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Analysis of the collaborative innovation network in agri-food systems: an All4Food case study

ABSTRACT – This study aims to investigate how a collaborative network is shaped and its effects on the innovation system. Theoretical approaches to networks and resources guided a case study on All4Food, a multi-actors network in the Brazilian agri-food innovation system. The results suggest that the prior personal relationship motivated the network design with the purpose of connecting stakeholders of the agri-food sector for sustainable innovative solutions. The network expansion was supported by the governance and organized into a set of coordinators and an advisory board. The network's diversity and size imply challenges in the network management. Complementary human and knowledge resources of actors resulted in intangible (collective knowledge, trust, reciprocity, and industry articulation) and tangible network resources (governance structure, platform for matchmaking, agenda and strategic plan). The network provided positive externalities for the innovation system, such as matchmaking and forum events, research agenda, and projects for co-creation, diffusion of knowledge and capacity building. This article is justified by the methodological-empirical contribution that the network has provided to important topics, such as innovation, food loss and waste, and sustainability.

Index terms: network, relationships, resources, sustainability.

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Análise da rede colaborativa de inovação em sistemas agroalimentares: um estudo de caso do All4Food

RESUMO – Este estudo tem como objetivo investigar como se configura uma rede colaborativa e seus efeitos no sistema de inovação. As abordagens teóricas de redes e recursos orientaram um estudo de caso sobre o All4Food, uma rede multiatores no sistema brasileiro de inovação agroalimentar. Os resultados sugerem que o relacionamento pessoal prévio motivou a concepção da rede com o propósito de conectar os stakeholders do setor agroalimentar para soluções inovadoras sustentáveis. A expansão da rede foi apoiada pela governança e organizada em um conjunto de coordenadores e um conselho consultivo. A diversidade e o tamanho da rede implicam desafios na sua gestão. Os recursos humanos e de conhecimento complementares dos atores resultaram em recursos intangíveis da rede (conhecimento coletivo, confiança, reciprocidade e articulação da indústria) e tangíveis (estrutura de governança, plataforma de matchmaking, agenda e plano estratégico). A experiência proporcionou externalidades positivas para o sistema de inovação, como eventos de matchmaking e fórum, agenda de pesquisa, e projetos de cocriação, difusão de conhecimento e capacitação. Justifica-se

este artigo pela contribuição metodológica-empírica que a rede tem realizado em temas importantes, como inovação, perdas e desperdícios de alimentos, e sustentabilidade.

Termos para indexação: rede, relacionamentos, recursos, sustentabilidade.

INTRODUCTION

The search for more sustainable supply chains to contain global warming, associated with the global health crisis caused by COVID-19, has led institutions and organizations to rethink their strategies and alliances, as well as ways to produce, distribute, and consume food and beverages. These factors demand solutions for new connections to accelerate innovation in favor of sustainable development. Furthermore, movements and standards related to the environment, social and governance concept in companies and production systems, motivated by the commitment to FAO's sustainable development objectives, tend to focus on inter and intra-organizational economic, social and environmental actions.

The contemporary paradigm involves collective actions in a network in which agents collaborate to obtain joint gains (Paulillo et al., 2016). In the context of innovation systems, networks are of particular importance, as the formation and interaction of networks in a specific technological field influences the development and diffusion of innovative solutions (Markard & Truffer, 2008; Oh et al., 2016). This article contributes to these notions in the context of food and network movements aimed at sustainability and innovation.

From the perspective of sociology and organization theory, network analysis captures the interactions between individuals, groups, organizations, institutions, and so on. Granovetter (2005) argues that social relationships, rather than institutional devices or generalized morality, are the main factors responsible for building trust. Individuals are linked to multiple networks governed by economic and noneconomic principles that influence their actions in different ways. From this perspective, networks make it possible to investigate the relational contexts in which actors are inserted: individuals, families, groups, and organizations. Shin (2022), for example, analyzed friendship networks and trust as a relational quality propagating refugee integration, and Gielfi et al. (2017) analyzed collaborative research networks in the petroleum industry in Brazil between universities and industry.

However, how exactly is the design and organization of the collaborative network in the agri-food innovation system, and its effects on the system? A phenomenon of theoretical interest is the investigation of the process of intentionally building a network and its implications for the innovation system. Despite the growing number of studies, there is potential to be explored in the formation of networks and their role for collective actions and the construction of innovation systems (Musiolik et al., 2012).

