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Technology Transfer for Social Entrepreneurship: Designing Problem-Oriented Innovation Ecosystems

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Abstract: Innovation systems are increasingly oriented towards the solution of societal and environmental problems. Social entrepreneurship can be regarded as a market-based actor, inherently aimed at finding solutions for these problems. The development of technologically advanced social entrepreneurship represents an outcome of problem-oriented innovation systems, requiring a closer link between social and technological innovation. Nonetheless, the literature has not yet explored a key element of these innovation systems: the technology transfer processes, which may enable social entrepreneurial organizations to act as innovation actors leveraging on technology. This paper investigates the relationship between the technology transfer processes targeting social entrepreneurship and different models of problem-oriented innovation ecosystems. The paper relies on a multiple-case-study design, including two problem-oriented innovation ecosystems in the Italian context, namely, MIND and Torino Social Impact, which are technology transfer projects designed to target social entrepreneurship. Drawing from content analysis of interviews, documents and direct observations, the results stress that the different objectives and contents of technology transfer, coupled with different perceptions of the idiosyncratic features of social entrepreneurship compared to commercial entrepreneurship, fit different ecosystem models in terms of the participating actors, governance and primary orientation to social or economic value generation.

Keywords: social entrepreneurship; innovation ecosystem; problem-oriented innovation; technology transfer; innovation systems

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1. Introduction and Context

The COVID-19 pandemic crisis can be read as an emerging factor stressing the importance of orienting innovation efforts and policies toward the solution of grand societal and environmental challenges. Bill Gates [1] has identified pandemics themselves as one of the major societal challenges for global innovation systems.

The compelling urgency resulting from the social and economic consequences of the pandemic occurs on the top of an already ongoing transformation, at both the European and international level, of innovation, science and technology policies [2,3], which are increasingly oriented to convey a transformative positive effect on society.

Narrow, technology-led and deterministic mission-oriented policies, such as those described by Mazzuccato [4] and Foray et al. [5], exemplified by the US government's Apollo Programs or Manhattan Project, appear to have been globally overcome by a new generation of innovation policies characterized by a broad transformative and socially constructivist character.

In this perspective, grand-challenges-oriented innovation policies are directly linked to wider socio-technical transitions. They ask for a rethinking of the key theoretical constructs of innovation systems and ecosystems developed in the domain of innovation management and economics, toward a greater linkage between the societal and technological components of innovation processes and technological development.

In such a context, consistent with a neo-Schumpeterian perspective [3,6] focusing on entrepreneurship–innovation interaction, it is possible to observe the new centrality acquired by socially and environmentally oriented entrepreneurial forms [7] as a novel player in innovation. These actors might also have a leading role in the generation of new science, innovation and technology policies.

In this view, Markman et al. [7] have stressed the scarcity of research on the grand-challenges orientation of innovation systems and the underlying entrepreneurial models suitable for this transformation. Thus, the authors define "impact entrepreneurial" forms as the development of "sustained applications and solutions that collectively address grand challenge to make the world better" [7] (p. 3). Impact entrepreneurship appears to include both social, environmental and sustainable entrepreneurship.

In this paper, we maintain a specific focus on social entrepreneurship, coherently with Ghazinoory et al. [8], who regard the technological development of social entrepreneurship as one of the key outcomes for problem- and challenge-oriented innovation systems and ecosystems. Social entrepreneurship is actually experiencing a gradual technological transformation, which is profoundly changing its organizational traits [9–11].

This ongoing transformation gives novel centrality to technology transfer processes in the field of social entrepreneurship and underlines the value of their empirical investigation.

Stemming from the observation of this emerging transformation, this paper focuses on problem-oriented innovation ecosystems. It analyzes the key characteristics of these innovation ecosystems that make them suitable environments to enable social entrepreneurship to exploit the opportunity offered by technologies. Specifically, the study investigates the relationship among the different models of problem-oriented innovation ecosystems and their conducive capacity for technology transfer to social entrepreneurship.

This paper relies on an exploratory multiple-case-study methodology, exploiting two embryonic problem-oriented ecosystemic experiences in the Italian context; data were collected in each of them through interviews with several players involved in designing projects of technology transfer for social entrepreneurship.

The two experiences are those of the Milano Innovation District in Milan, where Fondazione Triulza is building up the Social Innovation Academy for Technological Development of Social Entrepreneurship, and that of Torino Social Impact in Turin, where different stakeholders, starting with Fondazione Torino Wireless, are committed to developing the "I3S Project" for technology transfer for social entrepreneurship.

Moreover, a third experience, an ongoing and established innovation ecosystem experience targeting social entrepreneurship, the French Poles Territorial De Cooperation, is used to reinforce the validity of the results obtained from the two Italian case studies.

2. Literature and Theoretical Framework

The objective of this study is to investigate which characteristics of problem-oriented innovation ecosystems enable different processes of technology transfer to social entrepreneurship.

2.1. Innovation Systems and Ecosystems

The conceptualization of the notion of innovation ecosystems still lacks a univocal formalization [12] and is strongly contested in the innovation management literature [13].

We follow Granstrand and Holgersson [14], who define an innovation ecosystem as an evolving set of actors and relations aimed at fostering local innovation performances. According to Chaminade and Randelli [15], innovation ecosystems are "constructed relationally" [15] (p. 3), and the relations tend to occur among geographically close organizations. The key elements included in the abovementioned definition of an innovation ecosystem also have been considered by Ghazinoory et al. [8] (p. 2), describing the concept of innovation systems as the "creation, dissemination and use of knowledge and technology through interaction of structural components such as organizations, firms, research centres, policymakers".

The concepts of innovation systems and ecosystems are sometimes used as synonyms [13]. Nonetheless, the ecosystemic perspective can be set apart because it explicitly considers the dynamic, complex and non-linear relations among the members and it has a meso-territorial focus, meaning geographic proximity plays a key role [15]. This is why this perspective appears suitable for studying the technological transformation of social entrepreneurial forms, as shown by [16,17].

The concept of innovation ecosystems can also be applied to describe the experiences of innovation clusters [18]. According to the authors, ecosystemic innovation emerges from the non-linear complexity that is typical of knowledge-based economies, in which new values are co-created interactively in collaborative networks. This is why, when innovation is envisioned to address societal problems, the complexity of these types of challenges, and the inherent uncertainty typical of the search for solutions to solve them, raises the need to move toward ecosystem-based designs for innovation systems [19].

The ecosystemic perspective has been adopted by Znagui and Rahmouni [20] as well, who consider the ecosystem dimension necessary to understand the key variables that constitute a new generation of "technopoles" suitable for social and technological innovation. The study by Znagui and Rahmouni [20], describing linear and multiple helix ecosystemic models, identifies the key variables of success for the technopole as the capacity for stakeholder involvement, the degree of governance structuration, the international attractiveness and the presence of a national and shared strategy for problem-oriented innovation.

