Armazéns* as a permanent marketing space”) stems from the difficulty of marketing agrarian reform products in the country, and the consequent commitment to creating fixed points to support this marketing. The idea is that this marketing at fixed points will contribute to strengthening and improving the living conditions of producers.

The use of digital marketing platforms by the *Armazéns* arises from a need linked especially to this last strategic dimension. It is based on the idea of increasing accessibility to products and increasing sales volume, which would lead to an increase in revenue from the operation of the stores and, consequently, an increase in income for the producers at the end. However, at *Armazéns do Campo*, coffee is not just coffee, rice is not just rice. Each product carries with it a story of resistance – “*this honey comes from the bees raised in settlement X, conquered after years of struggle*”, “*these bananas are harvested by families who live where there used to be a latifundium*”. This narrative, so organically woven at the counter of the physical

store, encounters obstacles when it migrates to digital platforms.

P. describes the dilemma:

"In person, we can tell them that the chocolate comes from Bahia, from agroforestry cacao. On WhatsApp, the customer just asks: 'Got cheese bread? Price?'"

The team finds itself trapped between the need to sell more - to strengthen the cooperatives and producers settled under agrarian reform – and the risk of emptying the political meaning of consumption. In the same vein, AC. points out:

"We have 424 catalog items. How to explain each one's origin via message? In person, we see when clients connect with the story."

Technical limitations (inventory synchronisation, complex catalog presentation, multi-channel online sales integration, perishable product on-demand offers) reveal only part of the problem. WhatsApp (Belo Horizonte's main digital sales channel mentioned in the interviews) proves hostile to bond-building: lost messages (*"sometimes the person sends in the morning and we don't reply until the afternoon"*), outdated catalogs (*"the customer asks for three things we don't have"*) and the impossibility of conveying political enthusiasm (*"how do you put into words the importance of the cooperative that made this cheese?"*) frustrate both staff and customers. The website, which is expensive and difficult to manage, reduces the richness of the products to empty tags like "organic" or "from the MST", with no space for the stories that give these labels meaning.

Longtime store clients (mostly over 40, many decades-long MST supporters) suffer most from this transition. P. notes:

"There are customers who have been coming every week for years, (...) They want to know about Dona Maria, from settlement Y, not just the price of beans."

Digitally, these relationships fray. AC. explains:

"In person, we almost become family to some customers. Online, we're just a WhatsApp profile that sometimes takes a while to respond."

The tension revealed in the interviews goes beyond operational problems – it calls into question the very identity of Armazéns do Campo. How can the political-pedagogical character of the enterprise be maintained when digital platforms impose fast, fragmented and depoliticised interaction logics? The challenge that emerges is not to abandon technology, but to reinvent it: to create tools that don't just sell products, but that, as the collaborative meetings (Manzini, 2017) at the physical counters do so well, transform every purchase into a political act and every beneficiary into an ally. In this sense, the development of digital tools based on Solidarity Technology can address some of these challenges, while others remain. In the next section, we present the experience of developing "Sementes" in order to provide an empirical basis for this discussion.

Sementes: A development approach based on Solidarity Technology

Developed in 2022 and 2023, Sementes is a tool designed to manage the marketing cycles of perishable products. It is a plugin for the WordPress website management system, which works as an extension, adding new functionalities to the WooCommerce store management system.

To develop this software, combined methodologies were used. Since its inception, SOLTEC has employed *action research* – a participatory methodology for knowledge co-creation with social actors through concrete action (Thiollent, 1986). Action research, according to Thiollent (1986, p. 14), is “a type of empirical social research associated with action or the resolution of a collective problem, in which researchers and representative participants of the situation or problem are involved in a cooperative or participatory manner”⁶. In the case of Rio de Janeiro's *Armazém do Campo*, undergraduate students, master's and doctoral students helped to better understand the movement's problems and demands through their research. Participatory Design, which involves social actors throughout the design process (Schuler & Namioka, 1993), was used to raise the system's requirements, involving the Armazém workers, the MST leadership and the consumers and users of the old site.

Code development followed *Agile Methods* – a software engineering perspective fostering user-developer dialogue through rapid functional deliveries (Highsmith,

6. Translated from Portuguese by the author. Original: “a pesquisa-ação é um tipo de pesquisa social com base empírica que é concebida e realizada em estreita associação com uma ação ou com a resolução de um problema coletivo e no qual os pesquisadores e os participantes representativos da situação ou do problema estão envolvidos de modo cooperativo ou participativo” (Thiollent, 1986, p. 14).

