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From design to evolution: A four essay thesis on the dynamics of innovation intermediaries

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Thèse présentée en vue de l'obtention du grade Ph. D. en administration (option Management, stratégie et entrepreneuriat)

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From design to evolution: A four essay thesis on the dynamics of innovation intermediaries

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Résumé

L'innovation est devenue de plus en plus distribuée, participative et décentralisée, suscitant un intérêt croissant pour les intermédiaires d'innovation comme moyen de connecter des activités disparates tout en fournissant les ressources, services et conseils essentiels pour stimuler les collaborations multidisciplinaires et accélérer la commercialisation des nouvelles technologies. Au cours des dernières années, la recherche sur les intermédiaires d'innovation est devenue plus interdisciplinaire au point qu'il en résulte un manque de définition commune, ainsi qu'un cadre général permettant de guider les praticiens œuvrant au sein de ces organisations. En effet, ceux et celles qui souhaitent mettre en place ces organisation de soutien à l'innovation trouveront notamment peu de références sur la façon de gérer, de développer et d'évaluer leurs activités. De ce fait, cette thèse vise à explorer les dynamiques des intermédiaires l'innovation à travers quatre études interdépendantes. La première étude présente une revue systématique de la littérature avec un accent particulier sur les rôles qu'ils tiennent, les défis auxquels ils sont confrontés et la valeur qu'ils créent. L'article se termine par une évaluation critique de l'état actuel de la littérature en mettant en évidence plusieurs domaines clés pour l'avancement de la recherche sur les intermédiaires d'innovation. La deuxième étude adresse le design organisationnel des intermédiaires en identifiant les éléments qui caractérisent le « Living Lab » comme une approche pour structurer l'innovation ouverte axée sur l'utilisateur. La troisième étude complète la seconde en mettant en avant le rôle des Living Labs comme intermédiaires pour faciliter la diffusion des technologies numériques émergentes en santé. La quatrième étude passe de la conception à l'évolution, complétant les trois premières recherches, en montrant la façon dont ces intermédiaires s'adaptent aux demandes émergentes de leur écosystème. À travers une analyse de cas, ce travail retrace l'évolution d'un incubateur qui est parvenu à soutenir sa propre croissance ainsi que celle de ses résidents en plein contexte de crise. Cette thèse contribue au final à la recherche sur la gestion de l'innovation et offre de nouvelles perspectives sur une constellation d'organisations qui sont de plus en plus présentes dans le monde organisé.

Mots clés : Intermédiaires de l'innovation, design organisationnel, gestion de crise, incubateurs d'entreprises, Living Labs, écosystèmes d'innovation

Méthodes de recherche : Revue de littérature, Recherche qualitative, Meta-ethnographie, Étude de cas

Abstract

Innovation activities are becoming increasingly more distributed, participatory and decentralized. The growing awareness to this phenomenon has spurred great interest in innovation intermediaries as a way to connect these seemingly disparate activities while also extending essential resources, services, and guidance to stimulate multidisciplinary collaborations and expedite the commercialization of new technologies. In recent years, scholarship on innovation intermediaries has become more interdisciplinary to the point that there has been a lack of a widely recognized definition and acknowledged framework to guide practice. Thus, those willing to actually set up these support entities will find limited reference models on how to manage, monitor, and benchmark their activities. To this end, this dissertation sheds light on the underlying dynamics of innovation intermediaries through four interrelated studies. The first study presents a systematic review of the literature with a particular emphasis on the roles they assume, the challenges they face, and the value they provide. The paper concludes with a critical assessment of the current state of the literature by highlighting key areas shown to be the most challenging for the advancement future scholarship in this area. The second study focuses on their organizational design by delineating the main building blocks that characterize the "Living Lab" as a prominent approach to structure and promote user-centric innovation. The third study extends the second by showcasing the role of living labs as intermediaries for facilitating the diffusion of emerging digital technologies in healthcare. The fourth study moves from design to evolution, complementing the other three by illustrating how intermediaries effectively adapt to emerging demands and priorities. Through an inductive case analysis, this work traces the evolution of a business incubator as it manages to balance its own growth with that of its resident entrepreneurs amid a series of crisis-related disruptions. Taken together, this dissertation extends the growing body of work on innovation management in the era of ecosystems and offers novel insights into the underlying dynamics of a relatively new constellation of organizations that is becoming ever more theoretically and practically relevant.

Keywords : Innovation intermediaries, organizational design, crisis management, business incubators, Living Labs, innovation ecosystems

Research methods : Literature review, Qualitative, Meta-ethnography, Case study

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List of abbreviations

II	Innovation intermediaries
LL	Living labs
VC	Venture capital
MedTech	Medical technology
ROIR	Return on investment
PPPs	Public-Private Partnerships
TTOs	Technology transfer offices
CEO	Chief executive officer

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Chapter 1 Introduction

1.1 General overview

Within contemporary scholarship on innovation management, the least visible actors are intermediary organizations—entities that operate within pre-commercial gaps between the initial conception of an idea up until its successful implementation (Clayton, Feldman, & Lowe, 2018; De Silva, Howells, & Meyer, 2018; Howells, 2006). Though intermittently, these organizations have been traditionally supported by large welfare states driven by the desire to foster economic and social development at the local level. The successive evolution of innovation intermediaries was further guided by public-private partnerships (PPPs) under the conviction that such initiatives are essential to support the commercialization of scientific research, and with it, the primary actor responsible for the transfer of technology to market: the entrepreneur.

Perhaps, the most influential theoretical framework to illustrate the idea behind intermediaries and popularize it among policymakers is the Triple Helix¹ innovation model (Etzkowitz & Leydesdorff, 2000; Kodama, 2008). Although this model has indeed rendered innovation intermediaries more visible, it has been limited by its unique focus on the linkages between a trilateral innovation system (McAdam & Debackere, 2018; Ratinho, Amezcua, Honig, & Zeng, 2020) restricting the role of intermediaries to connecting universities, industries and the government. Recent academic interest in ecosystems has recast intermediaries as a central construct in innovation management². From this perspective, innovation is no longer understood to emerge independently from

¹ This Triple Helix model suggests that regional innovation is essentially driven by the strategic collaboration between universities, industry, and government. Innovation intermediaries play a leading role in streamlining this collaboration.

² In contrast to disintegrated innovation models, the ecosystem construct recognizes the micro-dynamics of innovation activities and captures the mix of locally-embedded actors, institutions, and artifacts required for the development and commercialization of research and scientific knowledge. The absence of any formal hierarchical control, coupled with high degrees of interdependence between ecosystem components renders the role of intermediaries more pronounced in the innovation process (see e.g., Adner, 2006; Adner & Kapoor, 2010; Jacobides, et al., 2018).

R&D labs and "Silicon Valley garages" (Atkinson, 2020: 1), but is rather the result of coherent efforts between a range of locally-embedded actors, institutions, and artifacts whose actions (and interactions) shape the technology development trajectory (Adner & Kapoor, 2010; Jacobides, Cennamo, & Gawer, 2018). Thus, innovation intermediaries offer a way to integrate these seemingly disconnected ecosystem components and open up new avenues of inquiry into both, strategy-related issues, such as how to reduce the costs associated with opening up the innovation process³ (e.g., Katzy, Turgut, Holzmann, & Sailer, 2013; Lee, Park, Yoon, & Park, 2010; Lopez-Vega, Tell, & Vanhaverbeke, 2016) as well as more fundamental policy-related questions regarding ways to boost economic activity through entrepreneurial action (e.g., Kivimaa, 2014; Ratinho, et al., 2020).

In practice, innovation intermediaries have been recognized under different names. For the most part, technology transfer offices (TTOs) traditionally played the major role in facilitating the translation of science-based innovation across the universityindustry boundary (Rothaermel et al., 2007). Their role has been central to the birth of many modern technologies and academic start-ups, but was mostly limited to the commercialization of research conducted inside universities. Over the years, different forms of entrepreneurial support organization (e.g., business incubators, accelerators, and science parks) started to emerge driven by the desire to support a wider range of ventures across industries. These organizations have offered an array of support services related to resources provision (e.g., financial and in-kind), mentorship (e.g., idea development, business model formation, and commercialization strategies), and basic infrastructure (e.g., co-working spaces and facilities). They have, therefore, been recognized as important intermediaries in revitalizing regional innovation ecosystems serving as network bridges for nascent entrepreneurs on the one hand, and sources of business opportunities for investors/resource providers on the other. More recently, the widespread

³ The innovation process refers to the sequence of events that unfold as new ideas are conceived, developed, and implemented over time. Many authors have looked at this process by attributing varied importance to these events by renaming and grouping them according to the context of their study. In this dissertation, I build on the three-stage innovation model presented by Garud, R., Tuertscher, P. and Van de Ven, A.H., (2013) in their review of the literature: (1) the recognition, research, and generation of novel ideas; (2) the development or exploitation of these ideas; and (3) the implementation, evaluation, and diffusion of the most promising ones.

adoption of open-innovation practices has spurred interest in new forms intermediaries (e.g., living labs, technology brokers, and private innovation agencies) that specialize in facilitating multilateral collaborations and knowledge exchange. What unites these various intermediaries is not their organizational form *per se*, but rather their key supportive role in the innovation ecosystem as a liaison between different stakeholders, motivating them to work together to leverage emerging opportunities.

Though questions remain about their effectiveness (e.g., Bergek & Norrman, 2008; Blair, Khan, & Iftikhar, 2020; Gimmon & Levie, 2021; Paskaleva & Cooper, 2021), innovation intermediaries have become too numerous to ignore. Early research estimates their numbers by the tens of thousands worldwide and that number seems to be steadily growing over time. For example, Hathaway (2016) estimates that the number of U.S.based business accelerators was growing by an average of 50% each year between 2008 and 2014. Similarly, the Global Coworking Survey⁴ reports that the number of coworking spaces alone has risen from 160 to over 19,000 in just over a decade (Howell, 2022). Similar trends can also be observed for other forms of intermediaries, such as business incubators, living labs, and science parks, to name a few (see e.g., Bergman & McMullen, 2021; Leminen & Westerlund, 2019; Ng, Appel-Meulenbroek, Cloodt, & Arentze, 2019). Their rapid proliferation across the globe—and clearly their growing share of public spending—provide theoretical and practical motivation to understand what exactly we are talking about when we talk about innovation intermediaries, and perhaps more importantly, how these entities are being developed, monitored, and sustained over time. This raises important questions concerning the underlying dynamics of innovation intermediaries, which are the subject of this dissertation.

1.2 The logic behind innovation intermediaries

Intermediation in the innovation context is broadly viewed as a special form of collaborative arrangement composed of loosely coupled coalitions, each with a potential

⁴ Deskmag, 2019: <u>https://www.deskmag.com/en/2019-global-coworking-survey-market-reserach-study</u>

to contribute to the innovation process by providing distinct, yet complementary assets, knowledge, and resources. Though many innovation networks do evolve naturally as *"actors make choices about who to connect with…without guidance from any central network agent"* (Kilduff & Tsai, 2003: 90), others are intentionally designed by an intermediary organization whose role is to foster linkages between organisations, share resources and knowledge about certain technologies, and provide advisory services to managers and policymakers (Howells, 2006a; Human & Provan, 2000). Such innovation strategy facilitated by intermediaries typically thrives in situations where the sources of industry expertise and specialized knowledge are widely dispersed and complex to articulate (Powell, Koput, & Smith-Doerr, 1996; West & Bogers, 2014) and in collaborations whose nature and direction are highly uncertain and poorly understood even by the stakeholders themselves (Agogué et al., 2017).

To date, the main body of work on innovation intermediaries has devoted considerable attention to describing what forms they take (e.g., Diener, Luettgens, & Piller, 2020; Howells, 2006a; Katzy et al., 2013), what services they provide (e.g., Barbero, Casillas, Ramos, & Guitar, 2012; Diener et al., 2020; Ng et al., 2019), what practices they support (e.g., Agogué et al., 2017; Agogué, Yström, & Le Masson, 2013; Apa, Grandinetti, & Sedita, 2017; Bøllingtoft, 2012; Kokshagina, Le Masson, & Bories, 2017; Traoré, Amara, & Rhaiem, 2021), and to what extent they tend to yield desired outcomes (e.g., Gimmon & Levie, 2021; Kivimaa, 2014; Kodama, 2008; Paskaleva & Cooper, 2021). While this work has rendered the role of intermediaries more pronounced in this literature, the development of a common theoretical foundation has been limited by the predominant focus on specific intermediation outcomes (e.g., technologies developed, products launched, and ventures created) rather than on the intermediation process itself and the way it unfolds over time and across contexts (De Silva, et al., 2018; Gamber, Kruft, & Kock, 2020; Kant & Kanda, 2019). Thus, it is interesting to note that our understanding of the value-creating potential of innovation intermediaries has largely outpaced our understanding of the dynamics that underpin their effective functioning (e.g., organizational design, objectives, processes, innovation-support philosophy, and evolution⁵). Ignoring these dynamics can be problematic for at least two reasons.

First, a static depiction of intermediaries sidesteps important decisions regarding the balance between value creation and value capture, a topic of much current interest in research and practice. So far, the central focus in the literature has been on the value created by intermediaries to other organizations (e.g., businesses, clients, and entrepreneurs). Yet, decisions over how value can be properly appropriated by intermediaries themselves in the context of their engagement in collaborative innovation (De Silva et al., 2018) also hold important implications on the way the collaboration process unfolds (Chesbrough, Lettl, & Ritter, 2018: 931). As prior studies suggest (e.g., Kant & Kanda, 2019; Kim & Wagman, 2014; Miller, McAdam, & McAdam, 2018), many of these decisions are loaded with trade-offs between what is best for collaborating partners, what is best for intermediaries, and what is best for sponsors institutions, with the interests of the latter often taking precedence (Bergman Jr, 2021).

Second, ignoring these dynamics assumes a uniform representation of intermediaries in the innovation ecosystem. Indeed, not all intermediary organizations operate under the same objectives (Bergek & Norrman, 2008) or at least most of them tend to articulate their priorities differently (Bøllingtoft & Ulhøi, 2005). Thus, recognizing idiosyncratic differences in the characteristics, purpose, and design structures between these support entities enables us not only to improve our theorizing about the different roles they have in addressing emerging innovation-related challenges, but also to better understand their synergetic contribution to improving a region's innovation capacity (Cohen, S. et al. 2019, Kivimaa, et al. 2019). Overlooking such organizational differences

⁵ Although recent work suggests that at least some intermediary organizations adapt their value proposition to the evolving needs of their stakeholders, when and how they are able do so in general remains unclear. The most documented account is that of the evolution of the business incubation model over time. As illustrated by Pauwels, et al. (2016), the first generation of incubators focused primarily on providing office space and financial support to selected entrepreneurs. Over time, the model has gradually shifted toward more intangible value-added services such as mentorship, business support, and networking services. This shift has ultimately given rise to accelerators, which exemplifies the most recent generation of incubation models.

only depicts a fragmented picture of the role of intermediaries in the ecosystem and provides an improper basis for evaluating and benchmarking their performance.

To this end, insights from the literature only partly help us to understand why the effectiveness of intermediaries has remained largely controversial. Addressing this issue is critical not only to understand how to better manage and monitor the performance of these entities over time, but also to ensure that they continue to provide unique, yet complementary services to the broader ecosystem in which they operate. Thus, to fully appreciate the practical and theoretical significance of innovation intermediaries, it is, therefore, important to recognize how these organizations emerge, develop, and operate internally. I examine this question through four tightly related studies (Table 1.1).

1.3 Summary of the individual chapters

To lay the foundations for the dissertation, the first study offers a systematic review and a constructive critique of the literature on innovation intermediaries. By reflecting on how innovation intermediaries have been studied to date, I present some major research gaps that could provide an impetus for future work in this area. First, I argue that the literature to date has lacked a clear theoretical framework for explaining the casual mechanisms underlying the intermediation process. Studies tend to focus on specific mechanisms while neglecting others. What is still lacking is a clear understanding of explicit causal relationships to disentangle what causes what and how different intermediation mechanisms yield different outcomes. Second, researchers have expressed a strong support for an evolutionary perspective of intermediaries, yet there is no universal agreement about the factors guiding their emergence/evolution and the process by which they develop over time. Third, there is also very little discussions on how intermediaries can manage the interplay between value creation and value capture, even though this is becoming increasingly essential to sustain their key supportive role in the innovation ecosystem. Finally, I detect a need for stronger methodological approaches for empirically capturing the performance of intermediaries in a theoretically meaningful way.

Insert Table 1.1 about here

The second study builds on the insights provided by the first to shed light on one particular form of intermediaries that have enjoyed a considerable interest over the past decade: the "*Living Lab*". Broadly defined as user-centred innovation ecosystems for the co-creation of complex solutions in real-life contexts, living labs have become a very well-known, but a poorly understood concept. Despite their proliferation, only few studies have focused on how to actually set up these innovation-support entities and monitor their underlying activities. As a result, the management of living labs has seemingly become a "trial and error" process rather than a systematic and professionally-managed endeavor. This study presents a practical, yet theoretically-driven approach for organizing and managing living labs. A meta-synthesis of 38 successful cases presented as notable examples in the literature reveals eight design elements that underlie four ideal living lab models, each characterized by a unique value proposition driving their design structures. This analysis is further substantiated by an empirical examination of a MedTech living lab for illustrating the dynamic nature to what is seemingly presented as a static typology.

To better unpack the intermediation process, the third study moves from organizational design to implementation by investigating how intermediaries support the diffusion of emerging technologies. This study is based on an in-depth case study examining the role of intermediaries in overcoming innovation-related challenges (e.g., technical, operational, institutional) facing the healthcare sector in Montreal, Canada. Interviews with 85 leading actors in the ecosystem, coupled with supplementary discussions, meetings, and follow-ups reveal two interrelated intermediation processes facilitating the effective diffusion of technologies: (1) "technology-focused intermediation" to help co-create the technology in accordance with existing demand; and (2) "ecosystem-focused intermediation" to help reinforce ecosystem components for enabling effective implementation. Each of these processes is underpinned by a range of sourcing, mobilizing, and scaling activities intended to align the technology development trajectory with envisioned sociotechnical requirements.

The final study turns to the attention to the evolutionary dynamics of intermediary organizations, particularly in response to crisis-induced challenges, and asks: why do intermediaries differ in their capacity to adapt to radical shifts in business demands? This question is important because whether or not intermediaries are able to evolve and proactively adapt to emerging environmental conditions (such as shifts in demands, adverse market pressures, and changes in regulations) can have a significant impact on their long-term performance. Drawing from an in-depth case study tracing the evolution a business incubator as it manages to respond to emerging regional priorities in the midst of the Lebanese crisis, I investigate what role do intermediaries play in such context, what major challenges they are likely to face, and how do they differ in their capacity to intervene in stimulating a gradual recovery. Results indicate that the accumulated set of experiences, processes, and learned behaviors that develop over time from actively managing the innovation process within emerging organizations (i.e., business support capabilities) enable intermediaries to become more responsive to evolving market opportunities/threats, thereby contributing simultaneously to fostering the resilience of individual ventures (i.e., local businesses) as well as that of the broader ecosystem. This study extends prior work on organizational sponsorship by highlighting an underexplored reciprocal relationship where the act of supporting businesses itself can provide unique capabilities to organizations providing this support.

1.4 Contributions of the dissertation

Findings from this dissertation contribute in three significant ways (Table 1.2). First, to theory by highlighting the dynamic and multi-level nature of intermediaries in the innovation ecosystem and offering an agenda for future research in this area. Second, to managers and sponsoring institutions by providing a theoretically-sound and empirically-driven model for managing and monitoring these support entities. Third, to policymakers by presenting intermediaries as an effective mechanism to enhance a region's innovation capacity and alleviate both technical and systematic constraints to innovation. -----

Insert Table 1.2 about here

1.4.1 Contribution to theory

A first theoretical contribution is to outline new opportunities for future work on innovation intermediaries by highlighting *major gaps and weaknesses* that persist in the literature. Based on a systematic review of existing research, I note four major challenges: (1) absence of a strong theoretical foundation that makes explicit the causal relations between intermediation mechanisms and innovation-related outcomes; (2) static depiction of innovation intermediaries without considering their emergence and evolution over time; (3) unclear understanding as to how the balance between value creation and value capture is achieved; and (4) absence of formal performance indicators for evaluating and benchmarking the effectiveness of intermediation activities. This review is intended to move the literature forward by offering a number of suggestions to address these challenges.