As a matter of fact, the interlink between societal and technological innovation for the solution of environmental and societal problems lies at the basis of the quintuple helix innovation model [21,22]. This model overcomes both triple and quadruple helix theoretical approaches in which innovation's objective is represented by the creation of a knowledge-based economy or, alternatively, of a knowledge-based society.

Conversely, quintuple helix models posit the development of a dynamic "socioecological transition" [21] of both societies, environments and economies towards sustainable development objectives as the main goal for innovation activities. In quintuple helix models, social and environmental dimensions and actors, beside economic ones, become central in innovation processes. In this paradigm, the non-linear social interactions and academic exchanges taking place in these complex systems are aimed to promote "a cooperation system of knowledge, know-how and innovation" aimed for sustainable development [21] (p. 4).

In this specific perspective, the relationship between social entrepreneurship as an economic actor on one side, and knowledge or technology intensive organizations on the other, should be processed and analyzed as a synergic element for sustainable development. Thus, this relationship mainly involves two "subsystems": on one side the Educational and Research sub-system and on the other the Economic Entrepreneurial one. Orienting this synergic relationship towards social entrepreneurship may be a factor enabling "technology, innovation and entrepreneurship" to represent a real driver for building "knowledge-based societies" [21] (p. 2) able to tackle novel societal and environmental problems and guaranteeing socioecological progress.

2.2. Problem- and Grand-Challenge-Oriented Innovation

In this view, Ghazinoory et al. [8] define problem-oriented innovation systems as systems of interactions and collaborations aimed at the diffusion and utilization of knowledge and technology to solve a socio-technical problem in society. Problem-oriented innovation systems tend to produce both economic and social value; in this perspective, the growth of technological and social entrepreneurship represents an outcome fully coherent with the hybrid value generation of these systems.

Ghazinoory et al. [8] have also outlined a series of characteristics of problem- and challenge-oriented innovation systems, drawing some of the elements from the more established notion of territorial innovation systems and some others from the concept of socio-technical systems.

According to Ghazinoory et al. [8] and Coenen et al. [2], territorial innovation systems seek to foster territorial economic development through innovation and technology development. Their primary economic goal is accompanied by knowledge and technology supply-side-driven system leadership (namely the leadership of academic institutions, private research centers, technology and knowledge intensive enterprises and incubators, which may be defined as the main producers of technologies). The governance of territorial innovation systems is often well structured and concentrated in few actors. These systems mostly display precise and fix rules of engagement of the members and higher homogeneity among the involved actors. These models are consistent with triple-helix theoretical approaches [23], which mainly pursue economic growth objectives (the growth of a knowledge-economy, [23]). They are driven by the approach of technological determinism, according to which technology determines the development of societal structures.

The other relevant concept to define problem- and challenge-oriented innovation systems is that of socio-technical systems, as formalized by Geels [24]. Socio-technical systems "consist of a cluster of elements including technology, regulation, cultural meanings, markets, infrastructures, maintenance and supply networks" [24] (p. 3). These systems are led by a socially constructivist approach, according to which society and technology co-evolve. The purpose of socio-technical systems is primarily the creation of societal value and the technological development is mostly driven by the demand-side, namely by those economic and social actors who are consumers rather than producers of technologies. The heterogeneity of the actors included in the systems is high, overcoming triple-helix approaches and entering into quadruple and quintuple helix perspectives. Socio-technical systems are therefore characterized by openness in engaging new actors and low formal structuration, with distributed forms of governance.

Therefore, problem-oriented innovation ecosystems can be considered halfway between the model of territorial innovation systems and socio-technical-inspired configurations. This study aims to support this assumption by investigating the distinct elements of ecosystems fostering the technology transfer processes for social enterprises.

2.3. Technology Transfer Processes

Building on Corsi et al. [25], technology transfer is defined as a process aimed at distributing technologies from their place of origin to other people, organizations and places.

From this perspective, technology transfer is a milestone for developing a genre of technology-able social entrepreneurs, able to exploit technological innovations for the solution of societal problems, contributing in this way to inherently reorienting innovation systems and ecosystems toward socio-technical problems [17]. In spite of the relevance of this theme, literature of scarce literature on the topic is mostly scarce and anecdotal, mainly covered by Vila Seoane et al. [26] and Friel and Patterson [27].

Thus, in this paper, we follow a "contingent model" of technology transfer, outlined by Bozeman [28]. It is, indeed, coherent with the perspective that analyzes technology transfer as a mechanism for sustainable development [25].

According to this model, it is possible to highlight a series of characteristics of the technology transfer processes. First, these processes can differ according to the typologies of the actors involved: academic, private and public. Every technology transfer process displays specific transfer-agents and transfer-recipients. Transfer processes can also vary based on the objective of the process and the content: the transferred technology can be intangible or tangible, hardware or software.

Furthermore, the transferred technology can require low adaptation or a higher degree of adaptive, specific knowledge for its development and application. Moreover, the demand environment for technologies can already exist or it can be induced by third actors of the ecosystems or by the supply side itself.

The technology transfer process can also be more or less mediated, leveraging on facilitation mechanisms and on "spaces" between the technology demand and supply sides,

guaranteeing a closer dialogue between the two sides. Technology transfer processes are also distinguished thanks to the media (patents, knowledge, etc.) instruments they exploit in the transfer.

2.4. Theoretical Framework

In this paper we aim at providing an exploratory investigation about the relationship between technology transfer for social entrepreneurship and problem-oriented innovation ecosystems. The literature review allowed to identify the variables we use as the drivers in the data collection and analysis. These variables are summarized in the framework outlined in Figure 1. It mainly relates the models of problem-oriented innovation ecosystems, inspired either by territorial innovation systems or, alternatively, by socio-technical configurations, to a set of key variables characterizing technology transfer processes, as described in the previous section. In particular, the framework links the different variables that characterize these two extremes—the social or economic orientation, the supply or demand side leadership, the techno-deterministic or socially constructivist guiding approach, the governance model, the degree of heterogeneity and degree of territorial proximity—to the key variables of the technology transfer processes outlined by Corsi et al. [25].