The development of technological solutions requires different actors with complementary expertise, knowledge and resources. In this sense, innovation processes can also be observed using the triple, quadruple and quintuple helix approach. In the first one, the contributory spheres are recognized by the industry, the academia and the government. From 1990 onwards, divergences arose regarding the incorporation of elements such as democracy (the advancement of knowledge and innovation, requiring a co-evolution of democracy or knowledge democracy) and ecology, ecological sensitivity and environmental protection as a necessity for the survival of humanity. There would be multiple implications for strategy, policy and practice, and aspects of Industry 5.0 and Society 5.0 would also be incorporated (Marostica et al., 2021; Carayannis et al., 2022).

Due to the fact that studies that explore how networks of actors are formed and managed and their influence on innovation systems are still incipient (Söderholm et al., 2019), this

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study explored this topic. The empirical analysis is based on a construction in progress: the All4Food network, born in 2020, as a pioneering and genuine initiative in the Brazilian agri-food innovation system, characterized as a polycentric, interdisciplinary, and multi-stakeholder network. By enriching active and collaborative connections between the academy and multiple stakeholders, the All4Food network seeks to facilitate and accelerate the development of technical-scientific multidimensional solutions aligned with the Sustainable Development Goals (SDGs) – in this regard, SDG 17, as it includes aspects of food security and agriculture, energy, water and sanitation, sustainable production and consumption patterns, climate change, and protection and sustainable use of resources. In addition to the elements covered at the beginning of this section, this article is justified by the methodological empirical contribution that the network has made to important topics, such as food loss and waste, and sustainability.

Therefore, this study aims to research and evaluate the process of ideation and organization of the collaborative network in the agri-food innovation system and its effects on the system, under the approach of network and resources. The structuring of the analysis involves two central questions: the origin and main characteristics of the network and its impacts on the agri-food innovation system in Brazil. The next section presents the theoretical contributions of social networks and their relationship with resources. The third section highlights the methods used in the research, presenting the results, discussions, and conclusions in sequence.

THEORETICAL APPROACH

Innovative solutions for the sustainable production, supply, and consumption of food require collective action. Actors and institutions are the key elements of the agri-food innovation system. Actors include different kinds of entities (such as food producers, food industry, universities and research institutes, financiers, consultants, associations, startups, and other facilitators with different competencies, resources, and strategies). Institutions refer to norms, standards, regulations, culture, and values that can facilitate or constrain the decisions and activities of actors – in consonance with North (1991) and Chesbrough (2024). Networks play a key role in the agri-food system because they enable actors to coordinate their strategies and organize collective action. By examining the processes through which networks are intentionally created, strategies can be provided to contribute to agri-food system performance and sustainability.

The seminal research by Polanyi (1944, 1957) argued that the relationships or affinities between individuals precede and determine economic exchanges. Economic relationships are embedded in social networks that are built between individuals. The author introduced the concept of “embeddedness”, which would be later developed by Granovetter (1985) to explain how social relationships affect economic behavior. Recently, Wasserman & Faust (1994) defined a network as an entity consisting of a collection of actors and their linkages. Actors are discrete, individual, firms, or collective social units. The network structural environment can provide positive externalities for a collective and can be framed as bundles of resources that are made available by network members or that emerge in the network. The relational ties between actors are channels for the flow of resources and for the generation of new resources.

Following the approach of tangible and intangible resources at the firm level (Barney, 1991; Hall, 1992), Lavie (2006, 2008) proposes that the resource concept can also be applied to higher levels of aggregation, including inter-firm networks. The author argues that strategically relevant assets can also be produced beyond a firm’s boundaries. In networks, firms can

access resources from their partners and those that emerge through the interplay between cooperating actors. Resources generated within networks include common vision, trust, reciprocity, joint knowledge, shared goals or reputation. They appear to be important factors for the successful development of innovation, next to financial and human resources. Some authors consider them a type of capital that enables access to other resources (financial, material, and human), which would not be individually accessible (Cox, 1995; Bourdieu, 1999). Social capital embedded in networks can be understood as bonds of trust and reciprocity between individuals (Coleman, 1988; Cox, 1995; Putnam, 1995). They tend to be self-reinforcing and cumulative. Successful collaboration in a project creates connections and trust, that is, social assets that facilitate future collaboration with other unrelated tasks (Putnam, 1993). Trust is quite important for network stability (Bryson et al., 2006).

Networks are structures for interaction and exchange of resources between interdependent actors that come together around a common purpose. The quality of the network actors' relationships, that is, the structure of the network, has an effect on the behavior and collaboration of the actors, which ultimately determine the network's performance (Söderholm et al., 2019). The structure, in turn, is influenced by the characteristics of the actors and the governance of the network.