2001), allowing demanders to test and evaluate progress. As noted earlier, participatory methodologies are crucial for Solidarity Technology development. In a study on technology and participation in the construction of collective proposals for social movements and local development, Alvear (2014) demonstrates how important these methodologies are for the learning, appropriation and collective management of digital technologies. Participation in the specification and design stages was therefore part of the system development process.

Another key element was interdisciplinarity. The software was developed through a long-term partnership between SOLTEC/UFRJ and the cooperative *Education, Information, Technology, and Self-Management (EITA)*, which also partners closely with MST. SOLTEC's coordination/development team included a computer engineer (with production engineering MA/PhD), a PhD candidate in anthropology and students in computing, design, communication, and arts. EITA participants included a computer engineer and a designer.

EITA, founded in 2011, develops technologies with social movements/popular organisations. It has created websites/e-commerce systems for MST cooperatives and maintains the movement's website. EITA's experience with technologies for solidarity economy commercialization informed *Sementes'* socio-technical development.

Participant observation also clarified production/sales processes. The agroecological product/basket commercialization cycle involves:

1. Requesting available products from farmers for harvest/sale
2. Inputting lists into the site's inventory
3. Opening the site for orders
4. Downloading/sending order reports to farmers
5. Delivering orders, managing payments, paying farmers
6. Zeroing perishable product inventories

As well as being suitable for this process, the system should also be easy to learn and handle, with a graphical interface that would make it easy to use for laypeople with little familiarity with computer systems.

The technology was developed in Free/Libre Open Source Software, with an open code, so that other people can use, study, change and share the system for free (SILVEIRA, 2004). This feature allows the system to be adapted to other demands or contexts more easily and at lower cost. The plugin adds a panel to the system to help manage the marketing stages, making it easier for the workers responsible

for this stage of the process to operate the online store.

The main adjustment was to break away from the pattern of conventional stores, which operate on a 24/7 basis and therefore complicate the management of stock that is shared with physical stores. The layout of the site was adjusted to highlight farming families - who are a central element of agroecology – and production collectives or cooperatives – central elements for the MST and the Solidarity Economy. Finally, one of the elements that was not developed at the time was the possibility for farmers themselves to enter their production directly into the system and see specific reports on the sale of their products.

It is important to note that the movement has its own coordination structures and therefore the workers who manage the tool are in constant dialogue with the coordinator of the movement's production collective. The coordinators are responsible for drawing up the lists of products to be offered by each family. Recently, the plugin was updated to include features that are adapted to more horizontally distributed organisational processes of other agroecological basket marketing collectives. We call this version "Sementes - Cooperativismo de Plataformas"⁷.

The implementation of the new Armzem website with the Sementes plugin brought significant operational and communication improvements. The website was very well-received by users, who considered it superior to the previous one, and it achieved its primary internal objective: to drastically facilitate the management of orders and the organisation of deliveries for the workers at the Armazém. This reduced the operational workload, allowing the team to dedicate more time to the project's core mission of promoting Agrarian Reform, Agroecology, and Family Farming (Alvear et al, 2024).

One of the most notable outcomes was the creation of the "Produtoras" (Female Producers) section, which gave prominence to cooperatives, settlements, and family farmers. This educational space aimed to inform the consumer about the production process behind the goods and the journey of these actors within the agrarian reform, strengthening the link between producer and consumer. The initiative was a communicative success, highlighting the movement's struggle and work (Alvear et al, 2024).

Financially, the project had a positive impact on sales. In the very first sales cycle after implementation, revenue increased by 38% compared to the same period the

7. The code for this version is available at: <https://gitlab.com/ticdemos/sementes-ticdemos>

previous month. An analysis of the period from September 2021 to July 2022 showed a stabilisation at consistent levels, with an average monthly revenue of between R\$15,000 and R\$20,000, approximately 100 to 120 orders, and 1,200 products sold per month. The number of registered users also saw significant growth, indicating an expanding customer base and solidifying the website's role as a crucial instrument for the commercialisation of goods from the settlements (Gonçales & Alvear, 2024).

The Sementes solidarity technology has been facilitating the collective management of the marketing tools of five responsible consumption groups, located in the states of Rio Grande do Sul, Pará, Goiás and Minas Gerais; and two Armazém do Campo stores, located in Paraná and the Federal District. As we have seen, by using the Solidarity Technology approach for its development, it has managed to make progress on important issues related to socio-technical adequacy, especially with regard to the usability of the tool by producers and customers. Nonetheless, other challenges presented earlier remain, requiring an expansion of the perimeter of the problem. We'll move on to this discussion in the next section.