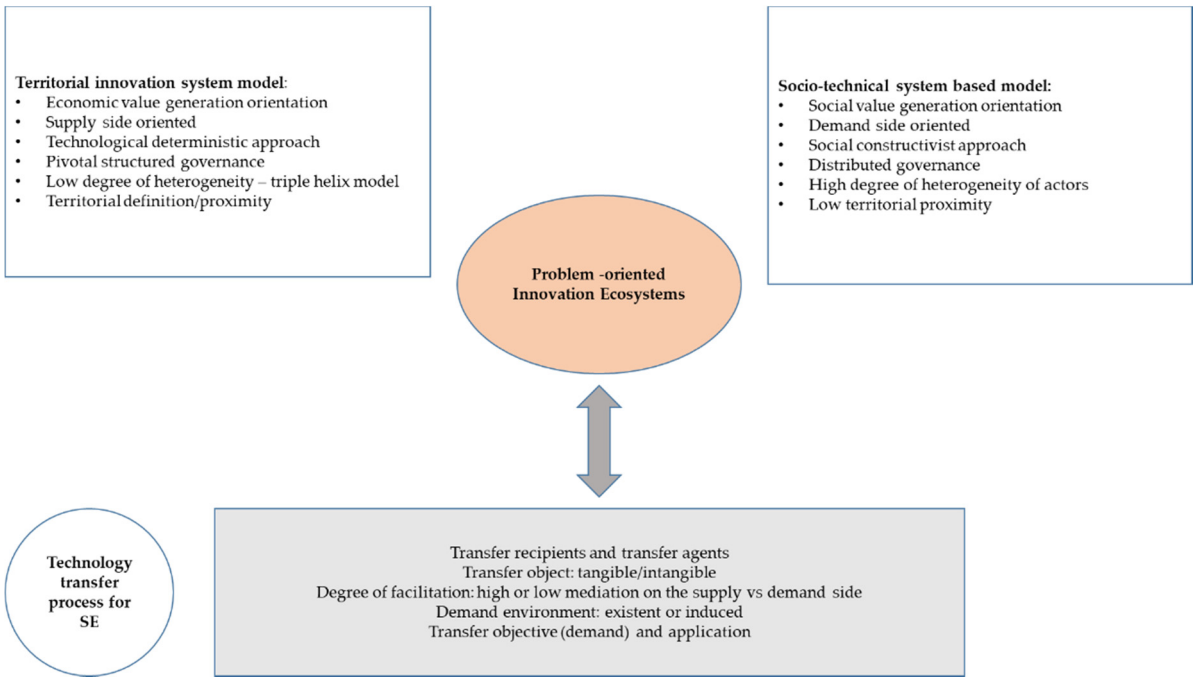

Figure 1. Analytical framework of the relationship between ecosystem models and technology transfer for social entrepreneurship.

This second set of variables is represented by the identity of the transfer recipients and agents, the typology transfer objects, the degree of facilitation in the process, the degree of induction, and, finally, the overall technology-transfer objective. Further characteristics of this relationship will be inductively outlined from the analysis.

Moving from the framework and consistently with Dubois and Gadde [29], we applied an abductive approach in the data collection and data analysis, which combines deductive and inductive elements in theory construction and in testing.

3. Methodology

To investigate our key relationship, we adopted a qualitative approach based on multiple and exploratory case studies [27]. A qualitative methodology based on case studies appears particularly suitable to the objective of the research due to the complexity

of the investigated ecosystemic phenomenon, which includes a variety of actors involved in non-linear and dynamic relationships.

3.1. Case-Study Methodology

A case-study methodology fits the objectives of the study thanks to its capacity to investigate settings in which boundaries between the phenomenon and the surrounding theoretical contexts are unclear [30]. This study focuses on experiences of innovation ecosystems where technology transfer processes for social entrepreneurship are still embryonic, in a design phase, and where non-anecdotal theory on the content has not yet been developed. Thus, an explorative approach has been adopted, given its capacity of investigating novel phenomena, allowing to infer preliminary theoretical insights [31].

We adopt a multiple-case-study design, selecting several different experiences at a different level of maturity and from different geographical contexts, to obtain a higher degree of heterogeneity and to reinforce the grounded theoretical insights, as suggested by Pauwels and Mathyssens [32]: two experiences are taken from an Italian context, which are still in a design phase, and a third one is a well-settled and diffused ecosystemic experience in France, which also include technology transfer elements

3.2. Cases Selection and Description

The main context of analysis is Italy, where the concept of social entrepreneurship first arrived in Europe, appearing in the country in 1990 [33]. The Italian empirical setting is particularly relevant due to the presence of a strong social entrepreneurial infrastructure, rooted at a local level through networks of social cooperatives and other social entrepreneurial forms [34]. The social cooperative, while the most prolific form of social enterprise in Italy, does not provide a complete picture of the social entrepreneurial movement there. Besides social cooperatives, new entrepreneurial forms contribute to shaping the realm of Italian social-impact-oriented organizations, such as benefit corporations, "ex lege" social enterprises and social innovative start-ups (SIAVs). Specifically, social enterprises traditionally operate in social assistance, welfare/healthcare and the educational and work integration sectors [35]. However, currently, social enterprises have broadened their activities, thanks first to Law No. 155 of 2006 and, more recently, to the third sector reform that occurred in 2016 (Law No. 106 of 2016 and its subsequent implementing decree), thereby now including also cultural, sports and recreational activities, and environmental protection. Subsequently, the technology transformation of Italian social enterprises displays a strong relevance for the entire European social entrepreneurial field. In the national context it displays a relevant transformative potential social economy involves 2.8 million enterprises and it employs 13.6 million people [36]. Having defined the boundaries of the Italian context, we focus on the first case, the Social Innovation Academy Project by Fondazione Triulza in the MIND ecosystem, the new Milan Innovation District, which is growing in the area where the expositions occurred.

MIND is a project for building an innovation ecosystem and science park focused on life and bio-tech challenges, which involves universities (Statale University and Politecnico di Milano-Human Technopole), hi-tech start-ups, hospitals (Galeazzi Hospital) and private research centers. It is intended to serve as a catalyst of the social and economic growth of Milan, as well as to create a novel neighborhood.

Fondazione Triulza is a not-for-profit Italian foundation gathering a variety of actors and representatives of the third-sector and social entrepreneurial organizations. Fondazione Triulza had filled the role of giving a voice to those organizations traditionally working in the social services domain during the Universal Exposition held in Milan in 2015 and to manage the Cascina Triulza pavilion, dedicated to the social-purpose activities taking place during the exposition. Since the exposition, Fondazione Triulza has maintained its mission of promoting innovation in Italian social entrepreneurship. This is the reason why Fondazione Triulza is working on transforming Cascina Triulza into a Lab-Hub for Social

Innovation, whose objective is to include also a "social innovation park" in the MIND ecosystem.

One of the projects promoted by Fondazione Triulza is the Social Innovation Academy, an incubation and technology transfer program targeting third sector and social entrepreneurial organizations with the objective of promoting entrepreneurial forms able to develop and deploy technologies to solve social and environmental issues ("social tech ventures"). The program was presented to the scientific committees of Fondazione Triulza in 2019, and it will be launched by 2021. The academy will target twenty existing social enterprises.