Some network characteristics can increase the possibility of solving collective action problems, because they influence social capital accumulation within networks. These features include the size of the group involved (there is a trade-off between group growth and individual cooperation), the heterogeneity of participants (discrepancy in benefits can reduce trust), face-to-face communication (which enhances solidarity between members), information about past actions (especially with accuracy of information), relationship networks, and information on whether individuals can enter or leave voluntarily (Ostrom, 2009).

If, on one hand, networks formed by actors with convergent and similar views can result in myopic behavior in the development of technological solutions and path dependence (Coenen et al., 2015), on the other hand, the most heterogeneous networks, with actors from different sectors, with different organizational agendas and different views on the same problem can result in innovative technological solutions. The diversity of network actors increases the chance of connecting with other organizations or communities critical to achieving the purpose, guarantees the necessary resources and favors the network's resilience (Söderholm et al., 2019).

The level of coordination and the form of governance of the network influence its performance. It is argued that networks with multiple connections and clear coordination units are better prepared to establish network priorities and actions. More recently, the literature has identified new network coordinating actors, such as intermediaries (Howells, 2006), brokers (Belso-Martínez et al., 2015) and system builders (Musiolik et al., 2020).

Musiolik et al. (2012) proposed an analytical framework with three levels of resources: organizational, network, and system. They argue that organizational resources are strategically accumulated or produced within firms. Network resources were developed within these networks. System resources are collective assets often deliberately created to support innovation systems, assuming that the characteristics of the network proposed by Ostrom (2009) can influence how the organizational resources of network members can be used, combined, and complemented for the generation of network and system resources (Figure 1, in methodology, presents the analytical framework used in this research).

In summary, organizations are formed by individuals with relationships and affinities with other actors, both internal and external

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to the organization. These networks of social relationships can influence the formation of networks, that is, the connection between actors around a purpose. These connections enable interactions between network actors. Interactions foster the flow of resources between organizations, at the same time as they are sources of new resources that emerge from the network and affect the agri-food innovation ecosystem. The connections and interactions in the network are shaped by the characteristics of the group of actors that form the network and by the governance structure.

Regarding the importance of theoretical subjects and their applications, it is important to note that contemporary research has shown a relationship between the networks' organizational form, multi-stakeholder involvement, and resources. In Dentoni et al. (2020), the authors analyzed new organizational forms in emerging economies in agricultural and food value chains, and pondered that the novelty lies in the way actors associate or collaborate with each other, making their natural, financial, physical, complementary human, technological, and social aspects more complex than in the traditional agri-food value chain, with its linear buyer-supplier or supplier-supplier collaborations. A systemic and interactive perspective to support the design and implementation of innovations was analyzed by Radaelli & Fuck (2023), who followed the structuring of new institutional arrangements in the process of technology transfer and adoption of innovations, with emphasis on Mixed Research and Innovation Units (UMPIs).

Fronzaglia et al. (2022) evaluated strategic management in public agricultural research organizations, including coordination with stakeholders, concluding that there was a range of stakeholders involved, something common in these types of organizations.

Van Dijik et al. (2023) analyzed an emerging group of farmers in Kenya who researched the dynamics of medium-sized farmers and the importance of the emerging system for agricultural development. By analyzing what helps farmers grow and prosper, this article outlines a range of services and suggests that intentions to improve the relationship between farm owners and managers are key to farmers' success.

Iza et al. (2020) base their findings on a systematic review of the literature on the influence of multisectoral platforms on farmer innovation. Based on a sample of articles, it was found that multisectoral platforms, unlike other new organizational forms emerging across the field of international development and agribusiness management, involve the presence of a virtual and/or physical interface between multiple and heterogeneous stakeholders.

In a different area of the food sector, Shin (2022) used data from the social network of refugees from North Korea in London, with a relational model on networks of ethnic friendship and trust present as an integral relational quality in the integration of refugees. Not every bond of ethnic friendship is related to better health, safety, etc., according to the authors, but rather those characterized by trust.

METHODOLOGY

The research follows a qualitative approach, applied to the All4Food network, and is exploratory and descriptive in objective terms. The methodological procedures included theoretical research on social networks and resources, in Capes periodicals (and without temporal delimitation), documental research on the actions developed in a network format by All4Food, and a case study of the network based on the interviews with key agents of All4Food network.

The documental research was based on reports resulting from the two challenges for startups and research groups of the All4Food network and internal documents, such as

projects and the network's action agenda. Secondary information was also provided by the website All 4 Food (2025). The case study then evaluated the experience and performed the action analysis of the All4Food network regarding some of its coordinators who have worked in the network since its original conception, in March 2020, and other network actors (Table 1). In this sense, the survey also assumed the participants' character.