Platform cooperativism or Digital Solidarity Economy?

When social studies in science and technology began to identify the influence that conventional technologies had on ways of organising work, initiatives to incubate solidarity enterprises and social technology gained momentum.

Self-management, however, faces the challenge of coexisting with the cultural heritage of capitalism. In a publication celebrating the results of the activities carried out by RTS between 2006 and 2009 through an agreement with the public agency Financiária de Estudos e Projetos (FINEP), the group of researchers involved in the activities of ITCPs recognises that the incubation process deals with the dispute between the strategies of networks and the vertical flows of large corporations.

This challenge led to the creation of the Technological Incubators of Popular Cooperatives (ITCPs), also known as Solidarity Economy Incubators (IES). Linked to educational institutions, in addition to building technologies suited to the reality of popular and self-managed groups, the incubators also carry out training and support activities. The pedagogical nature of the methodologies used by the incubators is also present in SOLTEC's and *Alter-Nativas de Produção*'s university extension initiatives.

But despite the lessons learned, the importance of digital technologies for the

marketing activities of solidarity enterprises still leaves many questions open. How can we develop technologies that incorporate the notion of self-management and decent work as central elements? The emergence of a new field within the solidarity economy, as a result of the process of platformisation of work, is a strong evocation of this debate.

In 2016, researcher Trebor Scholz released a book called *Platform Cooperativism*, in an attempt to characterise the experiences of workers who use digital platforms to develop collective work initiatives (Scholz, 2016). The concept gained prominence and became the subject of a broad debate on the future of cooperative initiatives. The issue has revived in Brazil the old debate mentioned in the first section of this article, related to disputes in the field of cooperativism. The Organization of Brazilian Cooperatives – OCB (corporate cooperatives) and the cooperatives of the solidarity economy movement (popular cooperatives) have once again disputed the public debate on the fate of cooperative (and associative) practices. One of the main focuses of the debate is care over the production and marketing process, now mediated by the use of digital platforms.

This is a very recent phenomenon and we are still unclear about the scope of this field in Brazil. If the platformisation of work is a strong trend in contemporary capitalism, is this just one sector or is there a tendency to encompass all associative experiences?

More recent debates characterise this field of research with different concepts that try to distinguish solidarity practices from those linked to the OCB. Zanatta (2024) proposes the concept of “*solidarity platformization*”, considering the accumulation achieved around the Solidarity Economy in Brazil and that most initiatives are not formalised as cooperatives. In a recent publication involving some researchers in this field, Grohmann (2025) uses the term “*Digital Solidarity Economy*”. The concept designates a new field which, in the face of technological changes, proposes an ecosystem of cooperation for the transition of solidarity economy initiatives to the digital environment.

However, beyond these epistemological disputes, we believe that the field still faces a challenge that has not been addressed in these debates. *How can the political-pedagogical character of associative experiences be maintained when digital platforms impose fast, fragmented and depoliticised interaction logics?* We now analyze this question deeper.

Dilemmas of digitalisation for another economy

The adoption of digital tools in marketing spaces linked to social movements brings out a fundamental contradiction: the same technologies that expand commercial reach can erode the very human bonds that give political meaning to these ventures. While face-to-face service enables organic narrations around products – where each item carries the story of its collective production and struggle – digital interactions tend to be reduced to functional transactions, emptied of their transformative potential (Han, 2017). This tension is evident when we compare the richness of the dialog at the physical counter (*"this rice comes from cooperative Z, the result of the 1998 occupation"*) with the coldness of WhatsApp messages (*"do you have stock? what's the price?"*).

Digital communication, with its standardised architecture, produces a paradox: it increases the number of interactions while decreasing their political depth. Platforms such as WhatsApp and e-commerce operate under a logic of efficiency that does not include the temporalities necessary for building political awareness – the slow rhythms of explanation, active listening and the formation of bonds (Tufekci, 2017). At Armazéns do Campo in Belo Horizonte, this manifests itself when the team, limited by the standardised architecture and overwhelmed by the simultaneous management of multiple channels, finds itself unable to reproduce the quality of face-to-face interactions online, especially with the older public, which constitutes an important base of support for the movement.

The narrative crisis in digital spaces becomes particularly acute when we observe how platforms fragment and simplify stories of resistance (Han, 2019). What in person is a rich conversation about the trajectory of a settlement, in digital is reduced to a tag *"produced by the MST"* or isolated posts on social networks. This loss of context and narrative continuity weakens precisely what distinguishes these organisations: their ability to turn every purchase into a conscious political act, not mere consumption (Han, 2018). Technology, which could amplify voices, ends up domesticating radical discourses by framing them in standardized formats.