The second case is I3S Project, launched by the Torino Wireless Foundation within the Torino Social Impact Ecosystem. Torino Social Impact is an open, socially oriented ecosystemic platform that is gathering over eighty companies, public authority institutions, financial institutions, universities, charities, foundations and social enterprises. Members can easily join the ecosystem by subscribing to a Memorandum of Understanding aimed at sharing ideas, experiences and projects within the ecosystem and promoting dissemination beyond the ecosystem.

The mission of Torino Social Impact is to strengthen Turin's local economic system by fostering innovation and entrepreneurial solutions "pursuing economic goals with social impact objectives", solving "societal challenges", as highlighted on its website (see Appendix A). In the ecosystem, Torino Wireless Foundation is in charge of the technology-transfer processes together with I3P, an academic incubator. Torino Wireless is a foundation based on collaboration among public–private actors, aimed at fostering knowledge-based development of the Piemonte region, accelerating the growth of companies leveraging on technology as a strategic factor.

In 2019, the foundation started working on designing I3S Project, which will begin by the end of 2020. I3S has the objective of launching an acceleration program aimed at technological transformation of social entrepreneurial and volunteering organizations, enhancing the Torino Social Impact network. The selected cases and unit of analysis are graphically summarized in Figure 2.

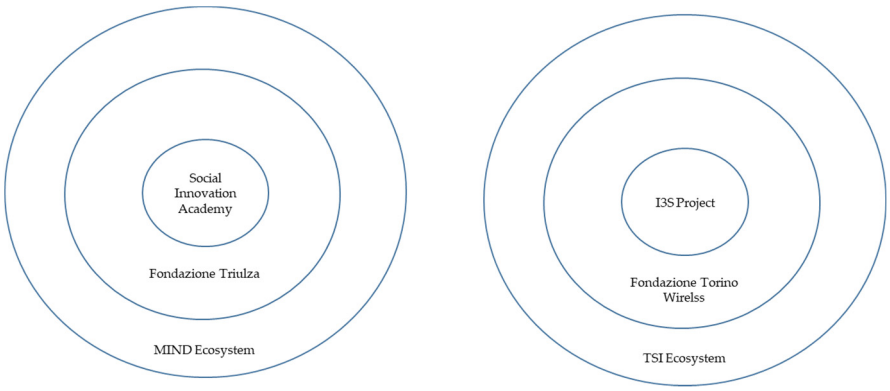

Figure 2. Selected cases and units of analysis.

In order to enlarge the heterogeneity of the data, we included in the analysis a third case different from those above described in terms of level of maturity and geographical context. Therefore, we compared the results of the Italian cases to an established experience in France that regard innovation ecosystems involving social enterprises, which has included technology and knowledge-transfer processes for social entrepreneurial forms [36].

The experience is that of the French Poles Territoriaux de Cooperation Economique, which was chosen after a thorough discussion with members of the European Clusters Alliance. The European Clusters Alliance is a bottom-up expert network initiative that gathers twelve national cluster associations, representing more than 700 innovation clusters

in the EU, where 112,000 of our most innovative businesses collaborate with thousands of universities, research centers and public institutions to boost their competitiveness.

The umbrella identity of Poles Territoriaux de Cooperation Economique includes 160 ecosystems [37] in the form of innovation milieus and clusters, which the French government launched in 2014 through Article 9 of the law ESS for the Social Economy. The Territorial Poles for Economic Cooperation (PTCE) are composed of a set of actors, associations, cooperatives, local authorities, companies and universities, located in the same territory, working around a common economic project to promote local development and social innovation. Their fields of activity are diverse and adapted to their local context: eco-activities, employment and securing professional careers, and food and sustainable agriculture. In this view, the PTCEs group together a series of enterprises acting in the fields of social and solidarity economy, along with research centers and other knowledge- and technology-intensive actors, enabling technology and knowledge transfer processes and representing an interesting and fertile field of observation and comparison.

3.3. Data Collection and Analysis

The data collection process took place between November 2019, when it was possible to join the first scientific committee of Triulza Foundation, and July 2020, when the defined project documents about the transfer projects were available.

The authors collected evidence through different sources shown in Table 1 and Appendix A. First, the authors conducted eight interviews with knowledgeable actors involved either both in designing transfer processes for social entrepreneurship and in innovation ecosystems, or solely in innovation ecosystems. A semi-structured approach was adopted for interviews. The interviews lasted between fifty minutes and one hour. They were all carried out remotely due to social-distancing measures caused by COVID 19. Interviews were recorded and transcribed. The structure of the interview covered the perception of the interviewees on the concept of the technology transfer process, the specificities of the technology transfer process for social entrepreneurship, the perception about the features of the innovation ecosystem able to make it the most conducive for such a process and any specific reference to the existing experiences.

Table 1. List of interviewees.

Role	Organization	Ecosystem
President	Fondazione Triulza	MIND
CEO	Arexpo	MIND
Scientific Advisor and Innovation Manager	Fondazione Triulza/Large Third Sector Organization	MIND
Social Innovation Manager	Private foundation	TSI
President	I3P Incubator—Politecnico of Turin	TSI
Strategic Advisor	TSI	TSI
Communication and Marketing Manager	Torino Wireless	TSI
Cluster Manager	Torino Wireless	TSI
Researcher	University of Angers	PTCEs
Researcher	University of Rennes	PTCEs
Applied Researcher and government consultant	LABO de l'ESS	PTCEs

The second source of data is represented by public documents available on the websites of MIND, Fondazione Triulza, Torino Social Impact and Torino Wireless, along with confidential documents, presentations and articles. Documents about technology transfer

projects fulfill a multitude of purposes, clarifying content and preventing obstacles to understanding. To triangulate the information, a third data source was established through direct observation by the authors who participated in internal project meetings of Torino Wireless and the scientific committees of Fondazione Triulza. Direct observation also allows the recognition of a misalignment between actors' "private" interviews with the authors and their declarations in public meetings.

Concerning the PTCEs' experience, two main sources of data were exploited: first, the collection of primary data through two semi-structured interviews with French knowledgeable academic informants from public universities (University of Rennes and University of Angers) and one interview with the research coordinator of a private research institute (Labo de l'ESS); this individual was the main government consultant for designing the strategy and the evaluation of PTCEs. Secondly, gray literature publications and secondary data from websites were reviewed and analyzed. The structure of the interview with the French knowledgeable informants covered the same areas as the Italian cases.

Data were analyzed through a qualitative approach. Data were paragraph-coded, and grouped into constructed categories, following an inductive approach consistent with Gioia et al. [38], identifying the first- and second-order categories that individuate the key patterns.

To validate the coding procedure and to allow an appropriate answer to the research question, inductive categories were deductively linked to theoretical variables drawn from the innovation ecosystem models and technology transfer.