Second, this dissertation argues that intermediaries do more than just support innovation *within* ecosystems, but also support the innovation ecosystem *itself*, thereby offering a much-needed *multi-level perspective on intermediation* in the innovation context (Russo, Caloffi, Rossi, & Righi, 2019). As revealed in Chapter 4, the role of intermediaries cuts across both, the level of the technology itself (i.e., technology-focused intermediation) through influencing the technology development trajectory and the level of the ecosystem (i.e., ecosystem-focused intermediation) through motivating, equipping and supporting participants to improve their capacity to innovate, creating what some scholars refer to "ecosystem additionality" (Goswami, Mitchell, & Bhagavatula, 2018). Whereas prior work has predominantly focussed on the role of intermediaries in supporting the technology development aspect, we advance prior work by extending their role to ecosystem-level influences by highlighting their underappreciated potential for supporting higher-order system performance.

Third, this dissertation responds to recent calls for a *deeper focus on the* heterogeneity between intermediaries (e.g., Bergek & Norrman, 2008; Cohen, Fehder, Hochberg, & Murray, 2019; Osorio et al., 2019). Prior research offers a relatively uniform perspective on intermediaries in the innovation context, making it impossible to demarcate the exact scope of their activities and benchmark their performance outcomes-which is a main reason why opinions over their effectiveness might differ. Across all four studies, I highlight key distinctions between intermediaries. For example, in my second study (Chapter 3), I document several design parameters that shape the way intermediaries are managed and monitored over time, whereas in my fourth study (Chapter 5), I identify some key characteristics and processes that make them more agile in the face of evolving business demands. What can be inferred from this analysis is that intermediaries are better understood on the basis of a defined set of envisioned objectives rather than uniformly on the basis of the type of services they provide. In other words, although many intermediaries appear to be providing comparable, and at times overlapping support, they can still differ in significant ways, namely in terms of their value proposition, organizational design, and role in the ecosystem.

Moreover, this dissertation makes a strong case that innovation intermediaries should no longer be seen as "behind-the-scenes organizations" (Clayton et al., 2018: 104), but are worthy of study on their own. Despite their rising popularity (as evidenced by the review conducted in Chapter 2), very few studies address the question of how these organizations emerge, evolve, or get disbanded over time. Throughout this dissertation, I proceed to show that *innovation intermediaries are actually quite dynamic* as new models emerge and others evolve over time to become better adapted to the emerging needs of clients and entrepreneurs. The case studies presented in Chapters 4 and 5 uncover processual details on how intermediary organizations respond to the evolving needs of their ecosystems and adapt their innovation-support activities accordingly. This opens up new research avenues to investigate what factors drive the evolution of innovation intermediaries and what strategies can be employed to ensure their sustainability over time.

1.4.2 Contribution to practice

For managers, this dissertation provides a basis for setting up and managing innovation-support entities. As many businesses, universities, and research institutions are increasingly establishing some form of intermediaries to boost their capacity to innovate, insights from this dissertation help those tasked with managing such entities to avoid the common pitfall of replicating best practices instead of designing innovationsupport models around the unique objectives they intend to achieve. For example, I find that intermediaries that specialize in certain technologies tend to rely heavily on a carefully selected group of experts and are more likely to increase their chance of survival by engaging in workshops, trainings, and events to reinforce their legitimacy in the absence of key performance indicators. In contrast, intermediaries that prioritize societal challenges are more reliant on governmental funding programs, and thus tend to be more inclusive in their collaboration approach while limiting their support services to a defined set of activities that are most relevant for promoting locally-driven solutions. The framework introduced in Chapter 3, although most pertinent to living labs, serves a managerial instrument for organizing design decisions and benchmarking performance outcomes.

Findings from this dissertation also highlight key characteristics and processes that enable intermediaries to sustain their *evolution in response to shifts in environmental conditions*. A key insight is that although unexpected disruptions do pose serious challenges, they afford opportunities as well. For example, I find that organizations with an already established track record and a visible social/physical presence in a region are more likely to adapt to new market conditions as they are better positioned to identify and secure new sources of funding and respond to emerging business development needs. Moreover, new opportunities exist by resorting to alternative revenue strategies and tailoring new programs specifically to local businesses and new ventures. Thus, the management of innovation-support organizations needs to be actively attuned to the specific needs, aspirations and capacities of the local context.

Moreover, this dissertation argues that *when it comes to innovation, location still matters*. However, it is no longer confined to just a few, well-recognized places, but is

increasingly being spread across different regions around the world—a phenomenon that has been largely facilitated by the proliferation of innovation intermediaries. Thus, researchers and entrepreneurs can significantly benefit from engaging with intermediaries to tap into the capabilities embedded in their regional ecosystems. Similarly, established organizations that might have adopted a more traditional, internal-facing innovation processes in the past can rely on intermediaries to experiment with more open-innovation approaches. Either way, managers need to be aware of the strengths and weaknesses of their regional innovation ecosystem and recognize appropriate strategies that can be used to take advantage of emerging opportunities. Innovation intermediaries offer a way to facilitate access to these opportunities, but their involvement does not, in and of itself, necessarily translate into better innovation outcomes.

1.4.3 Contribution to policy

In terms of policy, findings from this dissertation suggest that the strength of a region's innovation capacity is determined, at least in part, by the *diversity and* complementarity of locally-embedded intermediaries that co-evolve over time. Intermediaries are well-positioned to bring together a range of partners, including entrepreneurs, industry actors, government agencies, and other research organizations to address innovation-related challenges or gaps in their ecosystem. However, there is also the potential for different intermediaries to collaborate and work together to maximize their collective impact. As pointed out in Chapter 4, regional intermediaries benefited a lot from collaborating closely to overcome technical and systematic constraints to innovation diffusion, rendering local institutions more competitive at the national (and international) scale. Thus, it might not simply be that the collective contribution of intermediaries to their ecosystem is additive, but rather the result of synergetic efforts stemming from the unique, yet complementary services that each can provide (Clayton et al., 2018). Policy should, therefore, take into consideration appropriate strategies for fostering the collaboration and alignment between intermediaries while ensuring they continue to provide unique support to their broader ecosystem.

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	Study 1	Study 2	Study 3	Study 4
Research question	How have researchers examined innovation intermediaries to date and where the gaps are?	How can intermediaries be effectively organized to promote user- centric innovation?	How do intermediaries support the diffusion of emerging digital technologies?	Why do intermediaries differ in their capacity to adapt to radical shifts in market demands?
Methodology	Systematic literature review	Meta-ethnography + Empirical illustration	Qualitative case study	Qualitative case study
Key findings	Four major areas for the advancement scholarship in this domain	Eight design elements that underlie four ideal models; each model is underpinned by a unique value proposition	Two interrelated processes supporting the diffusion of emerging technologies: (1) technology-focused intermediation and (2) ecosystem-focused intermediation	The capabilities that develop over time from repeatedly managing innovation-related activities render intermediaries more responsive to evolving business demands

Table 1.1. An integrated view of the four studies in the dissertation

Table 1.2. Contributions of the dissertation

Contribution to theory

Offers a review and a constructive critique highlighting major gaps and weaknesses in the literature

Advances a multi-level perspective on the role of intermediaries in the innovation context

Provides a deeper focus on the heterogeneity between intermediary organizations Points to the dynamic nature of intermediaries that evolve over time in response to emerging needs and

challenges

Contribution to practice

Offers a basis for setting up and managing innovation intermediaries

Outlines key factors that render intermediaries better able to respond to evolving innovation challenges Argues that access to intermediaries, while helpful, does not necessarily translate into better innovation outcomes

Contribution to policy

Calls for a greater recognition to the diversity and complementarity of intermediaries as a means to enhance a region's innovation capacity

Chapter 2 Innovation intermediaries: Review, synthesis, and critical assessment of the literature

Abstract

Innovation intermediaries (IIs) have attracted increasing attention over the past decade and have grown substantially in number and importance. In this paper, we reflect on this rapid growth to review the literature on IIs, document its major findings, and present our line of critique around key areas, which we argue have limited its theoretical and practical utility to this point. While promising efforts are being directed at justifying the significance of intermediaries to contemporary innovation management, the literature continues to struggle to overcome its conceptual proliferation, fragmentation, and phenomenally-based nature. In support of continued advancement in this area, we encourage more attention to (1) sharpening the theoretical foundations of intermediation in the innovation context, (2) investigating the evolutionary dynamics of intermediary organizations, (3) exploring the interplay between value creation/value capture strategies, and (4) promoting stronger methodological rigor for evaluating and benchmarking performance outcomes.

Keywords: Innovation Intermediaries; Business/Innovation Ecosystems; Open-Innovation; Literature Review

2.1 Introduction

Innovation intermediaries (IIs)—entities that provide a supportive role during various stages of the innovation process—have enjoyed a growing interest on the part of academics and policymakers alike. While heralded for their transformative potential and relevance as a tool for fostering the commercialization of science (Clayton et al., 2018; Merindol, Le Chaffotec, & Versailles, 2021), catalyzing the development of new technologies (Madaleno, Nathan, Overman, & Waights, 2021; Osabutey & Croucher, 2018), and promoting productive entrepreneurship in a region (Bergman & McMullen, 2021; Goswami et al., 2018), IIs have also been subject to considerable criticism and numerous debates that have potentially undermined their theoretical and practical significance (e.g., Engels, Wentland, & Pfotenhauer, 2019; Paskaleva & Cooper, 2021). This paper steps back and offers a systematic review and a constructive critique of the literature. We reflect on how researchers have examined IIs to date, document the key findings that emerged from prior research, and present some major limitations that could provide an impetus for future work in this area.

Three main observations motivate this review. The first is driven by the increasing number of studies analyzing IIs across different contexts and levels of analysis with limited connections between their common findings. As a result of this fragmentation, this stream of research runs the risk of becoming internally disconnected and potentially incoherent. In our review, we integrate key insights from earlier work while emphasizing the multi-level nature of the intermediation in the innovation context. The second reason is that research on IIs tends to be centered around few particular topics (e.g., knowledge exchange, technology development, and innovation diffusion) with the results emphasizing certain relations while ignoring others. This review identifies some of important gaps that persists in the literature and highlights fruitful areas in need of future scholarly attention. Finally, while intermediation in the innovation context is a phenomenon and not a theory *per se*, this stream of research remains heavily undertheorized with no clear causal relationships between intermediation mechanisms and innovation outcomes. Accordingly, this review is an attempt to synthesize the debate

around the common threads that underlie the II construct and to promote more theory building efforts within this rapidly evolving literature.

First, we ask "what are IIs?". We start our review by unpacking the II construct and tracing its conceptual foundations. We then ask "what do IIs actually do?" Despite the fragmentary nature of the literature, we detect three broad theorizing and research perspectives on the roles of intermediaries in the innovation context: (1) brokers for facilitating the direct exchange between suppliers and customers of knowledge and technologies; (2) orchestrators tasked with creating the right conditions to innovate; and (3) sponsors for accelerating the development of specific innovation projects or new ventures. Next, we explore "what added value do IIs provide?" Across the reviewed studies, our analysis reveals that the value provided by IIs materializes across three levels: (1) individual firms and reflected by improvements in traditional firm performance measures (e.g., profits, growth, and survival); (2) networks as evidenced by changes the quality and quantity of connections between network actors; and (3) ecosystems that is determined by macro-level economic development indicators (e.g., new venture creation, job growth, and innovation diffusion). And fourth, we ask "what challenges do IIs face while undertaking their supportive roles?" Our analysis of this literature also reveals three broad sets of challenges: (1) temporal, which stems from the misalignment (or time lag) between the time when intermediation activities are initially performed and the time when the results are achieved; (2) governance, which deals with the challenges involved in coordinating between various stakeholders, most of which are beyond the intermediary's direct control; and (3) efficiency, implying that there is no standard way to determine the efficiency of IIs and the "return on investment" these entities provide.

While this work has rendered the role of intermediaries more central to contemporary innovation management research, it has also uncovered some weaknesses that persist in this stream of research. To this end, we conclude our review by outlining the main critiques that emerged from our synthesis of empirical findings from the literature. First, we argue that the literature on IIs remains heavily undertheorized and has lacked a strong *theoretical foundation* that makes explicit what intermediation activities are about. Indeed, this work has produced a long list of mechanisms that are important for

supporting innovation-related activities, but it is not entirely clear how and under what conditions these mechanisms are most likely to be effective in yielding a desired outcome. Second, several authors have criticized the "neutral" treatment of IIs that overlooks their *evolutionary dynamics* over time. Studies indicate that IIs are able to adapt in response to changing innovation needs, but a general understanding of the factors, processes, and contextual influences that drive the evolution of IIs is still lacking. Third, the *interplay between value creation and value capture* seems almost absent from this body of work. Indeed, the focus of this literature has been predominantly on value creation, that is the way IIs can generate value to others (e.g., clients, sponsors, entrepreneurs and the innovation ecosystem at large), however, there has been little discussion on the motives, strategies and mechanisms that enable intermediaries to capture value for themselves in the context of their engagement in supporting different innovation projects. Finally, the *performance evaluation and benchmarking* criteria remain insufficiently addressed with most measures being outcome-oriented and disintegrated with how different intermediaries manage and organize their activities

As a result, although it is well-known that intermediaries play an important role in modern innovation ecosystems, we still know relatively little about these organizations themselves and their underlying dynamics, that is the way they create, capture, and sustain value over time. We thereby highlight these four areas as promising avenues for future research. Understanding these dynamics has at least two important implications. The first is practical: being aware of the range of intermediary interventions for supporting innovation activities can help up better understand how to foster business development and expedite the commercialization of new technologies, a topic of much current interest. The second benefit is theoretical: acknowledging the supportive role of IIs in regional ecosystems opens up new avenues of inquiry into both, strategy-related issues such as how to reduce the costs associated with opening up the innovation process (e.g., Katzy et al., 2013; Lee et al., 2010; Lopez-Vega et al., 2016) as well as more fundamental policy-related questions regarding ways to boost regional economic activity through entrepreneurial action (e.g., Kivimaa, 2014; Ratinho et al., 2020).
2.2 Methodology

The term "innovation intermediaries" is often used as an umbrella term for referring to a wide denomination of organisations founded specifically for facilitating innovation-related activities (Agogué et al., 2017; Howells, 2006a). These are typically exemplified by a range of entities (e.g., technology transfer offices, innovation platforms, entrepreneurial support organizations, among others) that specialize in the provision of complementary and related services in support of the advancement of innovation. What unites these various forms of intermediaries is not their organizational form per se, but rather their position in their ecosystem as a liaison between individual entrepreneurs/organizations with potential stakeholders and resource providers (Clayton et al., 2018). However, since the vast majority of research and review papers tend to focus only on one particular form (e.g., Albort-Morant & Ribeiro-Soriano, 2016; Hossain, Leminen, & Westerlund, 2019; Howell, 2022) or on the distinction between one form from another (e.g., Bergman & McMullen, 2021; Bruneel, Ratinho, Clarysse, & Groen, 2012; Clayton et al., 2018; Osorio et al., 2019; Pauwels, Clarysse, Wright, & Van Hove, 2016), few scholars found it necessary to study IIs as an overarching class of organizations. As a result, the construct has not been applied systematically across disciplines and is often introduced without enough specificity to allow a meaningful comparison between different contributions, giving rise to its current conceptual proliferation.

To this end, we engage in a systematic review of the literature on IIs (Tranfield, Denyer, & Smart, 2003). Systematic literature reviews (SLRs) are particularly relevant for providing research-based evidence to specific questions about what works and what works best in a given context (Paré, Trudel, Jaana, & Kitsiou, 2015), which aligns with our objective of synthesizing research on intermediation in the innovation context. SLRs prioritize methodological rigor and transparency in the review process by means of minimizing the bias inherent in the identification, selection, and analysis of relevant studies (Patriotta, 2020). Consistent with this approach, we followed a series of four interrelated steps: (1) sample generation; (2) screening and selection; (3) data extraction; and, (4) synthesis.

Sample generation: To establish a relevant corpus of articles, we rely on the Web of Science (WoS) as our primary search database because of the breadth of its interdisciplinary research literature, particularly in the field of innovation management and entrepreneurship (Hillmann & Guenther, 2021; Karachiwalla & Pinkow, 2021). Given the wide array of organisation that specialize in facilitating collaborative innovation activities, we focus on the *intermediation* as a process (Johnson, Langley, Melin, & Whittington, 2007) to avoid presuming any particular form for the entity. Accordingly, our initial base query was organized into three parts, each reflecting appropriate terms and synonyms relating the core functions of intermediaries, their innovation-driven outcomes, and performance implications: ((incubat* OR accelerat* OR sponsor OR broker OR intermediat* OR "orchestrat") AND (innovat* OR creativ* OR entrepreneur* OR startup OR start-up OR ventur*) AND (performance OR effectiveness OR efficiency OR "business model" OR "value" OR design)). Once we became satisfied with the structure of the search query, we used it to search the titles, abstracts, and/or keywords of articles in our selected database. In accordance with the scope this study, we focus on papers in relevant academic disciplines such as management, business, economics, public administration, technology, information science, operations research, among others. The search was restricted to academic articles published in the English language. Taken together, this search generated a list of 2,491 research items.

Screening and selection: As a next step, we turned the attention to the content of these articles. Given the focus on the intermediation process in the context of innovation management, all papers were screened for their relevance to this particular area. For any paper to be considered as relevant to this review, at the very least, it should be able to provide some insights into the ways intermediaries can create and/or capture value from their active engagement in supporting innovation-related activities. Accordingly, papers were automatically excluded if they: (1) focus on intermediaries unrelated to the innovation process (e.g., financial intermediaries, market intermediaries or institutional intermediaries), (3) focus on online platforms as a way to encourage innovation activities (e.g., crowdsourcing and distributed problem-solving), (4) describe that specific strategies used by individual firms to engage in interorganizational collaborations (e.g., network

management strategies or competitive dynamics in ecosystems), (5) or not relevant at all (neither on innovation nor on intermediaries) but use related terms for the study of other topics. By applying these basic criteria, the initial sample was distilled into 357 relevant papers.

A more refined inclusion strategy was further developed to ensure that only relevant papers are selected. At this stage, full copies of the remaining articles were obtained and examined accordingly. All articles that do not seem to investigate or discuss IIs in a way that allows extrapolating their roles, characteristics, challenges, and/or value creating/capture potential were excluded. Typically, these articles focused on network hubs or brokers outside the innovation/entrepreneurship context (e.g., Clement, Shipilov, & Galunic, 2018; Ryall & Sorenson, 2007), on the innovative performance of firms/new ventures without reference to the role played by intermediaries in facilitating this process (e.g., Jia, Chen, Mei, & Wu, 2018), or on specific organizational strategies for attaining competitive advantage in innovation ecosystems (e.g., Bereczki, 2019). From the full review of the 357 articles, 184 were eliminated because they fell outside the scope of the study. Ultimately, the final sample comprises of 172 articles from 58 different journals. Figure 2.1 depicts the phases of our review process from initial search to final inclusion.

Insert Figure 2.1 about here

Data extraction: All papers were then compiled into an Excel database where each paper was represented in a single row while the columns display different descriptive and bibliographic details. The information extracted from each paper includes: the authors; publication title; authors; year; journal; abstract; purpose/research questions; study design; main findings; as well as the mentioned role(s) performed by IIs, the outcome(s) they achieved, and the challenges they faced while enacting their activities. The goal at this stage was to better understand and compare the findings, context, and contribution across studies in order to develop a comprehensive account of the internal dynamics of IIs and their role in facilitating the innovation process. The key findings that emerged

from these studies were carefully analyzed to determine the best approach for making sense of this dispersed literature.

Synthesis: From this vantage point, we began exploring the key elements identified in the literature that were shown to influence the underlying dynamics of IIs, that is the way these entities create, capture, and deliver value across the innovation process. For each paper, we examine (1) how intermediation was defined, (2) what were the roles performed by the intermediary organization, (2) what innovation outcome(s) resulted from the intermediation process, and (4) what were the key challenges (if any) identified by the authors that the intermediary entity faced while undertaking its supportive role in the innovation process. Each of these elements are described and evidenced more fully in the next section.