Armazém do Campo's experience reflects broader challenges observed in social movements around the world: as observed during the Arab Spring, there is a real risk that dependence on corporate platforms will end up mischaracterizing radical struggles, turning them into palatable versions of themselves (Tufekci, 2017). When militancy is forced to adapt to the rules of social media – with its emphasis on the instant, the visual and the simplified – it loses the ability to build the complex narratives that fuel structural change.

The challenge is therefore not one of technological rejection, but of strategic re-orientation: to think beyond ‘technological innovations’ towards ‘socio-technical innovations’ and ‘institutional innovations’. As international experiences of successful digital activism show, the way out lies in subverting the logic of the platforms – using them not as ends in themselves, but as tools to reconnect people and reinforce narratives (Tufekci, 2017). But to do this, we need to broaden the perimeter of the problem and recognise that digital technologies themselves can be, at most, only part of the solution.

This broader solution will depend crucially on a transformation of the economic model of collective organisations, which must not be confined to their own boundaries, but must expand towards the construction of a complex system of territorial actors engaged in the search for a (healthier and more emancipatory) social food space. The maintenance of these ecosystems, in turn, depends on the construction of an extended governance, based on devices of listening and reflexivity, which fulfils at least two functions: 1) it allows operators to socialise the constraints of working on the integrated solution that is being co-constructed; and 2) it allows beneficiaries to socialise the ways of life and constraints they face in order to make the co-production of the service viable (Souza, 2021; Xavier et al., 2024). This allows the development of key intangible resources, such as competence, trust, relevance and health, which in turn can boost the dynamics of cooperation and make territorial solutions more effective and meaningful.

Final remarks

This article invites reflection on how engineering and the social sciences can collaborate in the creation of technologies that serve collective interests, in dialogue with the principles of the solidarity economy. The road ahead is not simple, but the experiences analysed here offer contributions for those seeking to build a more cooperative and emancipatory digital economy.

The concrete objective of the extension project presented was to improve the living conditions of rural workers by building digital systems that facilitate the process of planning production and marketing their products. It illustrates how Solidarity Technology can contribute to the creation of digital tools that respect the principles of self-management and cooperation, avoiding the reproduction of the precariousness and control logics of the big platforms.

However, during the development process and the evaluation of the results achieved, we observed the importance of consolidating a cooperative ecosystem

for the success of solidarity ventures. This ecosystem involves establishing new habits among consumers, who become beneficiaries, co-producing the service and co-constructing the solution, factors that go beyond the boundaries of the organisation of the solidarity ventures themselves. This approach broadens the scope of action, encouraging the co-production of solutions adapted to local needs and shared governance between different actors. However, the effectiveness of these initiatives depends on overcoming structural challenges, such as dependence on corporate platforms and the fragmentation imposed by digital interactions.

We observed that solidarity enterprises face challenges when trying to adapt their organisational dynamics to the conventional technologies available on the market. In this sense, digital platforms reproduce logics that not only interfere in the ways workers organise themselves, but also in the population's consumer relations. This highlights the active role of technological devices in the dynamics that characterise society's current organisational models.

Platform cooperativism and the digital solidarity economy represent disputed fields where technological autonomy and critical appropriation of digital tools are central. With regard to the Solidarity Economy and Social Technology agendas, the accumulated experience of the institutions that have been mentioned here as promoters of the solidarity economy also allows us to present institutional barriers. The first concerns the difficulty of identifying solidarity technologies that are part of the extensive diversity of experiences in the solidarity economy (artisans, farmers, among others). The second is the lack of understanding on the part of the state and representative organisations of the importance of incorporating technologies that are properly suited to the organisation of productive activities and the management of solidarity enterprises. The lack of public policies for the distribution and redistribution of financial resources aimed at the development of science and technology, of a popular and solidarity nature, is also a fact that limits the realisation of projects for the solidarity economy.

Finally, we stress the urgency of broadening the debate and practical actions around platform cooperativism and the digital solidarity economy, integrating them into a broader agenda for social transformation. Digital solidarity is not an end in itself, but a means to reimagine and rebuild economic relations on a more democratic and sustainable basis. For *Armazéns do Campo*, this would mean developing technologies that do not reproduce the coldness of conventional e-commerce, but which make it possible not to lose the warm politicality of the physical counter – where each product remains, above all, part of an invitation to cooperation.

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