Triangulation between inductive coding and theoretical insights from the analytical framework allowed to identify the relevant variables that may determine the relationships between the technology transfer processes for social entrepreneurship and ecosystems, confirming or changing the insights from the analytical framework

Textual analysis was first organized by the identity of the ecosystem to which an actor belonged through a within-case analysis. Second, the analysis was repeated through a cross-case approach.

4. Results

In this section, we present the results of the case studies from the Italian cases and the French experience.

Given that in the Italian ecosystems the technology transfer projects are still in a design phase, the thematic pattern-matching within the same ecosystem appears particularly weak and problematic; our analysis thus proves that the ecosystems still lack a unified vision on the topic. Conversely, cross-case analysis allowed the disentanglement of the key thematic patterns, thus showing the suitable similarities and differences to provide insights about the investigated relationship.

4.1. Commalities Emerged from the Cross-Case Analysis

In the following paragraphs, we explain the themes emerging from the cross-case analysis. They represent those features of an innovation ecosystem that favor the technology transfer process to a social enterprise.

4.1.1. Hybridity

A recurring theme shared by all interviewees and confirmed by documents and observation is the necessity of building up innovation ecosystems displaying a "novel character" in their capacity of generating a hybrid value of both an economic and social character. Hybridity orientation appears to be a necessary condition to foster development of technological and social entrepreneurship.

MIND explicitly aims at generating both social value for citizens, especially in the field of life sciences, and at creating economic value to improve process productivity.

Hybridity characterizes both the ecosystem orientation and innovation generated in the system itself. Entrepreneurial organizations who are part of the ecosystems display a

hybrid orientation to socio-economic value generation. These elements are clearly shown in the TSI case (Q. 1–3).

> *(1) "We must never forget that MIND is a project that has a dual nature. It is a project of public interest, wanted and supported by public institutions, and it is also a project that must have its own economic and financial sustainability. This dual nature naturally leads us to pay particular attention to the territory and the desire to make an effective contribution to the development of an area, the Milanese and Lombardy, which represents a perfect habitat in which to enter with this hybridity." (CEO—Arexpo, MIND)*

> *(2) "The ecosystem wants to generate value in a double direction, that of social impacts for citizens, in particular on the issues of life sciences and of the smart city of the future, as well as in a direction typically linked to economic results and the improvement of processes' productivity." (President Triulza Foundation, MIND)*

> *(3) "What we care about is a concept of hybridization, a hybrid ecosystem, which reaches its value as a cross between profit and non-profit, this is also a little bit the role of Torino Wireless was born to work with profit, therefore it has logic with attention to productivity." (Cluster Manager—Torino Wireless, TSI)*

Social entrepreneurial organizations play a hybridizing role for the entire innovation ecosystem. This attribute is deeply linked to the social entrepreneurial capacity of creating a relationship between the ecosystems and the local area where the systems are located, thus enabling a place-based innovation perspective.

This element is specifically evident in the MIND case, in which an "isolation-danger" of the district from the rest of the territory is high. In turn, the need for making the ecosystems embedded in the local area appears to be a necessary condition to enable social entrepreneurship, playing a central and effective role. Indeed, in innovation ecosystems, social enterprises might act as collectors of the societal needs relevant in the local area, to ground the ecosystems objectives of local development (see TSI case, Q. 4).

> *(4) "A problem is the poor integration with the territory because it is not that one person arrives and decides that an incubator of social innovation falls from above in a place and hopes that the place and the local operators are ready to welcome it with open arms." (Social Innovation Manager, Private Foundation, TSI)*

4.1.2. Governance

Another element emerging from thematic analysis as a fundamental driver conducive for technology transfer to social entrepreneurship is the presence of a shared and collaborative governance, both for the processes and the whole ecosystem, mostly based on partnerships between different actors.

The creation of partnerships between private and public entities in an integrated governance perspective is stressed by actors involved both in the MIND and TSI ecosystems and in the design of the technology transfer process (Q. 5 and 6).

> *(5) "Who decides who should guide the orientation of resources in the ecosystem? Does the public decide? The private decides it? Is it the public or private decision together? I think together." (Third Sector Innovation Manager and Scientific Advisor, Triulza Foundation, MIND)*

> *(6) "At the meso-level, I think that the public-private partnership is the best thing . . . where, however, it is an organ of direction and not of management. There is a big difference between the two. If a part of the money is given to us by the public, but we are talking about a social enterprise and therefore a business, it is important for the public to exercise control, but not over where and why the money was invested." (Social Innovation Manager, Private Foundation, TSI)*

More specifically, MIND is also defining its own independent juridical entity and currently relies on a more clearly defined public–private partnership governance, between public ownership (through the Arexpo Agency) and private investors in charge of realizing the infrastructure.

The entire value-creation process in both ecosystems is based on networking and collaboration. In the case of MIND, Fondazione Triulza's role in the ecosystem is that of being itself a linking organization, working with different actors of the ecosystem and fostering inter-organizational partnerships.

4.1.3. Technology Demand Induction

A third element shared by the different actors clustered in the two ecosystems is the awareness of the low technological endowment characterizing social entrepreneurial organizations. This shared perception is related to the perceived need and urgency of developing technology transfer processes but also to their inherent complexity. Such a complexity is tied to the necessity of building a technological culture in social enterprises and to the need of inducing demand for technology in social entrepreneurship.

4.2. Differences Emerged from the Cross-Case Analysis

Once we have listed the key elements emerging from both cases as those conditions that enable the technological transfer processes for social entrepreneurship, we introduced those insights revealed by the cross-case analysis concerning the key relationships intertwining between the specific characteristics of the technology transfer processes and ecosystemic models.

Interviewees in the different cases analyzed clearly show distinct perceptions on the content and object of the technology transfer processes. A first pattern in terms of the configuration of the technology transfer for social enterprises sees technology transfer as mostly covering specific "know-how" and other "intangible" assets, such as capabilities, competences and skills or specific software, as clearly stated by the President of Fondazione Triulza (Q. 7–9).

> *(7) "What is technology transfer for me . . . technology transfer is not I take and make robots in the nursery and I made technology transfer. Technology transfer is building a cultural approach . . . it means bringing your dynamics into an x-ray that you carry within the organization (I have social enterprise in mind here). Technology transfer means introducing an organizational model that tends to become more efficient through the use of time which is spared, and which is provided by technology." (President, Triulza Foundation, MIND)*

> *(8) "We run into a rigid mindset, we need processes and continuous training that makes third sector workers agile, that makes our workers agile in the economic framework and this is what in mind we must give ourselves." (President, Triulza Foundation, MIND)*

> *(9) "We should work on the cultural mindset of this sector here, then after which we can make a series of arguments on which technologies, which organizational changes. We need a cultural approach to technological innovation, then understand which technologies, which transformative changes in business models." (Innovation Manager, Private Foundation, TSI)*

In this configuration, the technology transfer process is aimed at improving the internal management of social entrepreneurial organizations, by strengthening their digital skills. In this perspective, key applications of technology transfer are exemplified by applications and software that enable "smart working", technological "marketing" initiatives (e.g., website improvement), "websites" design and programs to enhance technological literacy and expertise, as described by the cluster manager of Torino Wireless Foundation, TSI and the designer of I3S.