2.3 General overview

2.3.1 Unpacking the "intermediary" construct

Ils are a relatively new constellation of organizations whose central purpose is to facilitate innovation activities by promoting the active collaboration between two or more parties during various stages of the innovation process (Howells, 2006a; Lauritzen, 2017). Their significance to the broader innovation ecosystem lies precisely in their ability to bridge the gap between the initial conception of an idea up until its successful commercialization (Clayton et al., 2018). They do so via a broad range of activities that vary according to their capacity to intervene in one or more of the following functions: (1) *equipping market actors* through connecting organizations that lack the knowledge, capabilities, and resources for solving a particular problem; (2) *supporting technology transfer* through helping organizations to develop and commercialize new technologies while providing them access to potential investors, experts, and users; and/or (3) *reinforcing regional innovation ecosystems* through creating and maintaining linkages between different, yet complementary system components (Agogué et al., 2017; Kivimaa,

Boon, Hyysalo, & Klerkx, 2019; Lichtenthaler, 2013; Lichtenthaler & Ernst, 2008; Vidmar, 2021).

In contrast to network orchestrators (Dhanaraj & Parkhe, 2006), network hubs (Clement et al., 2018), or anchor firms (Spigel & Vinodrai, 2021), IIs do not take direct ownership in the innovation outcome (De Silva et al., 2018; Kant & Kanda, 2019; Katzy et al., 2013). However, they use specific orchestrating mechanisms to reduce network opacity (Klein & Wareham, 2008; Radnejad, Vredenburg, & Woiceshyn, 2017), foster collaboration (Apa et al., 2017), and facilitate resource exchange (Galvão, Marques, Franco, & Mascarenhas, 2019; Somsuk & Laosirihongthong, 2014), thereby reducing the upfront costs associated with engaging in open-innovation activities (Al-Baimani, Clifton, Jones, & Pugh, 2021; Bruneel et al., 2012). At a macro-level, intermediaries help (re)shape the relational dynamics within and across industries (Blanka & Traunmüller, 2020) facilitating to the diffusion of specialized knowledge (Billington & Davidson, 2013) and giving greater material substance to the concept of knowledge spillovers (Clayton et al., 2018)

Multiple efforts have been directed at provide a common definition of IIs and explore the intermediation process within innovation. The early work of Howells and colleagues (e.g., Howells, 2006a; Howells & Roberts, 2000) was perhaps among the most influential attempts to synthesis this disparate literature and trace its conceptual origins. This work has rendered the role of intermediaries more pronounced in the open-innovation literature. Their rising popularity in open-innovation has been equally matched in entrepreneurship research, often under the name of entrepreneurial support organizations (for a review see Bergman & McMullen, 2021; Ratinho et al., 2020). While both research streams subscribe to the same foundational principles, intermediation in entrepreneurship research tends to be more focused on new ventures as the main outcome of the innovation process (e.g., Chan & Lau, 2005; M'Chirgui, Guerfali, Lamine, & Ben Aïssa, 2015). Subsequent work has been focussed on describing what IIs are (e.g., Diener et al., 2020; Howells, 2006a; Katzy et al., 2013), what forms they take (e.g., Barbero et al., 2012; Diener et al., 2020; Ng et al., 2013; Kokshagina et al., 2017; Traoré et al., 2017; Katzy et al., 2013; Kokshagina et al., 2017; Traoré et al., 2017; Magna et al., 2017; Traoré et al., 2013; Kokshagina et al., 2017; Traoré et al., 2017; Traoré et al., 2013; Kokshagina et al., 2017; Traoré et al., 2017; Traoré et al., 2013; Kokshagina et al., 2017; Traoré et al., 2017; Traoré et al., 2013; Kokshagina et al., 2017; Traoré et al., 2017; Traoré et al., 2017; Traoré et al., 2017; Traoré et al., 2013; Kokshagina et al., 2017; Traoré et al., 2

2021), and whether or not they tend to yield desired outcomes (e.g., Kolympiris & Klein, 2017; Paskaleva & Cooper, 2021)

Despite the conceptual and methodological proliferation inherent in this literature, we can, however, discern what seems to be the main theoretical foundations underpinning this stream of research. First, it is generally assumed, with varying degrees of explicitness, that (1) intermediation is preconditioned on organizations having a need for additional resources and/or capabilities, whether financial capital, status, knowledge, or complementary assets; (2) the underlying organization/entrepreneur already has a certain resource-base through which to attract new ties and persuade potential partners to collaborate; and (3) the target stakeholders have the complementary resources and capabilities to benefit the underlying organization/entrepreneur. Second, the essence of the II construct, and its broader contribution to innovation management, lies precisely in its ability to capture the relational dynamics within and across industries. Accordingly, any added-value of intermediation will highly depend on the active collaboration between partners who perceive one another as having the greater the possibility for mutual benefit (Mindruta, Moeen, & Agarwal, 2016). Finally, as business activities are increasingly becoming more open and distributed over time, intermediaries will continue to play an essential coordinating role in forging new partnerships and linking actors, institutions, and artifacts for an innovation-driven value proposition to materialize.

2.3.2 Intermediation in the innovation context

Across the reviewed literature, our analysis reveals three overarching set of intermediation activities: *brokering* activities for facilitating exchange and interaction, *orchestrating* activities for creating the right conditions to innovate, and *sponsoring* activities for accelerating the development of specific innovative-driven projects. These activities often range from low levels of involvement which is limited to linking disparate, yet complementary actors in an innovation ecosystem (e.g., Berbegal-Mirabent, Sabaté, & Cañabate, 2012) to a more active role in supporting particular ventures, and technologies (e.g., Mian, Lamine, & Fayolle, 2016; Theodorakopoulos, Bennett, & Sánchez Preciado, 2014). Table 2.1 summarizes the different roles attributed to IIs

grouped into three overarching set of activities according to the level of involvement in the innovation process.

Insert Table 2.1 about here

IIs have traditionally been described as organizations that "act an agent or broker in any aspect of the innovation process between two or more parties." (Howells, 2006a: 720). The metaphor commonly used here is "boundary spanners" to refer to all intermediation efforts dedicated to forging networks and partnerships for extending the essential resources and services across disparate system components (Van Geenhuizen, 2018). An intermediary's primary role as *brokers* is to coordinate network activities by connecting parties with complementary offerings and mutual benefit to collaborate (Van Rijnsoever, 2020). They do so via performing structural brokerage roles that bring together otherwise disconnected actors (Lichtenthaler & Ernst, 2008), as well as serving as relational brokerage (Apa et al., 2017) by facilitating knowledge sharing (Díez-Vial & Montoro-Sánchez, 2016; Paoloni & Modaffari, 2021) and resource mobility (Galvão et al., 2019; Woolley & MacGregor, 2021).

In addition to their role as brokers, IIs are also described as network *orchestrators* as they attend to create value for the entire network by shaping the overarching collaborative framework (Provan & Kenis, 2008). Whereas, brokering activities are primarily targeted at facilitating transactions between a set of collaborating partners, orchestrating activities deal with creating the right conditions to innovate (Dhanaraj & Parkhe, 2006). As network orchestrators, IIs influence the innovation process by shaping the institutional form of the network in terms of its membership, dynamics, and structure (e.g., Klein & Wareham, 2008), spurring actor interest and engagement (e.g., Radnejad et al., 2017), and uniting ideas, resources and people around a common innovation-drive objective (e.g., Feller et al., 2012). An II's role as network orchestrator becomes more pronounced in settings

where the requirements are more fluid and the objectives are less defined (Agogué et al., 2017).

Finally, IIs have also been considered as *sponsors* through their more active engagement in supporting, advocating, and shaping the outcome of the innovation process (Amezcua, Ratinho, Plummer, & Jayamohan, 2020; McAdam & Marlow, 2011). In contrast to brokering and orchestrating activities, sponsoring entails a more personalized support for particular projects or entrepreneurial ventures as they progress from their initial conception stage to the ultimate realization of value from commercialization (e.g., Alaassar, Mention, & Aas, 2021; Assenova, 2020; Breznitz & Zhang, 2019). An intermediary's role as sponsors, although still pertinent to breakthrough technologies and high-risk innovation endeavors, tends to be more visible in the context of entrepreneurial support organizations, such as incubators, accelerators, and science parks, and is often accomplished using tailored acceleration programs, professional advisory, mentorship, and endorsement (Bergek & Norrman, 2008; Cohen et al., 2019).

2.3.3 Value added by innovation intermediaries

To date, value creation has been the central focus of the literature on IIs (De Silva et al., 2018). A substantial amount of research has investigated the value created by IIs to *individual firms*, with a particular emphasis on science- and technology-based ventures (e.g., M'Chirgui et al., 2015; Mian et al., 2016; Motohashi, 2013). Others authors have focused on the connection (Van Rijnsoever, 2020) or the value created at the *network* level (e.g., Breznitz & Zhang, 2019; Theodoraki, Messeghem, & Rice, 2018), which is reflected by the strength of the relations between participants possessing complementary resources and capabilities (Lichtenthaler, 2013). Yet, another set of studies has emphasized the value "spilled over" to the broader *ecosystem* in terms of economic, social, and technology development (e.g., Giudici, Reinmoeller, & Ravasi, 2018; Sternberg, 2004). Taken together, the literature acknowledges the value created by IIs across all three levels of analysis (Table 2.2).

Insert Table 2.2 about here

At the organizational level, studies considers the value created by IIs mostly in terms of traditional firm performance measures such as increase in revenues (Lukeš, Longo, & Zouhar, 2019), number of employees (Breznitz & Zhang, 2019), and new products launched (Cravo & Marques, 2019). These studies have also focused extensively the effect of intermediation activities on the continuity of individual on organizations/ventures and their survival prospects (Scagnelli et al., 2019). Finally, some authors have also highlighted the benefits associated with a firm's visibility and exposure as reflected by a higher likelihood of attracting external capital and/or engaging in future collaborations (Lindelof & Lofsten, 2005). At the network level, the value created by IIs is typically reflected in changes in the structure of relations between participants (Theodoraki et al., 2018), their respective resources and capabilities (Galvão et al., 2019), as well as the collaboration dynamics between networks and partnerships (Giudici et al., 2018). Taken together, these studies have emphasized the role of IIs in aligning distinct, yet interdependent activities for generating a coherent, innovation-driven solution. Finally, the value created by IIs is also examined at the level of the ecosystem and mostly reflected in terms of macro-level indicators associated with economic and social development, diffusion of new technologies, new venture creation, and improvements in public policies.

2.3.4 Challenges faced by innovation intermediaries

Intermediaries face a range of challenges while undertaking their supportive role in the innovation process. The main challenges often discussed in the literature are also the ones pertaining to value creation, such as overcoming network opacity (Nilsen & Gausdal, 2017; Van Rijnsoever, 2020), strengthening network relations (Di Fatta et al., 2018), selecting and framing the right problems to solve (Diener et al., 2020), and managing the interactions between stakeholders (Galvão et al., 2019). However, in addition to creating value, intermediaries also face notable challenges associated with capturing part of the value created themselves in order to maintain their long-term survival and sustain their activities over time (De Silva et al., 2018). Taken together, our review reveals three sets of challenges associated with intermediation in the innovation process, which we label under the "temporal", "governance", and "efficiency" dimensions (Table 2.3).

Insert Table 2.3 about here

A first set of challenges relates to the temporal dimension that stems from the misalignment between the time when intermediation activities are initially performed and the time when results are achieved. This dimension creates particular challenges in sustaining or scaling up existing innovation activities (Kant & Kanda, 2019). The inherent nature of the intermediation process involves dealing with high levels of uncertainty that often accompanies a typical innovation trajectory (Hoppe & Ozdenoren, 2005) and is largely affected by changes in customer needs, technologies, and market trends (Feller et al., 2012). Therefore, it becomes even more challenging for intermediaries to focus beyond short-term organizational needs and funding structures (Blair et al., 2020).

A second issue falls under the governance dimension and deals with issues related to the coordination of the activities, interests, and contributions of various stakeholders, most of which are beyond the organization's direct control. As illustrated in Table 2.3, this dimension encompasses a range of challenges associated with designing and implementing non-contractual control mechanisms, ensuring ongoing engagement and participation, dealing with potentially conflicting demands, and integrating new members with complementary resources and capabilities (ibid). Although research suggests that IIs are able to navigate much of these governance challenges (e.g., Dahab & Cabral, 1998; McAdam et al., 2016), how they are able do so in general remains unclear.

A third issue pertains to the efficiency dimension, meaning that there is no standard way to benchmark the performance of different intermediation activities (Galbraith et al., 2019) and evaluate the return on investment (ROI) for setting up these entities (Gamber et al., 2020). As a result, the long-term value of IIs is often hard to establish and communicate to external stakeholders. The lack of a standard evaluation criteria for monitoring the effectiveness of IIs over time (Canovas-Saiz, March-Chordà, & Yagüe-Perales, 2021) makes it even more challenging to secure the necessary resources needed to ensure their long-term survival.

2.4 Discussion: Critical assessment and the way forward

Until now, much of what we have described has been retrospective in nature, reflecting on what has been done so far in the literature. We have shown that IIs, as a theoretical construct, has been used for different purposes to address a broad range of research questions across various contexts. There have also been multiple attempts to empirically capture the intermediation process using a mix of micro-level and macro-level performance indicators. A complementary stream of mostly conceptual research has sought to compare the purpose, governance, and design structures between IIs in order to derive ideal types or best-practices for monitoring and benchmarking their activities. This conceptual and methodological proliferation has prevented, or at least significantly hindered the accumulation of knowledge on intermediation in the innovation context. In the following, we present our line of critique around four key areas that our review has shown to be the most challenging for the advancement future scholarship in this area. We argue that addressing those challenges will greatly advance our understanding of IIs as a theoretical construct and augment its contribution to the broader the literature on innovation management.

2.4.1 Theoretical foundations

At its core, the II construct lies at the intersection between different, yet overlapping streams of research (e.g., technology transfer, ecosystems, open-innovation, and knowledge management) to ultimately make its way into mainstream academic discussions (Howells, 2006a). Despite its rising popularity, research on II remains heavily undertheorized. While a number of studies using the term has proliferated substantially over the past decade paralleling the growing academic interest in open-innovation (Chesbrough, 2007; Chesbrough et al., 2018), triple helix networks (Galvao, Mascarenhas, Marques, Ferreira, & Ratten, 2019; Todeva, 2013), and ecosystems (Adner & Kapoor, 2010; Jacobides et al., 2018), only recently have there been attempts to delineate the theoretical boundaries of IIs and explore the dynamics underlying their emergence and development. This has resulted in vague and expansive definitions that have led scholars to apply the term loosely across contexts. Owing to the absence of a strong theoretical foundation, most studies on IIs seem to have been focusing on a handful of common issues (notably knowledge exchange, innovation diffusion, and commercialization of science) while neglecting others (e.g., management/governance of IIs, negative externalities, and evolution over time).

One reason for the low number of studies that look relatively rigorously at the overall intermediation process is perhaps the complexity associated with the phenomenon. The literature has produced an extensive list of elements shown to enhance (or hinder) the role of intermediaries in supporting innovation. These elements range from the usual macro-level institutional arrangements such as regulatory and socio-cultural forces, to the meso-level resource endowments, namely in the form of available knowledge/financial capital, and all the way to the micro-dynamics that capture firm-specific characteristics (e.g., neutrality, legitimacy, leadership, and expertise) and internal value creation strategies (see e.g., De Silva et al., 2018; Kant & Kanda, 2019). Adopting such an expansive view makes it impossible to determine the exact nature and scope of successful intermediation activities beyond merely implying that their success is a reflection of the final innovation outcome, which itself is affected by other exogenous factors. This has therefore limited our conception of IIs and our ability to infer explicit causal relationships.

As a starting point, theorizing about intermediation in the innovation context could focus on identifying key antecedents and consequences of the focal phenomenon. That is to try to disentangle what causes what and how different intermediation activities help generate a desired outcome. In our review of this literature, we have identified a range of proper mechanisms and outcome indicators attributed to IIs. Thus, future research in this area could examine how each of these mechanisms can be best utilized, what impact do they have on one or several of these outcomes, and how these mechanisms and outcomes are interdependent on each other. Such analysis could reveal what are some effective mechanisms that qualify a successful intermediary intervention and help establish a theoretical foundation for a stream of research that is becoming evermore important.

2.4.2 Evolutionary dynamics

The literature on IIs has also been criticized for applying a static framework that describes the role of intermediary organizations without considering their evolution over time. This static depiction of IIs has overlooked how these organizations emerge, change, adapt, and/or improve over time as a function of supporting different innovation projects. As pointed out by several authors (e.g., De Silva et al., 2018; Pauwels et al., 2016), IIs do evolve in response to changing business conditions and emerging innovation needs, however, studies investigating this evolution are still rare, although this topic has been gaining a lot of attention recently. For example, Kant and Kanda (2019) highlight four factors that are essential for the evolution and survival IIs, including neutrality, knowledge of the technological context, ability to establish shared consensus, and internal value creation strategies. Similarly, Rossi, Caloffi, Colovic, and Russo (2022) show that IIs often need to reconfigure their existing business models (value proposition, target segments, organisation of activities, and key resources and competences) to maintain their evolution in response to emerging technologies.

These studies gave clues for how IIs are able to maintain their growth and survival over time, but an overarching framework for understanding their evolutionary dynamics is still lacking. Such approach needs to make explicit which factors and relations matter in which stages of an intermediary's lifecycle. Are some factors more important than others, and in which stages? Who are the key stakeholders responsible for setting up and monitoring IIs and how do their roles change over time? Are there prerequisite conditions that need to be put in place before setting up new intermediaries, and do these conditions need to change over the course of their development? Notwithstanding, research evidence

over the factors influencing the evolution of IIs remains sparse, but unanimous over the need for better understanding what determines their differential growth trajectories and how this growth materializes in practice. Therefore, important questions still abound concerning the emergence and evolution of IIs and the process for them to become self-sustaining.

2.4.3 Interplay between value creation/capture

Relatedly, studying the evolutionary dynamics of IIs necessitates understanding the interplay between value creation and value capture. As revealed by our review, research to date has predominantly focussed on the value creation aspect of the intermediation process often overlooking ways in which part of this value can be captured back not just by different collaborating partners, but also by the intermediary organization itself. De Silva et al. (2018) provide an important step in that direction by showing that intermediaries can derive internal value through knowledge-based practices, that is by leveraging the knowledge vested in their employees, collaborators, and broader ecosystem to maintain or improve their activities over time. Apart from few other studies (e.g., Reischauer, G., et al., 2021, Russo, et al., 2019, Kant and Kanda 2019), little is known about how IIs can generate internal value, even though this is essential for sustaining their long-term development and improving their key facilitating role in the innovation ecosystem.

To this end, our review has revealed a range of challenges that IIs face when it comes to capturing value from their activities. First, the lack of consensus on the best approach for measuring the impact of an II's activities makes it particularly difficult to secure funding and commitment from stakeholders (Barbero et al., 2012; Messeghem, Bakkali, Sammut, & Swalhi, 2018). Second, the multilateral nature of intermediation highly depends on the cooperation from strangers, making it necessary for IIs to address the legitimacy concerns of a wide variety of stakeholders to ensure their ongoing commitment. Third, supporting open-innovation activities almost always entail some form of uncertainty over the final outcome of the collaboration (Aaboen, 2009; Nair & Blomquist, 2020), making it even harder to guarantee the needed investment over the

course of the innovation process (Alon & Godinho, 2017; Binsawad et al., 2019). As a result, the way in which IIs can balance between value creation and value capture remain a fruitful area for future research.