This research focused on the perception of the participants themselves to assess the benefits of the network, despite the limitations of this form of evaluation. The use of this methodology for a network under construction is based on the premise, as previously explained, of social relations between the actors involved with common purposes. It is hypothesized that these connections are closely related to the agri-food innovation ecosystem, as well as to the shaping of the structure of the network and its governance. In this context, the participants, such as active members and key stakeholders, have a privileged perspective on the initial processes and results. This approach is based on the action research methodology, common in exploratory studies, such as in emerging networks, where internal perceptions contribute to an initial understanding of the impact and challenges. Thiollent (1986) defines action research as:

> [...] a type of empirically based social research that is designed and carried out in close association with an action or with the resolution of a collective problem, in which researchers and participants representing the situation or problem are involved in a cooperative or participatory manner.

This method emphasizes the importance of the active participation of those involved, a central principle in action research (Kemmis & McTaggart, 2005). This methodology, by its nature, is not limited to data collection, but also involves a collaborative process that aims to transform reality.

Additionally, in this participatory action research method, the people involved act as both practitioners and researchers, promoting a mutual transformation in research practices and the social settings in which they are inserted.

The case study proved to be adequate because it involves the strategy of organizational and managerial studies, of sociology and others, according to Yin (2001), and also allows for analytical techniques for disposing of information in different series, which will be used in this study. To better understand the objectives analyzed in this article, this research presents a contribution to the origin and purposes of the network below. Figure 1 shows the analytical framework used in this research.

By analyzing network building, this research can focus on the network characteristics and the interplay of resources at different levels (organization, network, and innovation system), which, in turn, impacts agri-food innovation system and sustainability.

Table 1. Summary of the interviews realized.

Sector	Role in the All4Food network	Number of interviews
Universities in the south and southeast regions	Coordinator	4
Universities at national level	Associate member	6
University in the southeast region	Associate member and advisory board	1
Research institute	Associate member	1
Agri-food industry	Network partners and sponsors	2
	Network partners	4
Supporting entity	Collaborator member	1
Non-profit organizations, training organizations	Award promoters	3

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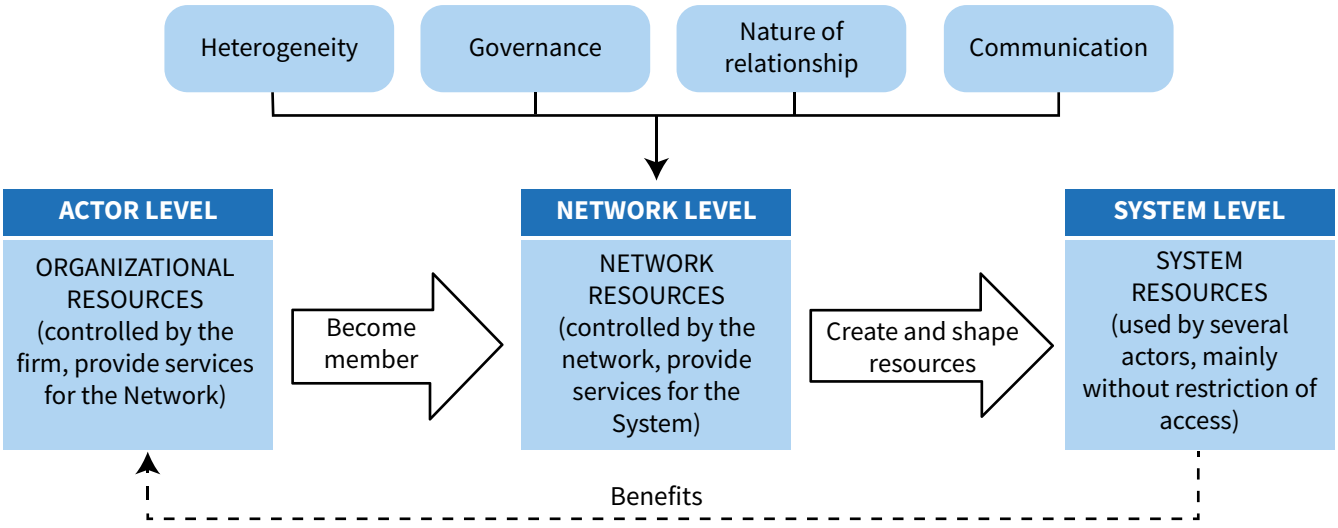

Figure 1. Analytical framework.
Source: adapted from Musiolik et al. (2012).