In this perspective, the content of "transferred technology", whenever "tangible", is mainly low-tech (Q. 11—by the President of I3P Incubator).

Furthermore, the interviewees underlined the necessity for a high level of adaptation of technologies to the specificities of social entrepreneurship.

As the President of I3P Incubator suggests (Q. 11), social entrepreneurial actors tend to require a specific technology transfer process, different from that of commercial entrepreneurial organizations.

> *(11) "It is a world in which I do not think that a traditional model of tech transfer that starts from a laboratory from a research center and offers an innovative solution on the technological frontier can work. I do not think that a product technological frontier model can already work on frontier that is thus adopted on the spot by an external subject that has a social and impact vocation." (President, I3P Incubator, TSI)*

On the contrary, a second pattern emerging from the interviews conceives the technology transfer as something different from a mere capacity building initiative (Q. 12). The technology transfer process aims at making the organization apply the hard technologies developed by research centers, academic institutions and laboratories.

> *(12) "But look, for me, technology transfer, it also means old-fashioned technology transfer for research and development. Technologies that come from research and development laboratories and that try to find an application within different institutions or organizations or whatever." (Innovation Manager, Third Sector, MIND)*

This configuration does not see the improvement of internal management processes as the main purpose (Q. 13). Therefore, the technology transfer process intends to directly improve and innovate the service or the product provided by the organization, rather than fostering its managerial structuration.

> *(13) "One thing is that technology serves to improve internal management processes, but at that point perhaps I wouldn't even talk about technology transfer. It is too easy." (Social Innovation Manager, Private Foundation, TSI)*

This theme considers technology transfer processes for social entrepreneurship as involving also "'plug and play' hard technologies" with low adaptation costs (Q. 14).

> *(14) "But look, if there were also some old-fashioned patent passages it wouldn't be bad. So for me it is no longer purely linear. I want also a bidirectional model, consistent with how the state of technological innovation is."*

In this configuration the technology transfer process is linear (Q. 15) and inherits the characteristics of the triple-helix models of technology transfer.

> *(15) "I also see a linearity with respect to what is technology transfer to the social enterprise, even if we do old-fashioned technology transfer, in my opinion, from the laboratory to the company, that is not a despicable thing." (Innovation Manager, Third Sector, MIND)*

This pattern does not perceive social entrepreneurial organizations as a specific recipient; on the contrary, it stresses an "isolation" risk of social entrepreneurship.

The third sector innovation manager (Q. 16) interviewed highlights the necessity not of emphasizing the specific characters of social entrepreneurial organizations but, rather, focusing on the commonalities between social and commercial entrepreneurship. Transfer peculiarities are generally related to organizations' sizes and to the specific sectors where they operate, rather than to the specificities posited by the social mission.

> *(16) "So I believe that there are just organizations. There are certain areas of technological innovation in which I don't see particular features, there are just companies and normal organizations!" (Innovation Manager, Third Sector, MIND)*

Innovation Ecosystem Model

Adopting a cross-case perspective, two main themes emerged in the actors' perspectives, who tend to display different views about innovation ecosystems in spite of the ecosystems they actually belong to.

A first theme sees ecosystems as a highly collaborative and participatory environment, where the matching between the demand and supply sides of the technologies acquires a central role.

In this perspective, the dialogue between the demand and supply sides is considered as the main effectiveness measure of the technology transfer processes (Q. 17) in the ecosystem.

> *(17) "I see the effectiveness of the process in the dialogue between the world of innovation supply and the world of demand. There is no lack of technology, that is there. The technology is there but it must be dropped into organizational worlds that have organizational rhythms and rhythms that are completely different from traditional companies." (Cluster Manager, Torino Wireless, TSI)*

This is why mediation emerged as a fundamental element in this first thematic pattern: the presence of mediating actors and spaces in an ecosystem is necessary to allow a proper adaptation and negotiation between the demand and supply sides.

Mediation is carried out on the supply-side technology through the presence of actors and spaces as thematic incubators and ad-hoc facilitating institutions, which support technology enterprises in understanding the needs expressed by the demand and facilitate the networking with demand organizations through targeted informative and promotional initiatives. On the demand side, mediation is enabled through a heavily weighted role attributed to network and category associations acting as representatives for social enterprises' presence and needs in the ecosystems.

In this view, the demand side of the technologies tends to play a central role in ecosystem governance; these ecosystems are mostly driven by social entrepreneurial organizations.

Moreover, actors belonging to this thematic group expressed a preference for open ecosystems models, like the engagement rules adopted by the TSI model, with a light governance structure (Q. 18), enabling the involvement of numerous and heterogeneous actors.

> *(18) "The risk, on the other hand, is to focus on managing the infrastructure, the governance must be liquid. On the other side, the equal risk is that it becomes too liquid." (Strategic Advisor, TSI)*

In this second pattern, the ecosystem is composed of a cluster of actors with a traditional R&D background close to the territorial innovation milieus where triple-helix transfer mechanisms are expected to take place. Physical proximity appears important in this perspective to allow proper knowledge and technology spillover processes in the milieu. In this context, a key role is attributed to academic- and research-intensive entities, who typically represent the technology supply side.

> *(19) "Rather than a social ecosystem based on the third sector that makes room for technological innovation, perhaps I would see the opposite more, I would see the third sector positioned within even tough and hard contexts of technological innovation." (Innovation Manager, Third Sector, MIND)*

The ecosystemic model depicted allows direct involvement of the demand-side actors (namely of SE organizations) with the technology supply side.

> *(20) "Small subjects who are convinced and give it their all. There must be the bearer of the demand for technological innovation to be directly involved, if there is too much intermediation it is not possible, there must not be too much intermediation. The distance needs to be shortened a little. The organizations go and meet directly." (Innovation Manager, Third Sector, MIND)*

The demand-side mediation is also low in this type of ecosystems. All the actors involved in the ecosystems are expected to directly work with organizations belonging to the technology supply side. The interviewees also stressed the value of a direct mutual relationship between the beneficiaries of social entrepreneurial organizations and technology-intensive actors.

Overall, if, on the one hand, a first thematic pattern emerged, which gives more attention to the idiosyncratic specificities of technology transfer for social entrepreneurship, it would depict an ecosystem model specifically suited for these organizations; the second theme focuses on the re-orientation of the existing models and structures of R&D-driven ecosystemic models toward societal goals.