2.4.4 Performance evaluation and benchmarking

Our earlier analysis on the roles, challenges, and value-added of IIs has revealed two major concerns that might have limited our understanding of the best ways to evaluate and benchmark their performance over time. First, performance is often measured uniformly (e.g., number of products launched, new ventures created, or funding received) and evaluated without considering differences in purpose, governance, and design structures of different intermediaries. Perhaps more critically, contextual influences of other innovation ecosystem components (e.g., sponsors, resource providers, support institutions, and pool of talented entrepreneurs) are often overlooked. Accordingly, these uniform quantitative measures have not fully accounted for the heterogeneity between IIs and their level of involvement across the different stages of the innovation process. In other cases, the performance is not measured directly, but rather inferred from specific outcomes (e.g., whether or not a favorable outcome has been achieved or the extent to which collaborators expressed their satisfaction with the involvement an intermediary). Here, qualitative case studies have dominated this area, often relying on more tailored evaluation criteria to try to capture the impact of intermediation activities in a theoretically meaningful way. Nevertheless, these qualitative approaches used for measuring the performance of IIs remains very much mission-oriented and context-specific (Barbero et al., 2012; Messeghem et al., 2018).

Accordingly, calls for more rigorous performance evaluation criteria have been noted. For instance, Bergek and Norrman (2008) outline some the challenges associated with defining performance based on outcome-oriented indicators as these outcomes are usually loaded with trade-offs between what is best for stakeholders and what is best for the organization itself. Similarly, Pauwels et al. (2016) argue that performance variations between intermediaries are at least in part due to differences in their design choices. Taken together, these studies suggest performance evaluation criteria need to take into consideration the organization-specific characteristics of IIs rather that be solely based on a uniform set of outcome-oriented indicators. Accordingly, we encourage future empirical work to consider these issues and discuss what aspects of the intermediation process are being truly measured, for which group of stakeholders are these measures intended, and why performance differences between IIs are likely to occur.

2.5 Conclusion

The literature on IIs has proliferated substantially over the past decade. If we are to match this proliferation of interest with advancements in theoretical and empirical understanding of intermediation in the innovation context, then important questions remain. In this paper, we add to the rapidly growing body of work on IIs by reviewing, analyzing, and integrating the key insights from this dispersed literature. We highlight the importance of IIs as a theoretical construct, clarify the supportive roles and major challenges associated with the process of intermediation, and discern its direct and indirect outcomes. Building on the insights provided from this review, we highlight four critical issues that we argue have potentially limited the theoretical and practical utility of the literature on II to this point. In support of continued advancement of scholarship in this area, we encourage (1) stronger theoretical foundations for understanding the casual mechanisms underlying the intermediation process; (2) more attention to the evolutionary dynamics of IIs and how they change, adapt, and improve over time as a function supporting of innovation-related activities; (3) new research inquiries on how IIs manage the interplay between value creation and capture; and (4) stronger methodological rigor for empirically capturing the performance of IIs in a theoretically meaningful way.

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Role	Operating Mechanisms	Sample Studies
Brokering	Boundary Spanning	Cantner, Meder, and Wolf (2011); Klerkx and Leeuwis (2009); Knockaert, Spithoven, and Clarysse (2014); Van Rijnsoever (2020)
	Facilitating knowledge exchange, recombination, and integration	Berbegal-Mirabent et al. (2012); De Silva et al. (2018); Kokshagina, Le Masson, and Bories (2017); Noack and Jacobsen (2021); Traoré, Amara, and Rhaiem (2021)
	Managing resource mobility	Inkinen and Suorsa (2010); Polzin, von Flotow, and Klerkx (2016); Stewart and Hyysalo (2008); Van Gils and Rutjes (2017)
Orchestrating	Setting, articulating, and refining innovation goals	Boon, Moors, Kuhlmann, and Smits (2008); Eberhart and Eesley (2018); Klein and Wareham (2008)
	Defining/promoting a collective vision	Agogué et al. (2017); Merindol, Le Chaffotec, and Versailles (2021); Silva, Venâncio, Silva, and Gonçalves (2020)
	Aligning roles, objectives, and structures	Batterink, Wubben, Klerkx, and Omta (2010); Klerkx and Leeuwis (2008); Radnejad, Vredenburg, and Woiceshyn (2017); Randhawa, Wilden, and Akaka (2022)
	Motivating, managing, and rewarding participation	Diener, Luettgens, and Piller (2020); Feller, Finnegan, Hayes, and O'Reilly (2012); Lauritzen (2017)
Sponsoring	Competence development, training, and business support	Alexander and Martin (2013); Goswami, Mitchell, and Bhagavatula (2018); Katzy, Turgut, Holzmann, and Sailer (2013); Meyer et al. (2018); Panda (2018)
	Assisting in commercialization, implementation, and evaluation	Breznitz and Zhang (2019); Cumming, Werth, and Zhang (2019); Diener et al. (2020); Johnson et al. (2022); Rossi et al. (2022)
	Championing high-risk innovation projects/ventures	Battistella, De Toni, and Pessot (2017); Bustamante, Matusik, and Benavente (2021); Germain, Klofsten, Löfsten, and Mian (2022)

Table 2.1. Range of innovation intermediary functions and operating mechanisms

Table 2.2 Value added by IIs at the different levels of analysis

Level	Value Created	Sample Studies
Organization	Firm performance (e.g., revenues, number of employees, and new product launched)	Albahari, Barge-Gil, Pérez-Canto, and Modrego (2018); Bustamante et al. (2021); Gwebu, Sohl, and Wang (2019); Lindelöf and Löfsten (2003)
	Business continuity and survival	Amezcua et al. (2020); Del Sarto, Isabelle, and Di Minin (2020); Scagnelli, Vasile, and Apostolov (2019)
	Visibility and exposure (e.g., likelihood of funding and future collaborations)	Galvão et al. (2019); McAdam and Marlow (2011); Paoloni and Modaffari (2021); Seet, Jones, Oppelaar, and Corral de Zubielqui (2018)
Network	Network structure (<i>i.e.</i> , quality and quantity of relations)	Cantner et al. (2011); Di Fatta et al. (2018); Galvão et al. (2019); Nilsen and Gausdal (2017); Van Rijnsoever (2020)
	Complementarities, co-specializations, and knowledge spillovers	Batterink et al. (2010); Paoloni and Modaffari (2021); Redondo, Camarero, and van der Sijde (2021); Squicciarini (2009)
	Culture of innovation and entrepreneurship	Blair et al. (2020); Clausen and Korneliussen (2012); Kruft et al. (2018); Xie et al. (2018)
	Industry/technology clustering	Castro (2015); Lefebvre (2013); Sun, Lin, and Tzeng (2009)
Ecosystem	Economic and social development (e.g., employment, GDP, and sustainability)	Bathelt, Kogler, and Munro (2010); Levén, Holmström, and Mathiassen (2014); Madaleno et al. (2021); Sternberg (2004)
	Technological advancement/adoption	Crupi et al. (2020); Lichtenthaler (2013); Osabutey and Croucher (2018); Theodorakopoulos et al. (2014)
	Spinoffs and venture creation (e.g., technology startups and research spin-offs)	Baglieri, Baldi, and Tucci (2018); Breznitz and Zhang (2019); Hillemane (2020); Motohashi (2013)
	Policy reorientation and infrastructure	Sung, Gibson, and Kang (2003); Lichtenthaler and Ernst (2008); Wang et al. (2020); Xiao and North (2018)

Dimension	Challenges	Sample Studies
	Sustaining/scaling innovation activities	Galbraith, McAdam, and Cross (2019); Nair and Blomquist (2019); Silva et al. (2020); Tang, Lee, Liu, and Lu (2014)
Temporality	Securing long-term funding	Alon and Godinho (2017); Binsawad, Sohaib, and Hawryszkiewycz (2019)
	Focus beyond short-term needs	Aaboen (2009); Blair et al. (2020); Schwartz (2009); Tamasy (2007); Thierstein and Willhelm (2001)
	Non-contractual control mechanisms	Cantner et al. (2011); Gattringer and Wiener (2020); Laur and Danilovic (2020)
Governance	Ensuring ongoing engagement and participation	Branstad and Saetre (2016); Sullivan et al. (2021); Van Rijnsoever (2020)
	Potentially conflicting stakeholder demands	Klerkx and Leeuwis (2008); McAdam, Miller, and McAdam (2016); Vanderstraeten, Van Witteloostuijn, and Matthyssens (2020)
	Constant need to integrate new members	Blanka and Traunmüller (2020); Roundy (2021); Zhang et al. (2020)
	No standard criteria for evaluating performance	Baraldi and Havenvid (2016); Barbero et al. (2012); Bergek and Norrman (2008)
Efficiency	Hard to establishing long-term value (ROI)	Klerkx and Leeuwis (2009); Lukeš et al. (2019); Ng et al. (2019); Sentana, González, Gascó, and LLopis (2017)
	Restricted by the regional innovation capacity	Brown, Gregson, and Mason (2016); Harper-Anderson and Lewis (2018); Hasan, Klaiber, and Sheldon (2020); Poonjan and Tanner (2020)

Table 2.3. Key challenges faced by innovation intermediaries

Figure 2.1. Phases of the systematic review



Chapter 3 An organizational design framework for managing and monitoring Living Labs

Abstract

Academic interest in living labs (LLs) has grown substantially over the past decade with researchers from a wide variety of disciplines actively studying the topic. While this widespread interest seems encouraging, it has been complicated by some inconsistencies regarding what LLs actually are, which types of activities they (should) perform, and under what conditions. We conduct a meta-synthesis of 38 case studies to understand effective LL practices for organizing and structuring user-driven innovation under presumably realistic conditions. Our research draws on theories from organizational design, supplemented by an in-depth empirical case analysis—the application of a MedTech LL in healthcare. By studying what worked best and under what conditions, we present a parsimonious typology of eight design elements that underlie four ideal models for organizing LLs. Our analysis reveals that although these different models do fit under the same umbrella concept, they tend to vary in a set of key design parameters. This typology serves as a framework for integrating past studies on LLs. It also serves as a managerial instrument for understanding how LLs can be set up, managed, and monitored over time.

Keywords: Living labs; Business model design; Innovation intermediaries; Metaethnography

3.1 Introduction

Broadly defined as user-centred innovation ecosystems for the co-creation of complex solutions in real-life contexts⁶, Living Labs (LLs) have emerged as a prominent approach to organize and foster open-innovation by systematically integrating end-users in the development of new products, services, and sociotechnical arrangements (Della Santa, Tagliazucchi, & Marchi, 2022; Engels et al., 2019; Følstad, 2008; Osorio et al., 2019). As of 2021, the number of LLs stands over 450 worldwide and has been steadily rising over the past decade⁷. LLs have also been featured in multiple policy discourses as a solution for tackling the growing imbalance between the research capacity of certain regions/institutions and the commercial success of their innovation activities (Dosi, Llerena, & Labini, 2006; Følstad, 2008). On a larger scale, entire cities have been framed as LLs. The city of Calgary, for example, has been turning much of its public spaces (e.g., industrial lands, transportation corridors, and fiber networks) into experimental LL platforms to "help entrepreneurs bring big ideas to fruition, support investment in [the] local economy and make Calgary more business friendly⁸." In other places, LLs have also been flourishing through a variety of financial and policy-related schemes (Leminen & Westerlund, 2019; Veeckman & Van Der Graaf, 2015). Despite this proliferation, empirical and theoretical knowledge on LLs remains relatively scarce and loaded with inconsistencies over what might be called a "Living Lab", which activities they (should) focus on, and under what conditions.

To date, research on LLs has addressed a variety of research questions pertaining to (1) their defining features and characteristics (Dell'Era & Landoni, 2014; Van Geenhuizen, 2018; Veeckman, Schuurman, Leminen, & Westerlund, 2013), (2) the types of service they provide (Osorio et al., 2019; Schuurman, Herregodts, Georges, & Rits, 2019; Thees, Pechlaner, Olbrich, & Schuhbert, 2020), (3) their primary contribution to the innovation process (Balau, Van der Bij, & Faems, 2020; Dekker, Franco Contreras, & Meijer, 2020; Schuurman, De Marez, & Ballon, 2016), (4) and the extend to which they

⁶ The general definition proposed by the European Network of Living Labs (ENoLL): <u>https://enoll.org/</u>

⁷ European Network of Living Labs (ENoLL): <u>https://enoll.org/</u>

⁸ https://www.calgary.ca/general/living-labs/living-labs.html

yield desired outcome (Bronson, Devkota, & Nguyen, 2021; Logghe & Schuurman, 2017; Paskaleva & Cooper, 2021; Schuurman, De Moor, De Marez, & Evens, 2011). While informative, this research does not go in-depth on how to actually set up LLs and monitor their activities over time. As pointed out by Hossain et al. (2019) in a recent review of the literature, "stakeholders wishing to set up a living lab and its activities, as well as firms considering developing one, find limited reference models for developing and managing a living lab." (p. 986). As a result, the design of LLs has been considered a "trial and error" process rather than a systematic and professionally-managed endeavor.

The purpose of this paper is to provide additional clarity to the organizational design of LLs. Our point of departure is practice-oriented, yet theoretically-driven—we wanted to develop an evaluation framework that allows for benchmarking the different approaches for managing and monitoring a LL. By benchmarking we mean classifying the most relevant indicators by which performance can be evaluated and compared. Accordingly, we engage in a meta-ethnography of 38 primary case studies with the goal of deriving unique patterns in LL configurations. A meta-ethnography is a systematic synthesis of qualitative research evidence to gain a more comprehensive insight on a contemporary organizational phenomenon (Hoon, 2013). Thus, we rely the extent literature to identify relevant published case studies and use those cases as a source of data to extract the main design parameters that distinguish one LL model from another. We adopt a design lens to our analysis of these cases by building on Zott and Amit (2010)'s business model design framework as a basis for our analysis. The design elements that emerged from our reviewed cases were synthesized and grouped into distinct configurations, each underpinned by a unique value proposition.

Taken together, our findings point to eight design elements that underlie four ideal LL models, which we label as: "Opportunity spotters", "Network orchestrators", "Technology sponsors", and "Community anchors". Each of these models is characterized by a unique value proposition that drives their strategic objectives and design structures. This analysis is further substantiated using an empirical case study (Siggelkow, 2007) focussed on a MedTech LL as it strategically alternates between models to maintain its key facilitating role in the innovation ecosystem. This empirical illustration allows to draw

concrete conclusions on the distinctive features of different LL models and introduces a dynamic dimension to what is seemingly presented as a static typology. Our intention is not to offer another literature review on the topic, but rather to introduce a research-based framework for organizing LLs and monitoring their activities over time.

3.2 Conceptual background

3.2.1 The logic behind "Living Labs"

The basic idea behind LLs stems from the growing interest in user-centric innovation approaches as an envisioned outcome is gradually given shape and validated by end-users in a real-life environment (Schuurman, Mahr, De Marez, & Ballon, 2013b). It is premised on the belief that the real value of innovation is not in its superior technical qualities, but rather in its alignment with the needs, capacities, and aspirations of end users. This resonates strongly with recent developments in experimental innovation approaches that emphasize multidisciplinarity and co-creation for addressing emerging societal and business-related challenges (e.g., Leminen, Rajahonka, & Westerlund, 2017; Nesti, 2018; Paskaleva & Cooper, 2018). As they became popular, LLs have inspired a surge of interest across disciplines leading some scholars to label the phenomenon as the "Living Lab movement" (e.g., Hossain et al., 2019; Huang & Thomas, 2021) fueled by a proliferation of studies with the sole purpose "to frame concepts about LLs and set them into action" (Leminen & Westerlund, 2019: 251).

Despite the apparent similarities between different conceptualizations, LLs have shown to be anything but clear in practice. The term was first presented to practitioners simply as a new way of developing customer-facing solutions through actively involving end-users in the innovation process (Bergvall-Kåreborn, Eriksson, Ståhlbröst, & Svensson, 2009; Lehmann, Frangioni, & Dubé, 2015). Early attempts to implement this approach has resulted in technologies being developed separately by engineers and then tested by users in a designed environment (Ballon & Schuurman, 2015; Schuurman, 2015). While users are in fact treated as key components in the innovation process, their role has remained rather passive and mostly relevant in the later stages⁹. The LL concept was further developed into a detailed methodology for managing and structuring innovation-related activities (Edwards-Schachter, Matti, & Alcántara, 2012; Veeckman et al., 2013). The idea was to purposefully allocate more agency to end-users right from the start of the innovation process with the aim of promoting more inclusive, relevant, and marketable solutions.

Over the years, LLs have come to be viewed as separate (physical or virtual) entities designed to facilitate multidisciplinary collaborations and user co-creation (Paskaleva & Cooper, 2021). Many of these entities were initiated by public-private-partnerships (PPPs) driven by the desire to achieve specific policy objectives, such as supporting the emergence of sustainable new ventures (Särkilahti, Åkerman, Jokinen, & Rintala, 2022) as well as boosting innovation within regional economies (Dupont, Mastelic, Nyffeler, Latrille, & Seulliet, 2019). More recently, LLs began to emerge as separate units within large organizations and business centers as a way to promote the development of customer-facing solutions (Osorio et al., 2019). The explicit focus on co-creation as a defining aspect of LLs has placed the consumer (as opposed to the technology) at the center of the innovation process. This renewed approach to innovation management has motivated the launch of the European Network of Living Labs (ENoLL) in 2006 as a European-led initiative to promote the concept of LLs and facilitate their diffusion around the globe. These different LL representations can be aptly grouped according to the four levels of abstraction shown in Figure 3.1:

Insert Figure 3.1 about here

⁹ Schuurman, (2015) labelled these early labs as "American Living Labs" where the focus is mostly on the infrastructural aspect which is modeled on based on a real living environment and users are studied in this environment, which can be considered natural but not real.

At the highest level of abstraction, LLs are viewed as a *movement* (e.g., Leminen & Westerlund, 2019) or an approach that portray how innovation can (and should) be cocreated with end-users (Leminen, 2013). More concretely, LLs are presented as archetypes derived from well-known exemplars and success stories (e.g., Logghe & Schuurman, 2017; Schuurman, De Marez, & Ballon, 2013a), such as the iMec (Belgium), Nokia Labs (Finland), and the MIT Living Lab (USA) to name a few. These archetypes are best thought to exemplify the essence of a LL and the way they can be set up in practice (Chronéer, Ståhlbröst, & Habibipour, 2019). At an even higher level of descriptive accuracy, LLs are described as a *methodology* for systematically engaging end-users in the innovation process (e.g., Dell'Era & Landoni, 2014). As a methodology, a LL signifies the mechanism through which these users along with other stakeholders can collaborate in a systematic way across a project's lifecycle. It outlines the general framework that depicts the roles and activities of each actor at different stages of the innovation process. In their most concrete form, LLs are described as entities with physical and/or virtual spaces (e.g., testing spaces, prototyping rooms, and co-working spaces) that are designed to encourage creative behaviour for the people within them and motivate their active collaboration (e.g., Osorio et al., 2019).

3.2.2 Living Lab evaluation criteria: Some basic principles

The distinctiveness between different LLs is not in their physical structure *per se*, but rather in the way they operate internally to generate value. Thus, as more and more initiatives are being put in place to establish some form of LLs, important questions have emerged over their performance and necessity as a tool for fostering innovation (see eg., Hossain et al., 2019; Paskaleva & Cooper, 2021). In line with similar work in this area (e.g., Bergek & Norrman, 2008; Moultrie et al., 2007; Osorio et al., 2019), we define performance as the extent to which a realized outcome aligns with a given value proposition (see Figure 3.2). Yet, the lack of standardization and insufficient criteria for measuring performance of LLs makes it particularly challenging to articulate their specific value proposition as it is often interpreted differently in different contexts and to different audience groups (Schaffers & Turkama, 2012). As such, demands for more rigorous performance evaluation criteria have been noted.

Insert Figure 3.2 about here

Prior research has provided prolific insights on the defining features of LLs and the range of benefits they provide to key stakeholders (e.g., business, universities, researchers, and user groups) and local communities (see e.g., Bronson et al., 2021). However, only few of these studies relate these benefits to the ways LLs are organized internally (i.e., organization design). Schuurman et al. (2013a) provide an important step in that direction by investigating a LL's typical infrastructure, including its main tangible (e.g., physical space, technology, and equipment) and non-intangible (e.g., network of stakeholders, end users, and knowledge) assets. Similarly, Mastelic, Sahakian, and Bonazzi (2015) point to the importance of considering cost structures and revenue streams when setting up a LL. More recently, Van Geenhuizen (2018) presents four factors driving the performance of LLs, particularly by looking at their learning processes, social values, networking capacity, and the quality of their real-life environment.