RESULTS AND DISCUSSION

All4Food emerged from the initiative of the center of organizational studies by USP (University of São Paulo) – CORS/NAP-USP. A network was created with the purpose of favoring connections between ideas and people, aiming to enhance the finding and co-creation of innovative multidimensional solutions (technological and organizational) for the agri-food sector in Brazil and worldwide, having sustainable development as its guiding principle. The network's mission is to contribute, in a collaborative and participative manner, to the generation of new businesses. The network also aims to bring new challenges to science and to contribute to the formation of a new generation of entrepreneurs.

The first steps of this ideation were taken at the beginning of the Covid-19 pandemic period, when a group of colleagues and partners with solid personal and professional experience established a connection to organize an event focused on innovation. Due to the Covid-19 pandemic, that work was canceled, as well as many others around the world. Even so, the dynamics of periodic work meetings were maintained, in which the group discussed different experiences and complementary knowledge to better understand the new scenario of uncertainties that have so suddenly unveiled and what would be the paths for overcoming and resuming the different spheres of personal and professional life.

In a short period of time, the discussions began to include topics related to the challenges and opportunities of the new normal that emerged during the pandemic period, in which sustainable development is consolidated, with a necessity for greater collaborative structuring involving different stakeholders of the innovation system, including academia. Considering the group's perception, connection between the food industry, academia, and other stakeholders is incipient and lacks effective actions to strengthen ties, especially in an organized and systematized way. In the succeeding sections of this study, the different obstacles already experienced and the difficulties of overcoming them came to light, as they were related to cultural aspects, such as the worldview, languages, timings, and behaviors of these two worlds (academia and market), which, although ideologically complementary, in practice, represented completely disconnected pieces.

The weekly virtual meetings (between researchers) created opportunities for new connections and the inclusion of more professionals who adhere to the purpose of

the network. New members brought important complementary expertise. What was seen, with the benefit of information technology, was the formation of an organic and dynamic network connected to the same purpose. Personal relationships favored trust and cooperation in network building and expansion. Table 2 summarizes the network's characteristics, benefits, and challenges.

The network formally celebrated its first anniversary in October 2021. October was chosen because of two important dates related to the intended construction: World Food Day (October 16) and National Innovation Day in Brazil (October 19). The network is currently structured in 20 institutes and universities in Brazil, operating in the five regions of Brazil, and it represents approximately 40% of scientific production in the country, and if considered as a metric, the number of publications related to the food topic on the Web of Science portal. The network currently spans the Brazilian

Table 2. Characteristics of All4Food network.

All4Food network			
Purpose	• Connection between stakeholders of the agri-food sector for sustainable innovative solutions		
Mission	• Contribution for new businesses • Articulation of agri-food sector demand for research • Contribution for formation of a new generation of entrepreneurs		
Characteristic	**Description**	**Benefit**	**Challenge**
Network entrance/exit	• Free of charge, voluntary entrance and exit	• Participation • Diversity • Inclusive network	• Financing of the network • Coordination cost
Nature of relationship	• Phase of network conception and building: personal relationship • Phase of network expansion: personal relationship and new entrants seeking for the network	• Greater cooperation • Trust and reciprocity • Knowledge on past action (reputation)	• Formalization of the network (organizations are regulated by different norms)
Heterogeneity of actors	• High heterogeneity: universities (different areas), research organizations, agri-food industry (competitors' firms), startups, intermediary organizations	• Additional resources • Network empowerment	• Coordination of different interests • Engagement of all network members • Value caption of new businesses fostered by the network
Communication/ connectivity	• Virtual communication, multidirectional communication	• Lower cost • Fostering of collaboration • Fostering of interaction • Participation of worldwide members	• Knowledge management • ICT tools
Governance	• Group of coordinators from different entities of academia (general and specific areas) and advisory board (market and academia)	• Plurality of visions • Impartiality of the academia	• Transaction cost (coordination cost)

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"continent" in a start that is very suggestive of its internationalization, initiating connections with partners from universities in Argentina, France, Italy, and China.

Along with institutes and universities, supporting entities are added to the network (which endorse and actively participate in the network's agenda with the contribution of human resources and other operational and technical facilities) and sponsors from the agri-food industry (which contribute with financial resources to the actions of the network), as illustrated in Figure 2.

The multiple stakeholders, with their complementary expertise, that constitute the network already add up to more than 120 members, divided into two categories: 1) associate members (with some active and regular action towards the network), among which are teachers, professors, students (high school, undergraduate, and graduate), researchers and industry professionals; and 2) the member of collaborators (acting on time). The greater heterogeneity of participants brought additional resources to the network and improved empowerment.