After appropriate triangulation with the documents and observations, we can conclude that the first configuration of the ecosystem for technology transfer to social entrepreneurship may be regarded as similar to the TSI experience, consistent with I3S's primary goal of developing internal "digital skills" in existing organizations.

Conversely, the second configuration appears more similar to the Social Innovation Academy and to the MIND model of a science park, where the relevance of the mainstream technology-intensive actors couples with a more structured governance and territorial proximity. The technology transfer processes shown by the Social Innovation Academy aim at developing "social-tech" entrepreneurial forms, which are thus technologically advanced in their core business.

4.3. Comparison with the Case of French PTCEs

To further support the interpretation of the results emerging from the two Italian cases, which are in an embryonic stage, we compared these insights with data concerning the more established experience of the PTCEs.

According to the surveyed knowledgeable informants, the role of the innovation ecosystem is tied to the generation of socio-economic hybrid value suitable to local development, leveraging on place-based resources and fostering local social innovation initiatives.

The goal of PTCEs, thus, is to stimulate forms of cooperation between heterogeneous actors, enabling social innovation. PTCEs share a highly horizontal and non-pivotal governance, given the inherent cooperative goal of their structure. Moreover, the main performance indicators of the ecosystems are related to their capacity of generating socially innovative projects involving the widest variety of local actors.

In this context, technology- and knowledge-transfer processes mostly include short-term, specific partnerships aimed at improving the internal management of social entrepreneurial organizations, such as the digitalization of their offer through websites and digital interfaces.

It is also worth mentioning that PTCEs display a high degree of recognized specificity in addressing exclusively social entrepreneurial organizations, mainly focusing on social cooperatives. PTCEs are thus focused on social entrepreneurial activities, and subsequently on the potential consumers of the technologies (the demand side).

Comparing the PTCEs' experience with the two configurations emerging from the Italian experiences, it is possible to observe a similarity with the first one, especially due to the high value attributed to the specific characters of the social entrepreneurial organizations in terms of technology and knowledge intensive transformation.

5. Discussion and Conclusions

In this paper, we explored the relationship between technology transfer processes for social entrepreneurship and the different characteristics of problem-oriented innovation ecosystems.

Drawing from two embryonic experiences in the Italian context, and one established French experience, we provide a better understanding of the features of the ecosystems that make them conducive to the technology transfer processes of social enterprises.

The level of perceptions of the peculiar characteristics of social entrepreneurial organizations appears as a key variable for inductive theory construction to distinguish different ecosystemic models and elements of technology transfer. This variable emerges inductively from our analysis, on the top of those depicted by the analytical framework.

In this perspective, ecosystemic models similar to Torino Social Impact, hosting I3S Project, appear to be fitting for the transfer of "enabling technologies" [39] to social enterprises. An enabling technology can be defined as "one that facilitates or helps a venture complement their core operations and strategic goals" [39] (p. 2). Enabling technologies can refer to social media, websites, internet pages, or specific equipment or devices. The Torino Social Impact model has the potential for being exported and replicated in regions where social entrepreneurial organizations are already deeply rooted in the local area and require marginal and gradual digitalization, mostly leveraging on their existing business models.

Conversely, the MIND model, hosting the Social Innovation Academy, appears to be more fitting for the transfer of "core technologies", characterizing proper social-tech entrepreneurship [39], which leverages on "significant and novel created innovation" [39] (p. 3) to deliver core services and products. Thus, the MIND model displays a higher potential for regions and areas ready to host novel and disruptive social entrepreneurial business models, being a hybrid and tech intensive [40].

The case studies also confirm the validity of the variables identified in the preliminary framework section. In particular, we observe that the technology development of the social enterprises is one of the functions of problem-oriented innovation systems. They also confirm the hybrid nature of such ecosystems, both in terms of the generation of hybrid (social and economic) value and orientation and in terms of mixed and collaborative governance. Moreover, they underline the value of inducting demand for technologies among social entrepreneurial organizations in the ecosystems.

Other key variables that emerged from the analysis, and which affect the relationship between technology transfer and innovation ecosystem models, are the content, the objective, the degree of induction and the degree of mediation in the transfer process.

In this perspective, key variables, partially coherent with Ghazinoory et al. and Etzokowitz and Leydesdorff [8,23], such as the transfer content, its purpose coupled to the degree of mediation and facilitation in the relationship between the technology supply and demand sides, appear to be linked to the perceived "peculiarity" features of social entrepreneurship in terms of technological development compared to commercial entrepreneurship.

These variables may be associated with different models of innovation ecosystems inspired by territorial innovation systems or alternatively by socio-technical systems.

The abductive approach adopted in the study allows for the explication of key propositions for a grounded theory, which we hope will be tested by further empirical research.

(1) The hybrid orientation and the collaborative governance of ecosystems, along with a certain degree of induction of the demand for technologies among organizations, appear as necessary elements for fostering technology-transfer processes for social entrepreneurship.

(2) Technology-transfer models of intangibles and soft and low technologies aimed at improving the internal management of social entrepreneurial organizations appear to fit models similar to socio-technical systems, displaying a primacy of social value, unstructured governance and high degrees of openness and heterogeneity among the actors. Actors belonging to this ecosystemic model tend to stress the idiosyncratic specificity of social compared to commercial entrepreneurship.

(3) Technology transfer of tangible, hard and high technologies, aimed at directly innovating services and products, and requiring lower adaptation and supply–demand mediation, appears to fit models similar to territorial innovation systems, displaying a higher density and stronger relevance of technology supply-side actors. These ecosystems show more structured governance systems, more defined boundaries, and a lower heterogeneity among the actors. Actors belonging to this ecosystemic

model tend not to stress the idiosyncratic specificity of social compared to commercial entrepreneurship.

To sum up, the framework proposed in Figure 3 summarizes the theoretical insights into the relationship between innovation ecosystem models and technology transfer processes, consistent with the inductive results obtained from the case analysis, thus opening the path to the development of new theoretical and practical approach to the topic.