Taken together, this work points to three broad conclusions: (1) the way LLs are organized play a major role in determining the dynamics of the collaborative innovation process and its underlying outcomes, (2) research efforts to understand the organizational design structure of LLs remain largely descriptive and exploratory in nature, and (3) it is important to establish a coherence between the organizational design of LLs and their unique value proposition. However, studies in this area have not gone in depth about how to actually establish this coherence (Paskaleva & Cooper, 2021). Thus, we posit that adopting a design lens to the study of LLs has the potential to offer a more structured approach for evaluating their effectiveness over time.

3.2.3 A design lens for studying Living Labs

The design perspective introduced by Zott and colleagues (e.g., Zott & Amit, 2010, 2013; Zott, Amit, & Massa, 2011) in their work on business models represents a fruitful starting point for evaluating the effectiveness of LLs and their value-creating

potential. According to this framework, a business model can be viewed as an *activity system* that determines how an organization operates and how it creates and captures value in the process (Li, 2020; Zott, Amit, & Massa, 2011). An activity system represents the set of interdependent processes performed by a focal organization in coordination with its stakeholders, so that value can be adequately created and properly distributed. The purposeful design of such a system is what constitutes the essence of a business model.

Two particular sets of design parameters characterize an activity system: design elements and design themes (Zott & Amit, 2010). The design elements describe an activity system's architecture in terms of its content (i.e., the selection of the activities), structure (i.e., the link between them), and governance (i.e., who performs what). Collectively, these design elements can be combined in different ways to give rise to the second set of parameters, referred to as design themes. Design themes are distinct configurations of design elements that depict how these elements can be connected to generate value. Taken together, these two design parameters constitute an organization's design framework.

The application of a design perspective to the study of LLs can be particularly relevant to understand not only how these innovation intermediaries can be organized, but also how different LL models can be differentiated one from another. From this perspective, the performance of a LL is reflected by the extent to which its design configuration is internally aligned with a given value proposition (Figure 3.2). Despite the significance of business model research for understanding how to set up and manage LLs, this view has not led to an abundance of studies at the intersection between these two research streams (Schuurman et al., 2019). Thus, we determined to make use of existing data and peer-reviewed knowledge to assess how innovation activities can be organized in a LL format and what key elements need to be considered before setting up this form of innovation governance.

3.3 Methodology

To this end, we start by reviewing the literature on LLs with a particular emphasis on their defining characteristics, distinguishing features, and performance outcomes. We considered a range of possible approaches to make sense of this dispersed literature in order to identify the main design parameters that underlies different LL models. We chose meta-ethnography for the purpose of this study as it seemed to offer the most productive way forward for inductively deriving the key parameters of our organizational design framework by "putting together" empirical insights on what worked best and under what conditions (Hoon, 2013). A meta-ethnography means using case studies developed by other researchers as our main source of data and synthesizing the main themes and issues that emerged from the authors' own description of these cases (Dixon-Woods, Agarwal, Young, Jones, & Sutton, 2004; Noblit, Hare, & Hare, 1988; Sandelowski, Docherty, & Emden, 1997). The "aggregation of qualitative studies" can therefore result in the construction of larger narratives and more generalizable models for explaining a certain phenomenon than those obtained from any single case study (Estabrooks, Field, & Morse, 1994; Simpson, Kelly, & Morgan, 2013). Given the constraints that are typically prevalent in developing a set of large enough LL cases in a format that allows policy makers and practitioners to evaluate and compare their different design models, a meta-ethnography was particularly relevant for providing the needed insights on how LLs can be organized for addressing different innovation-related challenges.

We followed Hoon (2013)'s recommendations to extract, synthesize and make interpretations across qualitative case studies and "to identify categories and patterns that emerge across the studies while attempting to preserve the original studies' integrity" (p. 526). Our choice of methods was largely driven by our motivation to integrate a large set of existing examples in a format that allows policy makers, researchers, and practitioners make better sense of how LLs can be designed to stimulate innovation-related activities. Once appropriate cases have been selected, we undertook a thorough analysis on how each LL was set up, what were its key objectives, who were the main stakeholders (e.g., sponsors, affiliates, and beneficiaries), and what outcome(s) have been achieve. Our selection of case studies was chosen to help illustrate concrete examples of the use of LLs

for managing innovation-related activities. We then identify our key design paraments through an in-depth cross-case analysis exploring how precisely did the application of LLs help in the development of given solutions and what can be learned from implementing this approach.

3.3.1 Step 1: Identifying relevant publications and case studies

As a first step, we started with a preliminary search in the Web of Science (WoS) database for studies containing either the term "living lab*", "innovation lab*", "test beds", or "real world laboratories" in the title, the keyworks, or the abstract. These terms are all used (often interchangeably) to denote experimental approaches to innovation management for development, testing, and diffusion of new solutions under real-world conditions (Engels et al., 2019). This search yielded a total of 569 contributions published in journals or book chapters. This basic search was then complemented by cross-checking the sample of articles of covered in recent reviews on the topic (i.e., Bronson et al., 2021; Dekker et al., 2020; Hossain et al., 2019; Paskaleva & Cooper, 2021). Accordingly, four more articles were identified that had not already been covered by the database search, yielding an initial sample of 573 papers. For each paper, we began examining whether one or more empirical cases of LLs were presented. With the absence of a unified definition of LLs and the plurality of meanings embedded in the term (Leminen & Westerlund, 2019), we considered a LL as any physical (or virtual) space designed to facilitate the co-creation of innovation-driven solutions involving users and other relevant stakeholders under presumably realistic conditions.

Following a first screening of the titles and the abstracts, we automatically excluded papers that are were not specifically on LLs (or its related concepts) but still uses these terms to refer to something else or to examine another phenomenon. For any paper to be considered relevant to our analysis, it must (1) focus on one or more LLs as its main unit of analysis; (2) provide sufficient details on the key characteristics of the LL under study, at least its founding purpose, innovation-support activities, and underlying operations; and (3) discuss how a LL project was achieved or was expected to be achieved. By applying these basic criteria, we manually screened the abstracts, introduction, and

methods (if the introduction made no references about the method used) sections and further excluded (1) studies that were either quantitative or purely conceptual in nature or (2) studies that do not provide the basic information to make judgement about the activities, organizational design, or performance outcomes for the LLs under study. The final sample was ultimately distilled into 27 papers containing 38 detailed cases studies¹⁰. All studies included our sample explicitly report detailed descriptions of each case, methods for gathering and analyzing data, and key findings, thereby consistent with qualitative research best practices.

3.3.2 Step 2: Case description and validation

The content of the assembled cases was then analyzed to identify key parameters (i.e., design elements and their underlying configurations) that distinguish one LL from another. To do this we had to determine what was the purpose of each LL, try to understand the innovation support strategies used, and produce a set of parameters that transcends the single case narrative (i.e., how well the identified parameters used in one study translate into the others). For this purpose, we developed a standardized database to describe and compare each of the LL cases covered in our sample. This was managed using Microsoft Excel, with each case assigned to a specific row and the columns containing relevant details, including the LL's: name, country of origin, year established, mission statement, industry or sector in which it operates, sponsoring organization(s), and outcomes achieved (if applicable). This information was initially obtained from the authors' own description of the case and further triangulated with data from other sources such as the LL's own website, publicly-available databases, and relevant press articles and/or reports. Many of these LLs had profiles listed on the official ENoLL website along with a summary of their goals, activities, contact person(s), and a link to their website. For others, we searched using the name of the LL for any traces of its activities. Our subsequent analysis was guided by what was gathered from these sources.

It is important to note that our primary data represent the insights constructed by the original authors based on their own understanding and interpretation of the case

¹⁰ Some papers cover more than a single Living Lab

(Hoon, 2013). Both context and narrative are therefore crucial because if the authors provided insufficient details about specific aspects of the case, identifying the design parameters becomes more complex. Often assumptions were made about how LLs ought to operate and what innovation-related challenges they are best suited to address. With few exceptions, studies assumed the existence of LLs without focusing on the processes surrounded their emergence or why a LL has been the chosen intervention mechanism for addressing a particular problem. Accordingly, we had to derive the main objective for setting-up the LL (that is often be reflected in the type of innovation-related challenge it is addressing or obtained from the LL's own website) and the main support services provided by each for meeting those objectives.

While not unique to case studies, there was often limited information about the effectiveness of the LLs under study, partly due to the absence of established indicators to monitor their actual performance (see e.g., Paskaleva & Cooper, 2021). However, one aspect that made a meta-ethnography particularly helpful to our objective is that all studies described successful (and often ideal) cases for organizing LL projects and thereby, have been presented as best-practices to managers and policy makers for structuring experimental innovation activities. Hence, our selected cases provided an opportunity to learn from these LLs and how their approach was suitable for addressing a given societal, organizational, or business-related challenge.

3.3.3 Step 3: Intra-case analysis

At this stage, we began comparing the data available for each LL by noting the similarities and differences between the types of projects they support, the roles they assume in the innovation process, their governance structure, and the outcomes they achieved. The idea was to move away from treating each case as a single entity to consider them more as a heterogeneous set of data suitable for inductive inter-case analysis; moving from the actual texts used to define a LL in each of the 38 examples to identify the commonalities/differences between those definitions—what do the 38 cases say about LLs when looked at as a whole? While relatively simple in principle, this process proved to be quite challenging because the primary data that we used to derive our design

parameters was bound to the reported information in each study coupled with supplementary information that we gathered manually for each case. We thereby focussed on organizing relevant material into a comprehensive synthesis, which could be shared with managers and policy-makers to guide their understanding of LL governance.

Consistent with Hoon (2013)'s recommendations, we began examining each of our primary cases in terms of which elements are common across all studies, which are likely to appear together, how the different elements can be logically linked together, and under what conditions. As expected, the most frequent commonalities between cases include user participation, multistakeholder engagement, and product/service development in a real life setting (e.g., Dupont et al., 2019; Van Geenhuizen, 2018). However, since all these characteristics are strongly emphasized in the generic definition of what a LL actually is (e.g., Huang & Thomas, 2021; Westerlund & Leminen, 2011), we focused instead on how their application varies across the different cases. Our objective was therefore to identify the specific characteristics that make it possible to distinguish one LL from another.

We started our analysis by identifying the founding purpose (objective) for each of the 38 LLs covered in our sample. We tried to keep these objectives as comprehensive as possible. For example, the objective of the "Mandalab Living Lab" is to "*support citizen participation by promoting digital information literacy and citizen appropriation of information and communication technologies*" (Lehmann et al., 2015) and that of UNaLab is to "*develop smarter, more inclusive, more resilient, and increasingly more sustainable societies through innovative nature-based solutions*" (Chronéer et al., 2019). Once objectives have been defined, we began examining who are the main sponsoring organizations. Sponsors were usually either universities, research institutions, consulting firms, local municipalities or a partnership between two or more of these actors. We then turned our attention to the innovation projects being carried out by the LL. For each case, we identified what services did the LL provide, what roles did users assume in the innovation process, and what were the reported outcomes. Overall, our analysis alerted us to eight key design elements that seem to underlie the different configurations of LL

model. These elements represent the building blocks of a LL and provided the foundations to further explore how our cases can be related under common themes.

3.3.4 Step 4: Inter-case comparison and analysis

From this vantage point, we began examining each case study carefully to detect underlying patterns across our sample. We thereby proceeded from a case-specific to inter-case analysis to determine how and under which conditions do these eight deign elements go together. We took Leminen, Westerlund, and Nyström (2012)'s categorization of LLs as our starting point. According to Leminen et al. (2012), LLs can be differentiated according to the group of stakeholders that holds the most influence over their activities: *utilizers* (i.e., organizations that launch and promote LLs to develop their businesses), *enablers* (i.e., public-sector or community actors that support LLs to pursue societal improvements), *providers* (i.e., universities and institutions that manage LLs for promoting research and knowledge creation), or *users* (user communities that focus on solving users' everyday-life problems). Applying this categorization to our dataset places a LL's "value proposition" at the center for explaining the interrelationships between the eight different design elements. The value proposition is reflected by the founding objective of the LL (or the project undertaken by a LL) and can change as the stakeholders' goals and priorities evolve over time¹¹.

Applying this categorization to our dataset has enabled the identification of four overarching LL models, each defined by a unique value proposition guiding their design element configurations. To ensure the validity of our models, we consulted an independent researcher in innovation management who is also an expert in managing LL projects so that the credibility of the results is not bounded by the authors' own interpretation of the data (Pauwels et al., 2016). We refined our analysis so that divergent judgments on the key elements and/or related themes were discussed and resolved accordingly. In what follows, we describe each of these elements in details and discuss

¹¹ Although the evolution of a LL's organizational model over time is likely (and often necessary) to occur, no example in our sampled cases captures this evolution. We thereby undertake a complementary in-depth case analysis tracing the evolution of a living lab that was initially created to accelerate the development and commercialization of new medical technologies in Montreal, Canada.

how they converge into four overarching models. This meta-ethnography shows that LLs are not to be understood as "one size fits all" approach for managing user-driven innovation, but rather, despite their common defining features, vary significantly in the way they are organized and operate internally—each tailored to its own purposes and sociotechnical context.

3.4 Findings

3.4.1 Design elements:

The design elements represent the main components of an organization's business model and collectively describe its content, structure, and governance (Zott & Amit, 2010). From our analysis, we identify eight design elements that distinguish one LL model from another. These elements were derived inductively from an in-depth comparison between the 38 different LLs contained in our sample. A summary of these design elements is presented in Figure 3.3 and described more fully in this section.

Insert Figure 3.3 about here

Stage of user involvement: A first element that emerged from our analysis relates to the stage of user involvement in the innovation process. In general, all LLs involve some form of user involvement, however they differ in the specific stages in which these users are involved in. These stages usually cover: (1) the exploration stage—the co-creation of new ideas, opportunities, and solutions; (2) the evaluation stage—the validation, prototyping and testing of co-created concepts in real-life settings, and/or (3) the exploitation stage—the development and implementation of the most promising ones. Some LLs tend to engage users at every stage of the innovation process, while others seem to prioritize user involvement only in particular stages (cf. Santarsiero, Lerro, Carlucci, & Schiuma, 2021; Toffolini, Capitaine, Hannachi, & Cerf, 2021). Botnia Living Lab, for

example, attempts to involve users at every stage of its innovation process so that each project becomes customised to the unique requirements for that particular user group (Bergvall-Kareborn & Stahlbrost, 2009). In contrast, JOSEPHS® Living Lab in Germany tends to prioritize user engagement only in the testing and prototyping phases where the feedback gathered from users would then be presented back to the innovators in order for them to make possible adjustments to their prototypes (De Vita & De Vita, 2021).

Degree of user involvement: User involvement is not only a matter of stages, but also a matter of degree. For instance, Leminen, Westerlund, and Nyström (2014) highlight four roles that can be attributed to end-users in LLs: informants, testers, contributors, or co-creators. Each of these roles is based on the level of agency assigned to users in shaping the outcomes of the innovation process. In general, the degree of user involvement can range from passive participation where users' role in a LL is limited to providing feedback on specific technologies, products, or services (e.g., Torvinen & Jansson, 2022) to a more active involvement where users become co-creators and leading contributors (e.g., Gascó, 2017). Despite the importance placed on active user involvement in LLs, research generally indicates that much of users' role remains rather passive (Nyström, Leminen, Westerlund, & Kortelainen, 2014) and is typically limited to testing products in a controlled environment, validating prototypes, and providing feedback (Huang & Thomas, 2021). Hence, we distinguish the degree of user involvement in the innovation process as the second key design element shaping a LL's activity system.

Service offerings: LLs also differ in the services they offer to their clients. Based our analysis, almost all LLs seem to provide the basic physical infrastructure in terms of localities, equipment, and facility-related services. While these amenities are relatively common, they can vary based on the kinds of spaces available, including prototyping rooms, co-working spaces, and testing facilities. In addition to the physical infrastructure, many LLs also provide business and administrative support such as consulting, financial analysis, and legal advice (e.g., Haukipuro, Väinämö, Arhippainen, & Ojala, 2019). Similarly, some LLs even offer educational and training programs mostly targeted at researchers and graduate students to help form a pool of talent that aligns with the LL's mission and objectives (e.g., Cantù, Schepis, Minunno, & Morrison, 2021; Torvinen & Jansson, 2022). These programs are often accompanied by a series of workshops, events, and lectures given by experts and industry leaders in the field (e.g., Ståhlbröst & Holst, 2017). Finally, LLs can also provide incubation services for specific projects and/or new ventures in order to expedite the development of certain technologies and facilitate their implementation in an existing domain (Budweg, Schaffers, Ruland, Kristensen, & Prinz, 2011). Periodic feasibility studies and some form of follow-up on the project development process are also common as well.

Project selection criteria: Project selection refers to decisions concerning which projects to accept and which to avoid. In general, most selection strategies usually follow one of two approaches. The first is a solution-based approach where a project is evaluated based on the viability of its proposed idea, that is the specific technology, product, or service that defines the outcome of the project (e.g., De Vita & De Vita, 2021). The second is a team-based approach where evaluation decisions are based on the team's knowledge and expertise for developing appropriate solutions to problems that are most relevant to a LL's mission and objectives (e.g., Torvinen & Jansson, 2022). Project support activities occupy the bulk of a LL's operation portfolio and therefore, the specific criteria used for selecting projects represent the basis for effective resource allocation and an important design element for a LL.

General focus: A fifth design element that characterizes a LL pertains to their general focus. In most cases, a LL's general focus is directed toward a specific industry sector and/or population group. For example, the Lab4Living in the UK focuses particularly on the *general health and wellbeing of the ageing population and people with disabilities.* Others LLs are more geared toward a specific geographical region. For instance, the Thessaloniki Smart Mobility Living Lab in Greece is focused on *improving the mobility infrastructure of the city.* Another group of LLs are set up specifically for addressing wicked problems that are usually much more complex and ill-defined, such as environmental degradation, food insecurity, pollution, and other sustainability issues created by urbanization (Veeckman & Temmerman, 2021). As an example, the Utrecht Refugee Launchpad (U-RLP) was initiated as a LL to innovate with asylum seekers in order to help them better integrate into the society (Dekker, Geuijen, & Oliver, 2021).

Dealing with wicked problems using conventional innovation strategies is often difficult and politically contested as they invoke potentially conflicting concerns that make it harder to agree on the best solution to implement. Thus, LLs have become a preferred mechanism to tackle these challenges, fostering active collaboration and knowledge sharing, while emphasizing multi-stakeholder participation and co-creation.

Membership: Membership denotes the approach used for selecting and integrating stakeholders in LL activities. Membership often ranges from an open collaboration strategy where anyone with a vested interest can participate (e.g., Mandalab Living Lab in Montreal), to a fairly more restrictive strategy where stakeholders are pre-selected and invited to participate in specific projects (e.g., the Apollon Living Lab in Finland) (cf. Lehmann et al., 2015; Ståhlbröst & Holst, 2017). Other LLs, such as the PSI laboratory in Finland, tend to have a more targeted membership approach a where a defined group of stakeholders actively participates in all projects. The unique governance features for managing membership participation are likely to be contingent on the specific attributes of the project (Felin & Zenger, 2014) in terms of the innovation capabilities required for identifying, selecting, and implementing relevant ideas (de Oliveira, Echeveste, & Cortimiglia, 2018). On the one hand, a high level of openness might bring more innovative ideas and help speed up development (e.g., Bergvall-Kåreborn, Eriksson, & Ståhlbröst, 2015), while on the other, it might require significant costs associated with sourcing promising ideas, filtering results and managing the greater number of stakeholders (Mastelic et al., 2015).

Funding mechanism: LLs also differ in the way they receive funding. The rapid proliferation of LLs particularly in Europe, has been largely attributed to the range of government-supported initiatives designed to promote multidisciplinary and holistic approaches in research (Leminen & Westerlund, 2019). Therefore, many LLs initially originate with regional or national policy objectives in mind (Katzy et al., 2013). Others are led by universities and research institutions, such as the University of British Columbia in Canada or the University of Manchester in the UK (e.g., Van Geenhuizen, 2018), as a way to effectively commercialize scientific research and expand their outreach. In the private sector, LLs are often created as in-house innovation units designed

to boost the company's innovation capacity and speed up its product development lifecycle (De Silva & Wright, 2019; Haug & Mergel, 2021) or as part of a business center to help facilitate business incubation, such as the Frascati Living Lab in Italy (Guzmán, del Carpio, Colomo-Palacios, & de Diego, 2013) or Transforma Lab in Belgium (Santarsiero et al., 2021). More recently, LLs have started to leverage crowdfunding initiatives to expand and/or maintain their activities. For example, the San Sebastiano del Monte dei Morti Living Lab (SSMOLL) has generated significant contributions from volunteers to support its mission of protecting the city's cultural heritage (Cerreta, Elefante, & La Rocca, 2020). LLs with a successful track record in specific field or industry (e.g., information technology or healthcare) can also rely on internal revenue sources that can be generated from providing specialized services to target audience groups (Van Geenhuizen, 2018).