Regarding network governance, there is a body of coordinators allocated to six fronts (the general one and the specific ones, which are: the observatory, technology, training and development, institutional cooperation, and finance), which in turn are assisted by an advisory board composed of renowned actors from academia and the market, as well as young leaders. Decentralized power with coordination across major pillars follows the network perspective discussed by Powell (1990) and Pahl-Wostl (2019). The governance mode is similar to what Musiolik et al. (2020) named as "intermediate mode". A set of coordinators collaborates with other actors to set up an intermediary entity (the network), resulting in the creation of system resources.

In short, All4Food is a network based on solid human bonds, benefiting from previous relationships of trust, and characterized as

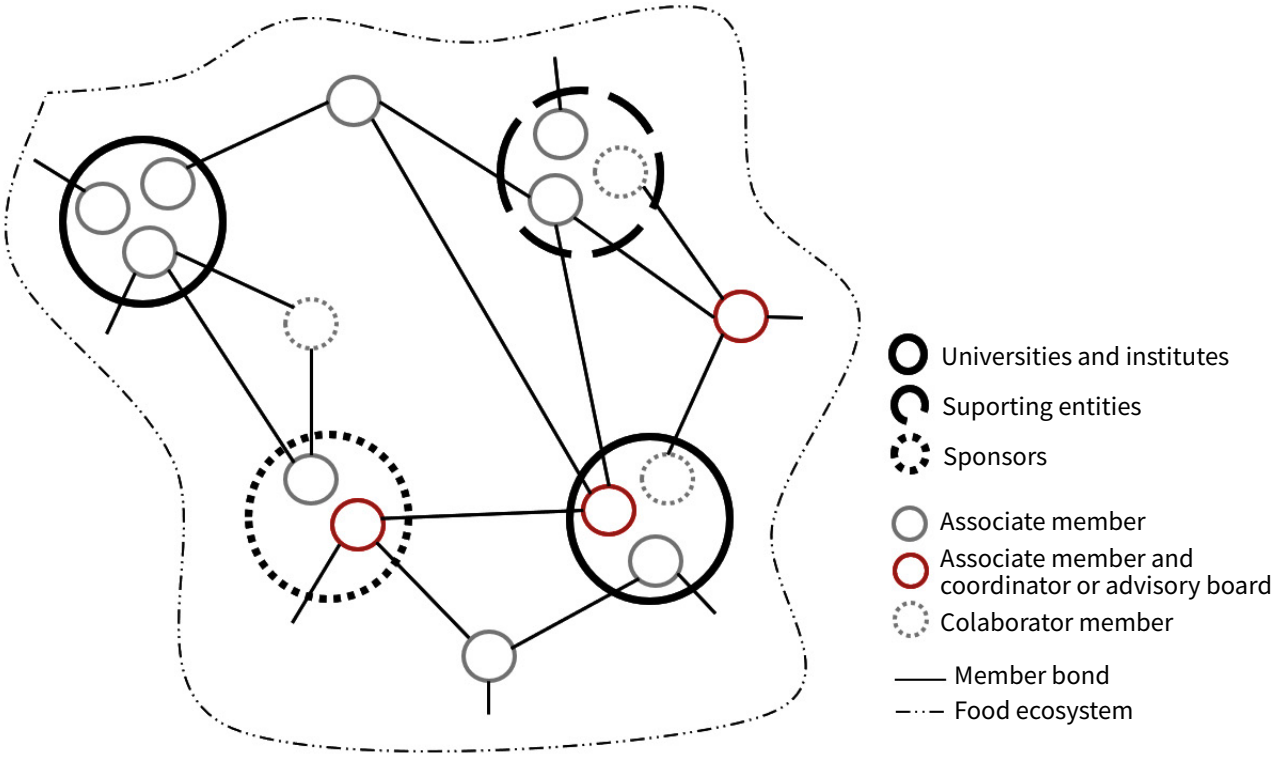

Figure 2. All4Food Network.

a living, collaborative, multipurpose, and polycentric governance construction (Coleman, 1988; Putnam, 1995; Pahl-Wostl, 2019). This construction is supported by its differentials: multi-functional – organic and dynamic structure with great capillarity; multi-stakeholders: academies, companies, startups, research and innovation centers; multi-institutions – researchers from institutions throughout Brazil and abroad; multi-areas – technology and management, encompassing, among others, organizations, markets, productive systems, sustainability, agri-food science and engineering, emerging processing technologies, new materials, and bioactive packaging.