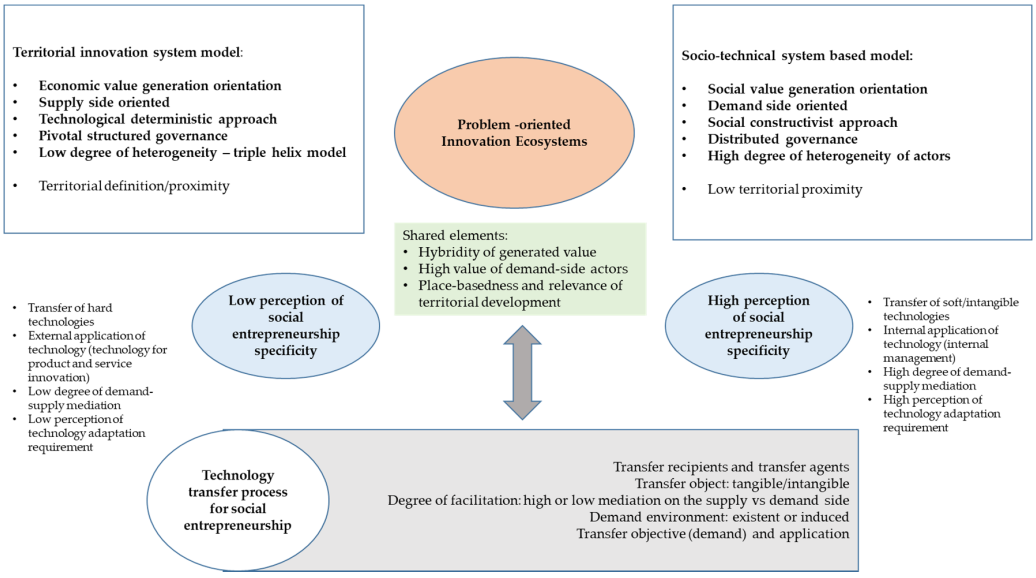

Figure 3. Revised abductive framework.

Through this exploratory study, we contribute to three main streams of literature in the fields of innovation and entrepreneurship.

First, from a neo-Schumpeterian perspective, we contribute to the literature about grand-challenge- and problem-oriented innovation, both concerning policies and ecosystems, by empirically deepening the knowledge about a key function of grand-challenge- and problem-oriented innovation [2,3]: the development of technological and social entrepreneurship. [8,16,41,42].

Second, we advance the social entrepreneurship literature by investigating how social enterprises might be supported to exploit the potential of technologies to increase their effectiveness and impact [40] and how the emergence of a new entrepreneurial genre, social-tech entrepreneurship [9,10,42], could take place.

Third, we contribute to extend the literature on technology transfer processes with a specific focus on technology for sustainable development and for social and environmental purposes [25,28], widening the knowledge concerning the interactive process that characterizes multiple helix innovation models [21,22].

The paper has several practical implications.

Firstly, it offers important insights to policymakers working in the field of innovation and science policies aimed at grounding a new generation of challenge-oriented innovation policies. These novel policies may be based on the development of local ecosystemic experiences suitable for developing social-technological forms of entrepreneurship.

Secondly, the study also displays clear implications for the members of innovation ecosystems, such as technology- and knowledge-intensive entrepreneurs, social entrepreneurs and technology- and knowledge-transfer officers. Through this study, we also aimed at providing insights for research and development managers, enabling them to identify the key elements for fostering technology transfer processes and addressing social entrepreneurial organizations.

Despite the contribution potential of the study, the embryonic stage of the two Italian cases of innovation ecosystems, which are designing technology transfer processes for social entrepreneurship, allowed us to conduct only a preliminary study on the topic, which provides a first grounding for theory development on the relationship between innovation ecosystems and technology transfer for social entrepreneurship, thus paving the way for a novel avenue of research.

Therefore, further empirical research involving cross-country comparisons at the European and global level might improve the validity of the inferences and depict the appropriate and inductively grounded theoretical insights about the conditions, to be included in an innovation ecosystem, that are conducive elements for technology transfer models for social entrepreneurial organizations.

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Appendix A

Table A1. Main Secondary Data Sources used in case analysis.

Main Secondary Data Sources	
Source	**Link**
Compagnia delle Opere website	https://www.foe.it/centro-servizi/fondazione-triulza-concorso-a-city-in-mind-per-gli-alunni-del-primo-ciclo-della-lombardia
Fondazione Triulza website	https://www.fondazionetriulza.org/it/news/2018/03/19/officina-dellimpatto-sociale-e-ambientale-per-sito-arexpo-milano/3740/
Fondazione Triulza website	https://www.fondazionetriulza.org/it/page/beeurope/1179/
Fondazione Triulza website	https://www.fondazionetriulza.org/it/page/human-factory-ricerca-e-societa-civile-per-linnovazione-sociale/1174/
Fondazione Triulza website	https://www.fondazionetriulza.org/it/page/social-innovation-academy/1184/
Fondazione Triulza website	https://www.fondazionetriulza.org/it/page/fondazione/60/
Fondazione Triulza website	https://www.fondazionetriulza.org/it/page/missione/61/
Fondazione Triulza website	https://www.fondazionetriulza.org/it/page/progetto-per-expo/62/
Fondazione Triulza website	https://www.fondazionetriulza.org/it/foundation/
Fondazione Triulza website	Statuto
MIND website	https://www.mindmilano.it/en/fondazione-triulza/
MIND website	https://www.mindmilano.it/en/the-vision/
MIND website	https://www.mindmilano.it/en/legacy/
MIND website	https://www.mindmilano.it/en/the-context/
MIND website	https://www.mindmilano.it/en/masterplan/
Start-up Business website	https://www.startupbusiness.it/perche-cariplo-factory-e-importante-nel-progetto-mind/102356/

Table A1. *Cont.*

Main Secondary Data Sources	
Source	**Link**
Fondazione Triulza	List of Candidate Enterprises (Internal Document)
Vita Magazine website	http://www.vita.it/it/article/2020/02/06/la-sfida-social-tech-di-mind/153985/
Vita Magazine website	http://www.vita.it/it/article/2020/01/28/a-milano-con-il-social-innovation-campus-la-tecnologia-risponde-ai-bis/153892/
Vita Magazine website	http://www.vita.it/it/article/2020/02/04/piu-crescita-e-piu-benessere-con-la-trasformazione-digitale/153963/
TSI website	https://www.torinosocialimpact.it/en/
TSI website	https://www.torinosocialimpact.it/en/who-we-are/
TSI website	https://www.torinosocialimpact.it/ecosistema/categorie/ricerca-innovazione-trasferimento-tecnologico/
Torino Social Innovation website	http://www.torinosocialinnovation.it/nasce-torino-social-impact-sociale-tecnologia-e-finanza-per-lo-sviluppo-sociale-ed-industriale-della-citta/
Torino Wireless website	https://www.torinowireless.it/certificazioni/
Torino Wireless website	https://www.torinowireless.it/chi-siamo/
Torino Wireless website	https://www.torinowireless.it/cosa-facciamo/
Torino Wireless website	https://www.torinowireless.it/nasce-torino-social-impact/
Torino Wireless	I3S Presentation (Internal Document)
Ministère de l'Économie, des Finances et de la Relance website	Présentation des Pôles territoriaux de coopération économique (economie.gouv.fr)
Coorace website	Pôles territoriaux de coopération économique | Coorace

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