Temporality: A final design element that distinguishes LLs pertains to their temporal dimension. Some LLs are driven by particular projects and thus tend to have a relatively short-term lifecycle (usually between two to five years) depending on the outcome of the specific project and its funding structure. For example, the Energy Living Lab (ELL) in Switzerland was set up as a two-year project to help companies operating in the Swiss energy sector co-design more competitive energy services with users, motivating a move from a monopolistic energy sector to a decentralized industry (Dupont et al., 2019). Other LLs, such as the CitiLab in Spain or the iMec Lab in Belgium, tend to have longer lifecycles. These LLs usually pursue a sustainable business model by relying on internal revenue sources while strategically managing their dependence on external funding (Gascó, 2017).

3.4.2 Design themes

The design themes constitute the second set of parameters that characterize the LL model. They represent unique configurations of design elements that shape the activity system's main value creation drivers (Zott & Amit, 2010). Taken together, our analysis reveals four broad design themes (summarized in Table 1), each representing a unique

model for organizing a Living Lab: (1) Technology sponsor, (2) Community anchor; (3) Opportunity spotter, and (4) Network orchestrator.

Insert Table 3.1 about here

Technology sponsor: A "technology sponsor" is a LL established specifically for the purpose of catalyzing the development of new technologies and facilitating their adoption in the market. It is usually engaged in markets defined as "transactions for the use, diffusion and creation of technology" (Arora, Fosfuri, & Gambardella, 2001: 423) and set up by large universities or research institutions in partnerships with governmental agencies and/or relevant industry actors. Technology sponsors frequently engage in organizing workshops and events to attract new stakeholders, forge partnerships with science-based communities, and reinforce their legitimacy in the absence of key performance indicators (Pauwels et al., 2016; Zott & Huy, 2007). This type of LL is therefore established as a means to commercialize scientific research and promote academic entrepreneurship by providing a range of services, guidance, and resources for the ultimate realization of value from emerging technologies.

Technology sponsors work closely with researchers to overcome information and resource asymmetries by providing personalised services pertaining to intellectual property rights, technical and ethical standards, as well as navigating clinical trials in the life sciences (Clayton et al., 2018). Given the high costs and uncertainties associated with the commercialization of scientific research, this type of LL is usually involved at every stage of the innovation process and is often accompanied by a selected groups of users and specialized participants that actively contribute to the advancement of the project. Hence, the LL's network is almost exclusively geared towards stakeholders with the relevant knowledge and expertise in a specific area and concentrated in a specific industry or discipline. While these forms of LLs are typically funded through fixed-term public

mandates, their track record and accumulated expertise can open up new opportunities to generate alternative revenue sources and help maintain a sustainable business model.

As an example, the imec.livinglabs¹², founded as a separate division within the iMec research institute in Belgium to help researchers and entrepreneurs co-develop and test with target users new products, services and business models related primarily to the field of nano- and digital technologies (Schuurman et al., 2019). Over the years, iMec has accumulated extensive expertise in managing diverse open-innovative projects and has developed its own panel of users who are invited to participate in different projects (Logghe & Schuurman, 2017). Through hosting various successful interdisciplinary collaborations, iMec has created a trusted environment where researchers, users, suppliers, policy-makers, and regional actors to come together to overcome systemic gaps in the innovation process. Similarly, the Apollon Living Lab initiative, initially launched in Finland as an effort to promote the acceptance and diffusion of technologies related to monitoring energy consumption, has led to similar initiatives for promoting these technologies that are replicated in other regions (Ståhlbröst & Holst, 2017).

Opportunity spotter: The "opportunity spotter" represents a LL whose primary purpose is to detect the most promising ideas and turn them into viable customer-facing solutions. These LLs are usually run by corporate entities or business centers as a means to boost their innovation capacity without hindering day-to-day business operations. Opportunity spotters also act as "listening posts" for providing access to strategic market knowledge and by facilitating the identification of emerging consumer trends (Kanbach & Stubner, 2016). As a result, these forms of LLs have inspired much interest among organizations and business centers around the world and are often perceived as a way to reflect the management's commitment to foster a culture of innovation among employees and resident entrepreneurs.

Opportunity spotters typically operate with a profit orientation and are closely monitored using a defined set of performance measures, such as indicators for tracking the number of ideas generated, the number of successful products launched, and the level

¹² Previously known as iMinds iLab.o: <u>https://www.imec-int.com/en</u>

of engagement among stakeholders. Hence, the project selection criterion is usually based on an idea's likelihood to turn into a viable business opportunity. The focus is, therefore, not only on solving a particular problem, but also on generating a broad pool of marketable ideas and increasing their overall speed of implementation. Users are typically preselected to co-design, test, and validate products or services that are being developed in the LL. However, the innovation process is almost entirely coordinated and controlled by the sponsoring organization.

One prominent example is the LL division of the European Energy Forum (EUREF) campus in Berlin (Engels et al., 2019). EUREF is proclaimed as a real-world laboratory designed to facilitate the shift to renewable energy in Germany by hosting leading actors in the fields of energy, mobility, and building technologies (e.g., engineers, businesses, and research institutions) and motivating them to work together to develop and test new solutions under quasi real-world conditions (Engels et al., 2019). The EUREF's LL model has been mostly geared towards the development of the most viable and marketable projects that best reflect EUREF's innovativeness vis-à-vis investors, policy-makers, potential partners and customers. Its LL approach is thus conceived not just as a neutral site for the co-creation and testing of new technologies, but also as an indicator of their feasibility and commercial success.

Network orchestrator: A "network orchestrator" is a LL whose main role is to coordinate partnerships between stakeholders with complementary resources and capabilities. These LLs help organizations and nascent entrepreneurs connect to key market actors, policy-makers, mentors, and potential resource providers. They are usually set up through partnerships between two or more research institutions in order to expand their network reach and provide incentives for faculty to engage in industry-oriented research. In this regard, a network orchestrator not only facilitates the innovation process at the individual firm-level, but also addresses the innovation gaps at the level of the ecosystem, thereby shaping the relational dynamics within and across industries (Magas & Kiritsis, 2021). They are open to all stakeholders and user groups that are able to contribute in one form or another to a specific project. Their success highly depends on

the relational dynamics and structure of their ecosystem as well as on their ability to manage informal knowledge spillovers.

As an example, the L3 Lab defines itself as an open, participatory, experimentation and co-creation space, which is situated in a public library in Barcelona with the aim of reinforcing the links between culture, technology and society (Nguyen & Marques, 2022). It is driven by the desire to foster multi-stakeholder collaborations with a Quadruple Helix approach as a way of transferring research outcomes faster to the real world. In effect, L3 has been the result of a bottom-up network initiative that emerged between local residents, businesses, the municipality, and a research center, which is coordinating the LL activities. Similarly, NovaGob.Lab has been set up in Spain to accelerate innovation in the public sector by fostering networks and collaboration spaces between public sectors organizations, academic institutions, private organizations and the civil society (Criado et al., 2021). It primarily operates by leveraging the academic knowledge generated by researchers in order to design innovative public policies and services. The outcomes generated from the adoption of these policies and services emerging from the LL would then feed back to enrich academic knowledge and inform researchers and political scientists about the validity of their theories.

Community anchor: The "community anchor" represents a LL created to address emerging societal challenges, either within a specific geographical region or within a target population group. It is typically funded by local municipalities or regional governmental entities with the aim of fostering sustainability, economic growth, and social welfare. Hence, it focuses heavily on an open and an active participation from citizens and from motivated members of the community. As such, stakeholders are usually very diverse and come from a range of different backgrounds and disciplines. All stakeholders are admitted as long as they are able to contribute to the Living Lab's overall value proposition. Because the majority of supported projects tend to be in their very early stages, a community anchor is mostly involved in the evaluation phase of the innovation process in order to help detect promising ideas and transform them into society-enhancing solutions. Urban Living Labs tend to generally fall under this category. They distinguish themselves from other models by their explicit focus on local societal issues and their heavy dependence on public support. Community anchors are usually deeply embedded in their society making it possible to identify and mobilize relevant stakeholders and monitor the effects of their actions. While many of these LLs tend to prioritize local sustainable solutions for addressing wicked problems, they can also be oriented at promoting economic growth or enhancing social cohesion. The support they derive from municipalities and members of their community enables them to use specific areas of the city as laboratories to develop and test new solutions.

One example of such a LL, is the Energy Avantgarde Anhalt (EAA) lab launched in Germany as part of a regionally tailored initiative to accelerate the sustainable conversion of the local energy system in the Anhalt region (Engels et al., 2019). It functions as a non-profit organization by bringing together multidisciplinary groups of energy experts, researchers, suppliers, utility companies, municipalities, as well as individual citizens to enable the co-creation, testing, and implementation of research and business ideas related to sustainable energy transitions. Another example is CitiLab¹³ founded in Barcelona for promoting social and digital innovation (Gascó, 2017). It operates with a particular focus on fostering digital awareness among citizens, facilitating the democratic access to information, and promoting open-innovation principles, thereby prioritizing a way of innovating much more focused on the needs of its community.

3.5 Dynamic change between models: An empirical illustration

Taking the above typology and conceptual framing as our starting point, we sought to explore how a LL's design configuration can be adapted across projects and over time. Most of our reviewed cases have focused either on a specific project (Lehmann et al., 2015) or on a specific element of a LL's design configuration, such as the role and degree of end-user involvement (Almirall, Lee, & Wareham, 2012; Leminen et al., 2014),

¹³ <u>https://citilab.eu/</u>

enabling spaces (Della Santa et al., 2022; Engels et al., 2019), and strategic orientations (Van Geenhuizen, 2018), overlooking how the alignment between each of these elements and project-specific requirements can be achieved. We thereby select an empirical case study for an in-depth examination with the goal of illustrating the dynamic nature of our typology and highlighting how LL models can be adapted from one project to another based on the needs of each project and the priorities of different stakeholders.

The case traces the evolution of a LL (referred to as ITMT thereafter) created for accelerating innovation in the medical technology sector in Montreal. Healthcare innovation is increasingly becoming a regional priority with more than \$1 billion allocated over the next three years to modernizing local hospital technology infrastructure¹⁴ and an additional budget of \$375 million assigned for life sciences research¹⁵. Though not as visible as other sectors, such as AI or aerospace for instance, the medical technology sector in Montreal has witnessed a range of local initiatives created to facilitate the development and implementation of innovation-driven solutions to respond to existing healthcare challenges. The prevalence of these initiatives coupled with the dynamically evolving nature of the healthcare innovation ecosystem in the region provided the right empirical context to examine how LLs can be actively (re)designed to address the changing needs of entrepreneurs, researchers, and other stakeholders.

The study is part of a larger project aimed at identifying common principles and best practices for managing innovation intermediaries in healthcare. More than 85 interviews were conducted throughout this project along with extensive document analysis, workshops, and presentations spanning over a two-year period. This fieldwork allowed us to detect the key moments in the life cycle of the organization, including its emergence, main challenges, and evolving priorities, as well as its implications on individual researchers/entrepreneurs and the regional innovation ecosystem as a whole. Our research strategy, therefore, combines insights from theory and research on innovation intermediaries with an in-depth case study for illustration purposes (Siggelkow, 2007).

¹⁴ https://www.canhealth.com/2022/06/30/quebec-to-invest-nearly-1-billion-in-health-it/

¹⁵ Source: Québec Life Sciences Strategy 2022-2025

We show that, despite differences in their design structures, LLs can (and often should) be actively adapted to address emerging innovation-support needs.

3.5.1 Case overview: ITMT

ITMT was initially set up in 2017 as led by Polytechnique Montréal in collaboration with three leading hospitals in the region with the aim of supporting the development and diffusion of new medical technologies across three categories of diseases: cancers, cardiovascular diseases and musculoskeletal. To achieve this objective, ITMT explicitly defines itself as a LL around which an active network of researchers, entrepreneurs, students, and industry leaders can co-create, validate, and test new medical solutions in an actual hospital setting. In effect, the LL has been strategically positioned inside a major hospital center, which facilitates the identification of emerging clinical challenges and allows researchers and entrepreneurs to validate and implement their technologies in real-time. This case can be seen as a typical example of an innovation intermediary actively adapting its LL model in response to the evolving needs and priorities of its partners, collaborators, and broader ecosystem.

From our fieldwork, we note two major factors that promoted to ITMT to (re)design its LL model over time and across projects. The first is attributed to the broad nature of projects supported by ITMT. Indeed, ITMT's activities span across the whole medical innovation lifecycle, from basic clinical research to implementation (Figure 3.4) and in effect, involve a wide range of stakeholders, including patients, healthcare professionals, researchers, entrepreneurs, and hospitals that contribute to the success of this process. While some projects tend to have well-defined objectives (e.g., testing/validating a new technology, gaining quality certification, accelerating research and development), others projects are more ambiguous, particularly those involving AI components and other breakthrough innovations, due to the uncertainty inherent in their commercialization. This wide spectrum of intervention necessitates ITMT to offer more tailored services as part of its LL model, including helping researchers/entrepreneurs navigate clinical trials, providing business support, and promoting networking and partnership opportunities. Insert Figure 3.4 about here

The second factor is attributed to the dynamically changing nature of the medical technology ecosystem. The LL approach adopted by ITMT puts it in an ideal position to mobilize the collective knowledge of its ecosystem in order deliver more tailored innovation-support services. However, despite notable efforts to establish responsible knowledge management systems, much of the knowledge accumulated by the institute seem too difficult to translate across projects. For example, we noted that many promising innovations, despite having apparent benefits to patients and end-users, remained as pilot projects and are never integrated into the healthcare system. This is largely due to the complexities inherent in commercializing new medical technologies, including stringent procurement criteria, long legal approvals, and restricted access to patient data (fieldnotes). In other cases, researchers, and even entrepreneurs often lacked the necessary business skills to articulate the "added value" that their technology provide to potential clients (e.g., hospitals and clinics) and investors-"the investor language" as one informant calls it. Thus, the role of ITMT is perceived differently by different stakeholders, each according to their own priorities and innovation-related needs. These factors drove ITMT to actively shift between different LL models to accommodate the broad nature of its supported projects and the dynamically changing needs of its ecosystem.

3.5.2 Shifting between models

Technology sponsor: Since its inception, ITMT has performed traditional *"Technology sponsor"* roles, prioritizing services related to the proper development and validation of new technologies and helping researchers/entrepreneurs commercialize their technologies to potential users (e.g., hospitals, clinics, and physicians). As such, ITMT's LL model has been essentially geared towards technology development focussed on

"translating the value of the technology to patients" (medical researcher). As ITMT's founder puts it:

"It's not enough to support the development, the innovation needs to be transferable, which is still less concrete than the development. What TMT is doing is creating the rights condition for an innovation to be transferable".

In many cases, technologies were not intended to be commercialized, but rather diffused directly into existing healthcare practices. "Because ITMT is situated inside the hospital, it already understands the barriers [to diffusion], that can be regulatory, procurement, or cultural between stakeholders." (Senior hospital representative). The contribution of ITMT here was to "provide the necessary incentives for these stakeholders to closely work together" (senior manager). For example, financial or other in-kind support are often provided for stimulating the collaborative exchange between experienced physicians, hospital representatives, and entrepreneurs in order to make sure that a proposed technology is suitable for addressing a concrete healthcare need.

Hence, the initial "target market" for ITMTs LL services was mostly clinicians and medical researchers. This approach has prioritized working mostly with specialized, multidisciplinary teams that are most able to evaluate the value of a certain technology and ensure its alignment with existing hospital practices. Users (e.g., clinicians, physicians, and patients) were more involved in testing the technical feasibility of the technology rather than in its actual development.

Opportunity spotters: Despite ITMT's efforts to help mitigate potential risks that arise during commercialization, a recurring concern expressed by our informants was "*how to convince healthcare institutions to buy the technology*" (senior hospital representative). The growing awareness to this challenge prompted ITMT to reorient its LL model to involve elements associated with "*Opportunity spotters*". In effect, ITMT has employed a range of mechanisms designed for "*scouting promising innovation projects*", "*customizing support services*", and "*broadening areas of expertise to accommodate for emerging technologies*" (project manager). For example, ITMT has collaborated closely

with other regional intermediaries, including business incubators and accelerators to help move the most promising medical innovation projects from research labs to the market.

"How to do research is not the same as to launch a company ... this needs institutions like ITMT to help researchers change their mindset... we should all support them in testing, developing prototypes, and accessing local markets because it's highly challenging for a start-up to penetrate the medical industry" (CEO – Business center)

Target segments have further expanded over time. In particular, ITMT began relying on its LL model to attract international companies interested in developing and validating their technologies in an actual hospital setting. This made it increasingly appealing for ITMT to act as "*Opportunity spotter*" by providing more personalized support for these organizations by helping them achieve technical and market feasibility. Such LL model was designed to ensure that a certain project has value and can be safely integrated in the healthcare system if developed further.

Network orchestrator: For other projects, ITMT has taken an even broader role as a "*network orchestrator*" around which different stakeholders can collaborate to co-create solutions to persistent challenges facing the healthcare sector. Its key objective as a "network orchestrator" was to facilitate the transfer of academic knowledge to practice.

"On the one hand ITMT is an institute that does multidisciplinary and collaborative research, but it also reflects best-practices in collaborative innovation, making it an expert on how to transfer research into commercial technologies" (chief innovation officer)

Accordingly, LL design for such projects focussed primarily on the provision of the right infrastructure for open-innovation. For instance, ITMT has engaged heavily in organizing various networking events and workshops to enable medical researchers and practitioners to work together, build roadmaps, and share ideas. In other cases, ITMT sought to forge new partnerships across the science-based and business community by introducing nascent (academic) entrepreneurs to more established industry leaders, mentors, or partners. *"ITMT is connected with pretty much all major actors in the medical*"

technology ecosystem...so there is like a cartography in our disposition" affirms one entrepreneur to highlight of the strength of ITMT's network reach.

Community anchor: Over the years, ITMT has been heralded as a flagship initiative for addressing the local challenges facing healthcare innovation in Montreal. Many of its LL projects began to share notable characteristics with a "*community anchor*". In effect, these projects were designed to support regionally-tailored solutions to address the problems raised by the local healthcare community while ensuring a more formal representation of the diverse stakeholders involved.

"The integration of new innovation is one of the major challenges in Montreal healthcare system...the solution for integration is to show the value of the innovation, meaning that to put them in the hands of the users and to measure their effectiveness, the living lab approach solves the first issue, but it's under-utilized in the sector"

ITMT's "*Community anchor*" approach resonates strongly with the notions of regional co-creation and experimental implementation that are most prevalent for promoting regionally-tailored solutions to emerging societal challenges. Diverse members from the medical community were invited to participate in the innovation process, including patients, clinicians, hospital representatives and specialists. "*The diverse expertise of the network enables fast response to [medical] researchers' needs*" affirms ITMT's project manager, it is this diversity of expertise that allows ITMT to "*tailor medical technologies to the local context*" she continues.

As ITMT's experiences have shown, there is no one-size-fits-all approach for managing LLs. Indeed, ITMT's ability to adapt its LL model with the unique requirements of each project has made it a go-to reference point for supporting the development and implementation new medical technologies. "A living lab approach is something everyone wants to implement. ITMT was a leader in implementing it correctly and had the courage to try it" affirms a senior innovation officer in the region. Hence, our purpose for presenting this case is to show that establishing LLs as intermediaries for promoting innovation will often require (re)designing new innovation-support models in accordance with the evolving needs of clients, partners, and the ecosystem.
3.6 Discussion

This study extends earlier work on experimental, co-creative approaches to innovation by introducing a parsimonious, conceptually robust typology of four ideal models for organizing and managing LLs, each underpinned by a unique value proposition guiding their objectives and design structures. Although these models are presented as mutually exclusive, we show that they could (and often should) be actively adapted to the nature and requirements for each project. We acknowledge that while LL models can differ in important ways, there are common elements that underlie their characteristics, such as active user involvement, openness, and experimentation under real-world conditions. A good deal of attention went into describing these common characteristics and their importance for generating more relevant and user-centric innovation. Less emphasis was placed on the distinguishing features or comparisons across models. This study therefore reflects this emphasis.