By using the organizational resources provided by its members, resources are generated within the network, which in turn fosters the development of important agri-food system resources. The next section details the resources generated by the All4Food network.

Impacts: All4Food network resources shaping food system resources

The network's strategic plan is revised annually, and the annual agenda of tasks and events is agreed upon by network members. Following the strategic plan, All4Food periodically chooses a guiding theme for its actions, which is always in line with the United Nations' Sustainable Development Goals (SDG). For the 2021/2022 biennium, SDG12 – Sustainable Consumption and Production – was chosen as the initial central theme. It is believed that sustainable development is achieved through individual engagement and effort. The solution to complex and common problems depends on the collective action and collaboration between multiple actors. A perspective with adherence to the network's proposal and a common vision of network members is articulated in three axes (matchmaking, research, and co-creation) that complement each other. It motivates active and collaborative connections between multi-stakeholders, which generates positive impact on society.

Matchmaking

Great innovations do not arise from isolated flashes of creativity and inspiration but from meeting ideas that complement each other. This is the premise that guides the essence of the All4Food matchmaking axis, which seeks to promote the connection between multiple stakeholders in the Brazilian agri-food innovation system by conducting regular and intense agendas of events, thematic meetings, and challenges. To achieve these goals, the network's first action was the planning of the All4Food's startups challenge since its original conception, conceived in a combination of three interconnected cycles – 1) process; 2) product; and 3) productive chain – with the aim of genuinely differentiating itself from other events by establishing a new opportunity for networking and generating new business based on the active connection between academia, startups, and six of the largest market leaders in the food and beverage segment.

In addition to the challenge, it is important to highlight the conduction of other actions of the matchmaking initiative, such as webinars and forums open to the public, with subjects that cover the agri-food system, and with network members or their guests as speakers. In addition, the network that focuses on the streamline internal relations created an action that focused on people and operations, with engagement and empowerment workshops and technical webinars. A research group composed by professors from universities linked to the network, in addition to graduate and post-graduate students and collaborators members from partner companies, was also created to discuss empirical and theoretical articles that complement the network's projects (periodically virtual meetings). The group discussion supports the construction of future agri-food agenda.

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Research

Connections that illuminate new challenges to science and research are included in the All4Food observatory. It uses the expertise of different researchers in different knowledge areas, combined with explanatory research methodologies, survey techniques, case studies, benchmarking and network analysis, computational technological prospecting, and big data analysis, to identify initiatives, solutions, technologies, and accumulated knowledge on specific subjects of sectorial or specific interest in demand by organizations. Currently, there are three actions in progress within this initiative: 1) project contracted on demand for the All4Food observatory of technological radar; 2) Fapesp sponsored project on sociotechnical dynamics in the agri-food system; and 3) ranking of the food industry and mapping of success cases in agri-food losses and waste in Brazil. The ranking is dedicated to a long-term agenda on the quality of private policies for combating food losses and waste.

Co-creation

Given the initial expectations of the collaborative construction of networks, the regular and intense schedule of events fostered new connections and strengthened ties that led to the ideation of new projects and initiatives, some of which were coined in the ideal of co-creation of innovative multidimensional solutions (technological and organizational) for the agri-food sector in Brazil and the world, with sustainable development as a guiding axis. In this regard, the All4Food network integrates a recent call submitted to Fapesp (São Paulo Research Foundation) under the project of Science Centers for Development (CCDs) in 2021, in collaboration with other partners such as the Food Technology Institute (ITAL), the Food Research Center (FoRC), and others.

Diffusion of knowledge and new ideas

The All4Food network develops specific content and interviews with experts from partner companies and guests on relevant

Table 3. All4Food resources.

Organizational resources provided by members	Network resources generated within the network	System resources provided by the network for food system
Tangible Financing Human	• Tangible • Social media • Strategic plan • Agenda • Governance structure • Trainee program • Platform for matchmaking	• Matchmaking events • All4Food startups challenges, including research group initiatives • Workshops on specific themes. • Research group meetings to advance the frontier • Research agenda • All4Food observatory • Articulation of demand for research • Co-creation • Project on development centers for science. • Diffusion of knowledge and new ideas • Interviews with experts • Webinars and forum on specific themes • Capacity building • Students trained for the market (entrepreneurs)
Intangible Knowledge (lectures on specific topics; organization of events)	Intangible Trust and reciprocity between members Collective knowledge (on startups challenges, ICT tools, strategic planning, connection between academia and market, etc.) Articulation with agri-food industry competitors and other facilitators	

and challenging topics in the agri-food sector. This knowledge is disseminated through social media, such as Spotify and YouTube. The objective was to draw the interest of more companies and professionals to collaborate in the co-construction promoted by the network.