Having established the differences between LL models, the natural follow-up question is in what ways are some models better than others. Implications on the performance of supported projects were not immediately obvious, though our results suggest that differently designed LLs exhibit different outcome expectations. Studies generally take one of two perspectives. The first is that of outcome-neutrality, meaning that the key stakeholders tasked with setting up and monitoring a LL are outcome-neutral as long as the innovation process unfolds according to some defined set of criteria stated in advance. This perspective suggests a quasi-scientific understanding of LLs where the purpose is to test and validate the feasibility of new solutions in a real-life context. The second perspective is a more output-oriented in the sense that the outcomes of LLs need to serve (and be evaluated against) a defined set of policy objective or organizational goals. As such, performance indicators here are more concrete and driven primarily by organizational and/or political interests.

From our analysis, we note that LLs that are set up mainly by universities and research institutions tend to prioritize the former approach focusing more on the early stages of the innovation process (i.e., research, experimentation and testing). In contrast, LLs set up by

business centers or policy mandate are more output-oriented and involved heavily in the late innovation stages (i.e., implementation, commercialization, and venturing). In that sense, our analyses confirms Leminen et al. (2012)'s arguments that LLs can be differentiated based on the most influential group of stakeholders.

In addition to the innovation outcome itself, participating in LLs also provides some form of social capital. Interestingly, our case evidence seems to suggest that one primary reason many entrepreneurs and researchers have to come to value the work conducted in LLs was not to gain direct access to users and/or a real-life testing environment (despite their evident advantages to the success of their projects), but rather for the connections made with potential customers, partners, resource providers, or investors along the way. This is important because the networking aspect of LLs has not received much attention in the literature. As ITMT's experiences have shown, LLs plays an important role in hosting meetings, workshops, and events to build a social community around a certain technology or technical domain. Thus, we argue that the value of LLs as an innovation governance mechanism is not only bound by the direct outcome of a specific project, but can also be observed at the level of the innovation ecosystem in terms of new partnerships, serendipitous encounters, and knowledge spillovers.

Looking at the broader innovation ecosystem, however, we note that LLs are only one of the variety of intermediaries supporting innovation-related activities. Thus, to fully appreciate the synergistic contributions of these intermediaries, it is important to recognize the unique, yet complementary services that each could provide. The LL design configurations presented in this study can be used to position the different approaches for managing experimental innovation activities across geographical regions and sociotechnical domains. It provides insights for managers and policymakers to evaluate the impact and distinguish their role to their broader ecosystem. Across all four models, we note that innovations emerging from LLs gradually take shape from the non-linear interactions between a range of different actors including entrepreneurs, researchers, users, moderators (e.g., LL managers, mentors, and consultants), and often citizens. In contrast to top-down approaches, such as those adopted by business incubators, science parks, and accelerator programs, LLs prioritize a more emergent and experimental support strategies. Thus, even though the innovation outcome cannot be predicted in advance, the potential for achieving a desired objective (i.e., value proposition) can be properly designed.

Finally, we argue that LL design choices often evolve as innovation needs change over time and across projects. As it is the case with ITMT, LLs often embrace multiple models across projects. Hence, we conceptualise the link between LL design and innovation outcomes as one where they emerge concurrently through evolving priorities, serendipitous interactions, and active feedback rather than predominantly linear in which one leads to the other. This means that the four LL models presented in our typology should not be viewed as pre-existing alternatives for managers, but rather emergent properties. Given the high degree of the social embeddedness of LL initiatives (Engels et al., 2019), it remains to be seen how these models would compare across different regulatory, political, or sociotechnical contexts

3.7 Conclusion

The increasing complexity of contemporary innovation activities is driving businesses, researchers, and policy-makers to seek new ways to engage in open collaborations by tapping into the capabilities of their regional innovation ecosystems. LLs offer a structured, user-centric approach to researching, developing, and implementing complex solutions to concrete societal and business-related challenges. The framework we present here, developed from our analysis of 38 presumably successful LLs, provides a practical approach to such strategic engagement. It helps managers, policy-makers, and other stakeholders involved in setting up and managing LLs avoid the common pitfalls of deciding how to organize innovation-support activities before having identified a clear value proposition and whom to engage with before having determined which actors and resources are most essential for the project's success. Our systematic approach to LL design suggests that leaders consider eight key design elements that underlie four ideal LL models, each anchored in a unique value proposition. Identifying what model to adopt should flow from leaders' high-level innovation priorities and their

own assessment of their organizational capabilities. While simple in its formulation, our four-model typology can be challenging to implement, especially for LLs involved in multiple projects simultaneous and thus wish to combine different models for managing these projects. The challenge however, is how to ensure a "fit" between innovation-support activities and LL objectives without creating bottlenecks. As we attempt to show from ITMT's LL experiences, it is always essential to ensure an internal alignment on what outcomes are to be expected, what resources are available, and who the key stakeholders are for each project.

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Table 3.1. Living Lab design models

	"Technology sponsor"	"Opportunity spotter"	"Network orchestrator"	"Community anchor"
Value proposition	Catalyze technological advancement	Detect the most promising marketable solutions	Foster stronger relations in an ecosystem	Address local societal challenges
Design Elements			·	
User Engagement	An established network of users with frequent access to workshops and events	Access restricted to selected groups of participants	Open to specific user groups with a defined set of criteria	Open participation to concerned members of a community
Services Offerings	Services related to the proper validation and implementation of new technologies	Services related to idea conception, refinement, and testing	Services related to the formation of new networks and partnerships across the science-based business community	Services related to the co-creation and refinement of relevant and practical solutions
Project Selection Criteria	Projects contributing to the advancement of a certain technology. Favors teams with a proven track record in research or the industry	Projects aligned to the sponsors' interests and objectives. Favors ideas with the strongest potential to succeed in the market	Projects supporting the commercialisation (or transfer) of scientific research done in universities	Projects prioritizing the welfare of a society. Favors ideas that are considered important to certain groups stakeholders
Level of Involvement	Heavily involved in the concept refinement and market validation stages. Also prioritize scalability testing procedures to ensure technical viability and technology acceptance	Mainly involved in the late stages of the innovation process after operational feasibility is attained from market feedback and preliminary results	Prioritize concept evaluation and validation to help overcome barriers associated with commercializing scientific knowledge	Involved uniformly across all stages of the innovation process with a particular emphasis on integrating the needs of the community during co-creation.
General Focus	Technology development in specific industry sectors	Building viable customer- facing solutions	Forging new partnerships and stronger collaborations	Economic development and social welfare
Funding Mechanism	Mix between public funding and internal revenue sources	Corporate/Private investors	Universities/Research centers	Government support programs
Temporality	Based on the viability of the underlying technology	Based on the performance of the innovation outcome	Based on active network participation	Based on a renewable project mandate
Case Examples	iMec LL (Belgium), Apollon LL (Finland), Transforma Lab (Belgium)	EUREF Berlin (Germany), i2Cat Digital Lab (Spain), and LLs run by corporate entities	L3 Lab (Spain), Circular LL (Australia), Botnia LL (Switzerland)	EEA Lab (Germany), CitiLab (Spain) and Urban Living Labs in general





Figure 3.2. A performance evaluation framework for monitoring living labs







Figure 3.4. Benefits provided by ITMT through its living lab approach

ITMT Living Lab

- 1. Project Support
- 2. Technology Platforms & Research Chairs
- 3. Scholarships & Training
- 4. Educational Workshops/Events
- 5. Innovateur en Residence





Chapter 4 The role of innovation intermediaries in the diffusion of digital technologies in healthcare

Abstract

Innovation intermediaries have emerged as prominent forms of intervention for supporting technological change and sociotechnical transitions. In this paper, we draw on an in-depth case study tracing the emergence of an intermediary created particularly to address innovation-related challenges facing the healthcare sector in Montreal, Canada. We analyze data from 85 interviews with leading actors in the healthcare innovation ecosystem to theorize how intermediation helps facilitate the diffusion of emerging digital technologies in this sector. Our analysis reveals two interrelated processes: (1) "technology-focused intermediation" to help co-create the technology in accordance with existing demand; and (2) "ecosystem-focused intermediation" to help reinforce ecosystem components for enabling effective implementation. Each of these processes is driven by sourcing, mobilizing, and scaling activities intended to align the technology development trajectory with envisioned sociotechnical requirements.

Keywords: Innovation intermediaries, digital technologies, innovation diffusion, digital transition, healthcare innovation

4.1 Introduction

Innovation intermediaries (IIs) are becoming increasingly pervasive in fostering innovation across geographical regions and sociotechnical domains. They represent entities founded particularly to support the collaborative exchange between two or more parties during the various stages of the innovation process (Kivimaa, Boon, Hyysalo, & Klerkx, 2019; Lin, Zeng, Liu, & Li, 2020; Thomas, Balestrin, & Howells, 2014). They do so either directly through the provision of the necessary resources, guidance, and services (Gredel, Kramer, & Bend, 2012; Wright, Clarysse, Lockett, & Knockaert, 2008) or indirectly through supporting the development of networks and partnerships within and across industries (Clayton, Feldman, & Lowe, 2018; Gredel et al., 2012). While intermediation in the innovation context is not new, recent advances in digital technologies—the combination of tools, systems, and devices that generate, store and/or process data—coupled the growing awareness to the potential implications that these technologies can have on businesses and societies have accentuated the role of intermediaries in supporting digital transition projects (Dąbrowska et al., 2022; Rossi, Caloffi, Colovic, & Russo, 2022).

Digital technologies are inherently complex and challenging to implement (Bunduchi, Tursunbayeva, & Pagliari, 2019), often requiring fundamental changes to existing organizational processes (Gruia, Bibu, Nastase, Roja, & Cristache, 2020) and significant investment in both tangible (e.g., equipment, software, and infrastructure) and intangible (e.g., business model and technology development processes, organizational restructuring, and worker training) assets to yield significant productivity gains (Piepponen, Ritala, Keränen, & Maijanen, 2022). IIs are well-positioned for helping organizations leverage the opportunities brought forth by these technologies, providing access to specialized knowledge, skills, and capabilities that remain relatively scarce even in large enterprises, and largely absent from smaller ones (Benbya, Davenport, & Pachidi, 2020; Spanò, Massaro, & Iacuzzi, 2021). Despite the significance of IIs for overcoming key barriers to the development of digital technologies, there are two highly important, yet underexplored aspects associated with their diffusion.

First, highly regulated sectors, such as healthcare, finance, and energy are usually subject to local laws and practices that dictate what forms of data can be utilized, what data management criteria should be followed, and how the resulting outputs can be interpreted and communicated (Hermes, Riasanow, Clemons, Böhm, & Krcmar, 2020). Hence, organizations face challenges that are not only technical, but also institutional in nature (Dąbrowska et al., 2022) requiring serious consideration of the interests and concerns of different stakeholders (e.g., regulators, suppliers, developers, users etc.) most of which are beyond the organization's direct control (Dattée, Alexy, & Autio, 2018). In such settings, the intermediation process needs to occur well before the technology is being implemented so that all relevant stakeholders can be heard and accounted for (Järvi, Kähkönen, & Torvinen, 2018). However, how different stakeholders are able to co-create new technologies as participants in an ecosystem remains a challenge to be addressed (Prodi, Tassinari, Ferrannini, & Rubini, 2022).

Equally important is also how the innovation ecosystem itself, as defined by the set of "interdependent actors, activities, and artifacts, and the institutions and relations ... that are important for the innovative performance" (Granstrand & Holgersson, 2020: 1) needs to adapt to accommodate for the emergence of these new technologies. By their very nature, ecosystems are highly dynamic and evolve over time in response to new waves of innovation and competitive pressures (Rong et al., 2020). However, as recently pointed out by several scholars (e.g., Hansen & Sia, 2015; Hermes et al., 2020), studies on digital transition have focussed predominantly on intra-organizational changes (e.g., transformations in organizational processes, structures, and business models) overlooking the changes that also need to occur at the level of the ecosystem (e.g., public policies, industry regulations, financing schemes, and appropriation regimes) for enabling its attainment in different regions and industrial domains.

Hence, while both a bottom-up approach (i.e., adapting emerging technologies to the evolving needs of the ecosystem) and a top-down approach (i.e., adapting the ecosystem to the needs of emerging technologies) are useful to understand how digital technologies get diffused over time and across contexts, they have been examined separately in the literature (Dąbrowska et al., 2022; Prodi et al., 2022). IIs offer a way to integrate these seemingly disparate approaches, playing a major role in shaping the pace and direction of the technology development trajectory (Agogué et al., 2017; De Silva, Howells, & Meyer, 2018). Nevertheless, we still know little about the nature of the challenges that these intermediaries face in managing digital transition projects and the mechanisms they employ to enable their effective resolution (Kivimaa, 2014; Rossi et al., 2022).

The purpose of this paper is therefore to explore the intermediation process underlying digital transitions in regional ecosystems. We ask: (1) how do intermediaries create the necessary momentum to facilitate the diffusion of emerging digital technologies? and (2) what aspects of intermediation are particularly important for overcoming systematic constraints? For conceptual clarity, we define innovation diffusion as "the process in which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 2003: 5). We draw from an indepth case study of the medical technology sector in Montreal, Canada. The gradual evolution of this sector has been largely facilitated by an intermediary organization founded primarily to accelerate the development of new medical technologies and enable their adoption in the local healthcare sector (e.g., hospitals and clinics). Given the high institutional, organizational, and regulatory challenges associated with the implementation of new digital technologies in healthcare (see e.g., Agarwal, Gao, DesRoches, & Jha, 2010; Massaro, 2021), our empirical context provides a fruitful opportunity to highlight the direct contributions that IIs can make in facilitating this process.

4.2 Theoretical background

4.2.1 Digital technologies in healthcare: Basic principles and barriers to diffusion

The healthcare sector is often portrayed as one of the most resistance to change (Hermes et al., 2020), trapped by crippling rigidities and strict bureaucratic procedures that persistently challenge innovation in favor of maintaining the status quo (Bhattacherjee & Hikmet, 2007; Massaro, 2021). Any technology that does not fit readily into the established system is usually met with harsh resistance inhibiting its successful diffusion (Kane & Labianca, 2011; Venkatesh, Zhang, & Sykes, 2011). The wellestablished norms and practices of the industry put potential adopters (e.g., physicians, clinicians, nurses and other healthcare professionals) in a position where they are likely to resist external pressures to change (Bhattacherjee & Hikmet, 2007), particularly those that could threaten the autonomy of their profession (Walter and Lopez 2008). While many healthcare professionals are increasingly endorsing new digital technologies (Denicolai & Previtali, 2022), the high costs associated with integrating them into existing healthcare systems (e.g., infrastructure, technical support, data regulations, interoperability issues, security, and insurance coverages/reimbursements) erect substantial entry barriers.

Perhaps more critically, access to reliable data remains a major challenge hindering the adoption to digital technologies in healthcare (Hermes et al., 2020). When it comes to digital health systems, studies indicate low trust in public and private institutions in handling sensitive patient data (Anderson & Agarwal, 2011; Khodadad-Saryazdi, 2021). Even if the technology is deemed appropriate, problems often arise in adapting it to the specific needs of health professionals (Campbell et al., 2000). Ultimately, the lack of incentives to adoption, the difficulty in accessing patient data, and the complexities associated with systematic assimilation remain among the key barriers threating the successful diffusion of digital technologies in healthcare. As noted by Massaro (2021), the healthcare landscape needs to be thought of as a multi-stakeholder ecosystem where different actors (e.g., patients, physicians, nurses, regulators, public bodies, and investors) interact to facilitate a healthy transition.

Insert Figure 4.1 about here

Prior research offers a variation of innovation diffusion models aimed at describing key "triggers" (summarized in Figure 4.1) driving the rate of adoption of emerging technologies over time (e.g., Edmondson, Bohmer, & Pisano, 2001; Garud, Tuertscher, & Van de Ven, 2013; Silvestre, 2014). The bulk of this research have focussed predominantly on the implementation stages, that is when a certain technology with evident potential benefits is introduced to the market to gradually find its way within existing organizational routines (Kiesling, Günther, Stummer, & Wakolbinger, 2012). Successful implementers will ultimately overcome the main barriers to adoption by framing, blending, and transforming the technology to make diffusion possible (Hargadon & Sutton, 1997). From this perspective, the initial emphasis is placed on the focal organization and the ways by which it manages the diffusion process within and across its traditional boundaries.

Because innovation propagates within a social system (Rogers, 2003), it entails important considerations that go beyond the nature of the technology itself to also encompass the broader ecosystem within which the diffusion process unfolds (Owen-Smith & Powell, 2006). From this perspective, innovation diffusion starts not with the implementation stage, but rather with co-creation. Co-creation refers to a specific form of collaboration arrangement involving multidisciplinary stakeholders working closely together, integrating their resources, skills, and capabilities to achieve a common objective (De Silva, Gokhberg, Meissner, & Russo, 2021: 4). In effect, co-creation assumes an iterative innovation diffusion process (Figure 4.2) facilitated largely by a myriad of intermediaries that are often essential for taking new discoveries (e.g., technologies, inventions, and ideas) from research labs to market (Johnson, Gianiodis, Harrison, & Bock, 2022). This interplay between individual agents, institutions, and intermediaries forms the basis of the ecosystem-based co-creation approach to innovation.

Insert Figure 4.2 about here

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4.2.2 Innovation intermediaries: Roles and operating mechanisms

Academic interest in IIs strongly coincides with the rising popularity of ecosystems as a novel approach for organizing and managing innovation-related activities. At its core, the ecosystem construct recognizes the micro-dynamics underlying the innovation process, and therefore captures the diverse mix of intermediaries that effectively contribute to its successful progression (Clayton et al., 2018). However, research on IIs as a distinctive entity remains relatively scarce, especially as facilitators of digital transition projects. Despite the existence of an emerging body of work on "transition intermediaries" (Kivimaa et al., 2019; Moss, 2009; Rossi et al., 2022), studies have offered a wide range of interpretations over their exact role in supporting technological transitions (Engels, Wentland, & Pfotenhauer, 2019) and the extent to which they are able to influence their end outcome (Kivimaa, 2014; Van Lente, Hekkert, Smits, & Van Waveren, 2003).

From our review of this literature, we identify a range of mechanisms that underlie the intermediation process in the innovation context. We carefully ordered, linked and grouped these mechanisms into three broad categories (Table 2.1) based on an intermediary's level of involvement in the innovation process, that is its willingness and capacity to influence the pace and direction of the overall innovation trajectory. These categories range from low levels of involvement that is limited to *brokering* transactions between disparate, yet complementary actors in the ecosystem (e.g., Berbegal-Mirabent, Sabaté, & Cañabate, 2012) to a more active involvement in *orchestrating* the right conditions to innovate (e.g., Agogué et al., 2017) to an even stronger position in the innovation process by directly *sponsoring* specific technologies and/or new ventures (Engels et al., 2019). We settled on these three groupings as a parsimonious means to clarify the roles of intermediaries in supporting innovation-related activities and the mechanisms undertaken to fulfill each role.

Although this research suggests that intermediaries are able to navigate much of the challenges associated with facilitating digital transitions through brokering, orchestrating, and sponsoring activities, how and when they are able do so in general remains unclear. Rossi et al. (2022) provide an important step in that direction showing that dealing with emerging digital technologies requires intermediaries to go beyond simply brokering transactions to also engage in orchestrating dynamic networks around the technology itself. This often requires a reconfiguration to their own business model to perform these multiple roles. Other studies (e.g., Katzy et al., 2013; Kivimaa, 2014; Russo, Caloffi, Rossi, & Righi, 2019) also stress on the importance of taking a more active role in supporting technological transitions through directly engaging in business development (Germain et al., 2022; Lin et al., 2020), expediting commercialization (Johnson et al., 2022; Meyer et al., 2018), and facilitating sociotechnical transformations (Kivimaa et al., 2019; Moss, 2009), particularly in cases where the emerging technology necessities new knowledge sources, new business models, and new working practices (Agogué, Yström, & Le Masson, 2013; Boon et al., 2008; Tran, Hsuan, & Mahnke, 2011). Given the complexities associated with implementing new digital technologies in organizations and the potential (unintended) implications they can have on many aspects of their business activities (Dąbrowska et al., 2022; Lanzolla et al., 2020), we expect intermediaries to assume various roles to enable their effective diffusion.