Capacity building

All4Food has a group of interns in different areas of knowledge (management, IT, food engineering, etc.). The All4Food internship program facilitates these young people's entry into the job market because of the proximity to the network's partner companies and the expertise and knowledge acquired in the network.

Regarding the network's resources, All4Food constitutes a structure and social resource based on intense resilience and social capital (Coleman, 1988; Cox, 1995; Bourdieu, 1999; Putnam, 2000). This is because intentional relationships and bonds of trust based on past trajectories common to many in the network (research areas and the location of their research institutions, for example) are fed back as benefits are provided and perceived by everyone. Some of these benefits include the good results obtained by events of matchmaking, the discussions and sharing of research, the growing involvement of undergraduate and graduate students, etc. Reciprocity has also become an internal landmark for researchers who are part of the network, as joint actions, involved in their work tasks, start to be shared as contributions in classes, bringing different points of view.

Furthermore, considering Putnam (1993) claim that successful collaboration in an event is self-reinforced through other actions, it is possible to signal the interest of companies in the food sector that are working on a project, such as Startups Challenge, in integrating another project within the scope of research prospection. This expands connections not only internally to the network but also externally to the network. These connections are aimed at exchanging information on innovation and events about the agri-food sector in Brazil and, in line with the treatise by Pretty & Ward (2001), bidirectional information between the constituent members of the network.

From the point of view of growth and the strengthening of connections and relationships, some processes need to be improved such as communication – already illuminated by Ostrom (2009) in collective actions – since the use of various technologies and multiple events can generate communication failures and transaction costs. However, to achieve this, it is necessary to promote advances in learning and experiences with a team of professionals (teachers and students) specialized in information technology that constitutes a network.

DISCUSSIONS

Society is experiencing a period of great transformations, making us certain that our journey requires increasingly complex and interdisciplinary solutions. Cooperation and collective actions play a prominent role in the face of this new paradigm, which also challenges the production, processing, and distribution of food and beverages. Rethinking consumption and production patterns to achieve inclusive economic growth and sustainable development requires collective and collaborative efforts. Public and private institutions need to consider ways to efficiently use resources, reduce food waste along the entire value chain, and make people aware that small actions can make a difference, without return, on the path to sustainable development. In this panorama, the article focuses on the progress of a proposal for the agri-food innovation system.

The ideation came from a group of colleagues and partners with solid personal ties and professional experience connected to organize an event focused on innovation. In a short period of time, the discussions began

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to include topics related to the challenges and opportunities arising from the pandemic. The need for a more collaborative structure brought different stakeholders of the innovation system, including academia. Personal relationships favored trust and cooperation in network building and expansion.

The multiple stakeholders and their complementary expertise that constitute the network add up to more than 120 members. Greater heterogeneity of participants brought additional resources to the network and improved empowerment. Regarding the network's governance, there is a body of coordinators allocated to six specific dimensions, who in turn are assisted by an advisory board composed of renowned actors from academia and the market, as well as young leaders.

It is a network under construction whose impacts are the strengthening of connections, by strengthening bridges and bringing actors together, and the contribution to an innovative process with generation of business, illumination of new challenges for science, and contribution to the formation of a new generation of entrepreneurs.

The results contribute to the literature on networks and resources by showing elements of the conception and design of the network itself, resources, and their effects on the innovation system. They also contribute to scholars interested in that phenomenon by representing illustrative material on the design and organization of impact networks. In addition, they provide insights for the formulation of public and private policies to encourage innovation and sustainable development by illuminating the bases for network governance.

CONCLUSIONS

The process of designing and organizing the collaborative network was performed by a group of colleagues and partners with solid personal ties and professional experience, who came together to organize an event focused on innovation. However, the need for a more collaborative structure brought different stakeholders from the innovation system (such as organizations) and academia. The greater heterogeneity of participants brought additional resources to the network and improved empowerment.

The network's agenda raises challenges that still guide the ongoing debate in the literature, such as the sustainability of networks in terms of the challenges of continuous growth, network formalization, and coordination costs. In addition to cultural elements that transcend the network itself, such as challenges of institutional paradigms and the strength to change the mindset towards a perspective of collaboration, including that of its members, reserving new chapters for the social dynamics of interest to the network and the system.

The limitation of the study is based on the number of interviews carried out for this case, but this could be eliminated with future research on the evolution of the network, with subsequent effects.

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