4.3 Methodology

To address our research questions, we base our work on a qualitative, inductive case study (Strauss & Corbin, 1998) relying on the method described by Gioia, Corley, and Hamilton (2013) to collect and analyze relevant data. This approach is particularly suited for making sense of complex social phenomena, such as innovation diffusion, while accounting for the specificities of the local context (Eisenhardt, 2021; Van de Ven & Poole, 2005). Thus, our aim is not to test a specific hypothesis, but rather to derive conceptual insights that could assist researchers and practitioners to understand the role played by intermediaries in supporting the diffusion of digital technologies in healthcare.

For this purpose, we draw on an in-depth case study of an II (henceforth referred to as ITMT) that was created specifically to address persistent innovation challenges and gaps in the regional healthcare ecosystem in Montreal, Canada. ITMT was set up as an intermediary tasked with supporting the co-creation of new medical technologies and ensuring their alignment with the needs of the end-users. ITMT was selected because its positioning within its local ecosystem gives it, in principle, a good possibility to intermediate between various system components to facilitate innovation-related activities. As a highly regulator sector that is undergoing significant digital disruptions, healthcare provides a fruitful empirical context to distill the role of intermediaries in promoting (or inhibiting) certain aspects of sociotechnical changes. The diversity of the stakeholders involved has also allowed us to gather different perspectives, thereby providing a more comprehensive account of the focal phenomenon.

4.3.1 Research setting:

ITMT was launched in 2017 as a university-led initiative in collaboration with the three leading hospitals in Montreal, partly in response to a perceived gap in the regional healthcare ecosystem and partly as a regionally tailored initiative to support more efficient patient treatment. To achieve this objective, ITMT defines itself as a living lab around which a growing network of researchers, physicians, students, entrepreneurs, and industry leaders collaborate to co-create new medical solutions in an actual hospital setting. Necessarily, it has been strategically positioned inside the university hospital center, where emerging clinical needs can be easily identified, analyzed, and communicated. The four main lines of activities for ITMT include (1) supporting the development and commercialization of new medical technology projects; (2) maintaining open technology platforms in universities and hospitals; (3) financing research chairs and graduate students; and (4) managing entrepreneur-in-residence programs with partnering hospitals.

Since its inception, ITMT'S strategy has largely focused on co-creation as a cornerstone of medical research and development (R&D). It was crafted around the vision of user-driven innovation in healthcare where the value created can be magnified as the technology becomes moulded to the specific needs, requirements, and aspirations of end-

users. To begin with, ITMT places the needs of end-users (e.g., patients, clinicians, and hospital staff) at the center of the innovation process. It actively engages with the medical community, organizes workshops/events, and leverages its informal network of researchers and practitioners so that all stakeholders that need to contribute to the conversation can be present from "day one". In the words of its founder:

"The idea is to create an environment that allows to facilitate research, development, and industry partnership and finding ways to motivate actors to work together ... to respond to the needs of patients, hospitals, and the industry."

Despite its relatively short history, ITMT has indeed become recognized as a bestpractice model in the region for the development and commercialization of new medical technologies. As the senior innovation officer for Quebec puts it:" *the fact that [ITMT] designed their model in a way that integrates best-practices in collaborative research, creative end-user engagement, and innovation cycles positions them as experts in how to transfer [medical] research to the field.*" Many see its public credibility to be rooted in the renowned expertise of its founding members and the uniqueness of its value proposition, which in a way has been very much effective in driving innovation and bringing about digital transformative changes in healthcare.

4.3.2 Data collection

Data collection spanned over a period of a year and a half, including preparation for data collection, interviews, and follow-ups. Our primary data source comprised of 85 semi-structured interviews with key members, researchers, and entrepreneurs associated with ITMT, as well as representatives from the broader healthcare ecosystem. We relied on two types of informants: (1) internal informants, which are executives, advisors, and senior managers of ITMT and (2) ecosystem informants, which include members from local hospitals, physicians, medical researchers, entrepreneurs, industry actors, representatives from the government, as well as other intermediaries (e.g., business incubators and accelerators) also operating in the region (Table 4.1). Our choice of informants ensured full coverage of the key actors that are involved either directly or indirectly in influencing the diffusion of new medical technologies. Interviews were

conducted either in English or in French. All interviews except three were recorded and later transcribed.

The first round of interview started in July 2020 until late November 2020 involving of 33 informants and focussed primarily on understanding: 1) the main role and characteristics of ITMT as an intermediary, including its mission, key stakeholders, nature of activities, and desired outcomes; 2) the way innovation-support activities are conducted, that is how ITMT identifies and selects promising projects to support, how it manages the collaboration between multidisciplinary actors, and how it helps researchers/entrepreneurs to develop and commercialize their technologies; and 3) the key barriers to innovation in healthcare. In effect, nearly all supported projects involved a digital component requiring serious consideration on how to integrate them with existing physical processes, how to access data from local hospitals, and perhaps more importantly how to justify the "added value" of these new digital technologies compared to those that already exist.

Building on the insights provided from our initial round of interviews, we expanded our focus to the broader healthcare ecosystem to include more medical researchers, entrepreneurs, industry representatives, and other intermediaries that operate in the region. We engaged in another round of interviews between January and May 2022 involving 52 additional informants to better understand the challenges (and strengths) of the medical technology ecosystem in Montreal and how ITMT is helping to address those challenges (and/or reinforce the strengths). These interviews were semi-structured and covered all aspects related to the development of new medical technologies, the available support to help accelerate this process, the strategies for navigating clinical trials, the difficulties associated with commercialization (internally inside Montreal and externally to other regions/countries), and the desired changes, practices, or policies that can further help spur innovation in healthcare. In addition to these interviews, we used multiple data sources for the purpose of triangulation, including internal documents and industry reports. We also visited the ITMT's premises on several occasion to discuss its current business model, impact, and future trajectory.

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Insert Table 4.1 about here

4.3.3 Data analysis

We began our analysis by synthesizing interview data and archival materials into a comprehensive case description. Our initial aim was to understand how the application of "living labs" in healthcare facilitates the knowledge exchange between multidisciplinary stakeholders, creating what is often referred to as innovation commons (Cohendet, Grandadam, & Suire, 2021). We built on this preliminary analysis to direct our focus more to the role of IIs in supporting innovation diffusion and digital transition in local hospitals. After completing an initial case analysis, we began to identify emerging patterns by analyzing the case from an ecosystem perspective-the dynamic interplay between macro-level institutions and micro-level individual actions (Jacobides, Cennamo, & Gawer, 2018; Phillips & Ritala, 2019). As common themes started to emerge, we referred to prior research to compare resulting insights with research on innovation intermediaries, thereby following an iterative process of refining insights and relating them to existing theory. In many cases, follow-up interviews were also conducted to clarify issues that were left open and discuss specific events in greater detail. Despite the iterative nature of this analysis, it progressed through a series of recognizable phases summarized below:

Step 1. Construct definitions and measures

As a first step, we started by defining our theoretical constructs. Our goal was to understand how the intermediation process has helped facilitate the diffusion of new digital technologies in the local healthcare system. We define intermediation as an external intervention involving brokering, orchestrating, and/or sponsoring innovation activities (Table 2.1). By diffusion, we are referring to the way that digital technologies have come to be accepted and implemented in the market (i.e., local hospitals and clinics). Accordingly, this process is not just about the technology itself and its apparent benefits to patients and hospitals, but also about the cultural, organizational, and institutional changes that might need to occur to enable its successful integration.

Step 2. Identifying first-order codes

We proceeded our analysis with an open coding approach (Corbin & Strauss, 1990) focusing on relevant keywords that best reflect how ITMT, as an intermediary, helped facilitate the diffusion process. First order codes (i.e., informant statements) emerged by categorizing and labeling groups of text that emerged from interview data. The initial codes were intentionally kept broad and covered a variety of topics, including stages of the innovation-support process (e.g., project selection, services granted, and follow-ups), technology development challenges (e.g., difficulty in accessing testing facilities, addressing ethical regulations, and navigating clinical trials), the dynamics of the healthcare industry in the regions (e.g., main actors involved, the way the procurement of new technologies takes place in hospitals, and the potential barriers for integrating and using new digital technologies), the major strengths of ITMT and its living lab approach, and so on. The first-order coding was undertaken by one of the authors followed by active discussions, refinements, and validations by the rest of the author team during regular meetings. In this way, our first-order codes integrated our raw data and provided our initial interpretation of the case.

Step 3. Identifying second-order codes

We continued this process by organizing our first-order codes into higher-level conceptual themes (i.e., second-order codes) eliminating those codes that are irrelevant to our research focus (Gioia et al., 2013). While first-order codes reflect informant-based statements, second-order themes provide a more researcher-centric perspective on the process elements related to the underlying phenomenon. Accordingly, we clustered first-order codes into aggregate categories by iterating between the emerging themes from our data and the existing constructs from the literature. As we began comparing and categorizing our first-order codes, we started noticing the intermediation process unfolding simultaneously along two levels: (1) the first, which we labelled as "technology-focused intermediation", captures the set of activities designed to help cocreate a specific technology in accordance to the needs and demands of the market; (2)

the second, which we labelled as "ecosystem-focused intermediation", captures the set of activities designed to motivate, equip, and reinforce actors in the regional healthcare ecosystem to leverage the opportunities brought forth by the new technology.

Step 4. Abstracting higher-order dimensions and building the theoretical framework

The final stage involved consolidating our second-order themes into higher-order theoretical dimensions. Similar to the earlier stage, this process was iterative in nature and largely facilitated by active discussions between the author team to best explicate how ITMT is supporting the diffusion of emerging digital technologies in healthcare. Consistent with our inductive research design, we revisited the data from a theoretical perspective drawing on innovation diffusion theories in relation to the literature on IIs and innovation ecosystems. We finally settled on three aggregate theoretical dimensions (i.e., sourcing, mobilizing, and scaling), which served as the foundation of our model. These three aggregate dimensions reflect external interventions (i.e., intermediation activities) that are mobilized to achieve a desired outcome (i.e., diffusion of digital technologies) within an existing context (i.e., regional healthcare ecosystem) leading to a broader system-level objective (i.e., more efficient patient treatment). The resulting structure of first-order categories and second-order themes along with their corresponding aggregate dimensions are shown in Figure 4.3.

Insert Figure 4.3 about here

4.4 Findings

The emerging data structure data (Figure 4.3) highlights three interrelated processes undertaken by intermediaries to facilitate the diffusion of emerging digital technologies in healthcare: sourcing, mobilizing, and scaling. Specifically, these processes are intended to support the co-creation at the level of the technology itself (i.e., technology-focused intermediation) while simultaneously adapting the sociotechnical requirements at the level of the ecosystem (i.e., ecosystem-focused intermediation). In effect, our field study confirms that innovation in healthcare necessitates a co-creation approach that is it driven by multidisciplinary collaborations within and across the medical community, including researchers, clinicians, patients, regulators, industry actors, and investors. IIs operate at a meso-level coordinating the contributions of these individual actors to ensure that the technology development trajectory aligns with the needs and capacities of the broader sociotechnical context.

4.4.1 Sourcing

As highlighted earlier, ITMT has been a regional pioneer in promoting living labs as a means for driving the development of new medical technologies and facilitating their implementation through regulatory and market alignment. By definition, it operates by sourcing for relevant solutions that address concrete clinical challenges and working closely with different partners to transform these solutions into market-validated technologies. Sourcing in the innovation context refers to the organization's strategy for generating incoming flows of resource/knowledge either internally or through external collaborations (Lin & Wu, 2010; Purdy, Eslami, Eshghi, & Rod, 2022). Our analysis of the data revealed that the success of an intermediary's sourcing strategy relies on its ability to manage not only on the potential flows of external *projects* (e.g., external requests for support), but also on the flow of multidisciplinary *partners* that can contribute to the coccreation of new solutions in a collaborative environment. We, accordingly, use the label "*sourcing*" to encapsulate to the specific acts undertaken by intermediaries to search for, identify and select promising projects and complementary partners to address specific innovation-related needs.

4.4.1.1 Sourcing projects

Sourcing projects refers to decisions concerning which projects to accept and which to avoid. As shown in Figure 4.3, two second-order themes emerged from the data related to sourcing projects: (a) scouting promising innovation and (b) establishing early product-market fit. Both of them are essential to ensure that the resulting innovation can be practically developed and readily accepted by the market (i.e., clinics, hospitals, and the industry). As ITMT's project manager describes:

"The objective is truly to identify clinical needs and to bring forth new solutions to implement in the healthcare system... we receive requests either from the industry or from researchers...then work to bringing together all the necessary expertise to help develop eligible projects."

All researchers that got their projects approved "are considered part of the team" (senior advisor). ITMT's promise to co-create new technologies in collaboration with local hospitals has somewhat granted a broader assurance that the resulting technology will have a readily available demand. For research physicians and entrepreneurs, confirmation of demand is a highly symbolic milestone. It signals the feasibility of their project and its likelihood of success in the eyes of potential investors. As one entrepreneur explained: "*The main challenge to commercialization is just to get a few people to adopt [the technology] so it becomes more easily validated*." At the same time, the expertise of ITMT's leadership team and their accumulated data gathered from prior projects have largely accentuated the organization's ability to evaluate and select the most promising solutions to support. In the words of one informant:

"[ITMT] play another important role in evaluating the potential of a certain technology. It is capable of rapidly evaluating the potential of new technologies based on its [living lab] innovation approach ... It is considered a leading model in the region about how the evaluation of new technologies can be better performed" (Regional innovation advisor)

This process therefore builds on the intermediary's expertise and position within its ecosystem to help founders gain relevant user feedback and access to the resources needed to navigate the technology development process. The technologies supported by ITMT are, therefore, perceived to viable and fairly promising in terms of generating cost savings and contributing to a more efficient healthcare treatment.

4.4.1.2 Sourcing partners

At the level of the ecosystem, sourcing denotes the specific acts undertaken by intermediaries to identify, select, and involve stakeholders with complementary resources, skills, and capabilities. These are typically accomplished using traditional brokering functions designed to link disparate actors and align their respective contributions. The majority of our informants emphasized the importance ITMT's role in legitimizing open-innovation activities, notably by prioritizing multidisciplinary collaborations in the development of new medical technologies.

Indeed, the vast majority of medical devices rely heavily on advanced digital technologies, such as AI and data analytics, necessitating multidisciplinary teams to promote innovation in this domain. As indicated by one entrepreneur: "there's not really a start-up that specializes only in medical technologies, there's always an element of convergence with digital technologies ... requiring to leverage multidisciplinarity." ITMT has always been engaged in major industrial events, actively organizing training and workshops, and trying to create a common platform for facilitating the collaborations. This strategy has been very effective at expanding its network reach and promoting its living lab approach to medical innovation. As one informant puts it "living labs are something everyone wants to implement. ITMT was a leader in implementing it adequately and had the courage to try it." (Medical researcher)

Equipping key market actors within the ecosystem is another essential element driving the success of sourcing activities. Researchers and entrepreneurs seemed to recognize the potential limits of commercialization without the involvement of intermediaries to support this process. For researcher physicians, the challenge is particularly "because there's not much funding ... to navigate clinical trial", while for the industry "it is challenging to develop a medical technology without access to the [hospital] data" (senior hospital representative). ITMT helps in both alleviating financial constraints for researchers and nascent entrepreneurs as well as providing opportunities for organizations to test their technologies with real-time data. "The strength of ITMT lies precisely in it's ability to connect researchers, patients, clinicians, and the industry" confirms one medical technology researcher.

4.4.2 Mobilizing

The second intermediation process that we recognize essential to innovation diffusion is mobilizing participation, which broadly represents the strategic actions undertaken to maximize the perceived value that can be realized from participating in co-creation activities. In our sample, researchers and even entrepreneurs frequently lacked the business expertise to communicate the added value of their technology to potential clients and investors. Many have even lacked the essential resources, connections, and guidance to navigate clinical trials and to form a viable business model for commercializing their innovation. Fortunately, we also saw how IIs helped overcome these challenges by mobilizing the necessary resources at the technology-level and the different stakeholders at the level of the ecosystem.

4.4.2.1 Mobilizing resources

We saw three second-order themes emerge for mobilizing resources at the technologylevel. The first involves signaling the viability of the technology to potential adopters. At its core, ITMT's strategy emphasizes a co-construction mode of collaboration for tailoring emerging technologies to concrete medical and clinical needs. This resonates well with its living lab approach, which prioritizes testing and development under presumably realistic conditions. As highlighted by one senior advisor:

"The message to all companies is that every technology needs to be developed in a very close collaboration with the caregivers and key opinion leaders within a proximity hospital in order to ensure its integration and implementation with the existing system."

Hence, the technologies supported by ITMT are already perceived to be aligned with the envisioned sociotechnical requirements. Likewise, many researchers and entrepreneurs have highlighted intermediation benefits in terms of gaining market visibility, which is evident in the use of terms such as "*identifying emerging [market] needs*" "*evaluating commercial success*", and "*calculating…the concrete value of the project*." Their involvement with ITMT allowed them to better articulate what their innovation is about, what it seeks to achieve, and how do best achieve it. This additional visibility is manifested in ITMT's efforts to identify and resolve bottlenecks early on in the innovation process.

"The strength [of ITMT] is that they have specialists accompanying research teams to help them develop their products, while they themselves work with established organizations to help in commercialization... if they don't cover the whole innovation continuum, from idea to market, it puts them at risk of always depending on the collaboration of others." (Senior manager of a business accelerator)

ITMT's privileged access to rich and real-time clinical data also made it possible to secure information exchange and facilitate decision-making. The fact that it is strategically located inside hospital premises while preserving strong ties with all major universities and research centers in the region is viewed as a strategic advantage to help move new medical technologies from research labs to the market—the "science of implementation" as one informant noted. Ultimately, "all the supported projects generate new results, which becomes valuable for [supporting] future projects" notes ITMT's senior advisor to highlight the importance of learning from past experiences. "New companies approach us because of our access to clinicians, scientists and databases" she continues.

4.4.2.2 Mobilizing stakeholders

ITMT's role has been also prevalent in mobilizing active collaborations between participants in the healthcare ecosystem. In some cases, it provided some form of material incentive to initiate stronger commitment to co-creation and to ensure that the threshold for participation is low enough for combinatorial efforts to occur. In other cases, ITMT motivated stakeholder participation by presenting concrete results, which *"shows that the work that they are doing has value."* Participants therefore seemed more motivated to engage and commit resources when they anticipate at least some way of realizing value from collaborating on certain projects.

However, actors remain at odds about how to precisely evaluate this value. For researcher physicians and entrepreneurs, value from collaboration is often reflected in "connections with the industry", "access to early financing", and "effectively applying

[clinical] safety regulations." For hospitals, the collaboration needs to "always starts with a need than ensure that links are established within the hospital". Investors, however, tend to be more concerned with commercialization either directly through "selling IP licences to international organizations" or "indirectly through "supporting new ventures to commercialize their own products." Here, the intermediation process is particularly pronounced in aligning expectations right from the start of the collaborative innovation project.

"For each project we are identifying additional collaborators that are needed at each stage of the project's development. ... However, one of the first step it is that it is essential to check who owns the IP rights very early in the definition of the project and on which aspect of the collaboration." (Senior advisor, ITMT)

The importance of intermediation has been clearly visible in the emphasis on cognitive proximity between researchers, entrepreneurs, and industry actors.

"How to do research is not the same as to how launch a company.... this needs support institutions, such as [ITMT] to help researchers change their mindset" whereas "businesses are good at making presentations of their business models and commercial value but not so much in showcasing the value they offer to the hospital." (Senior hospital representative)

One interesting finding relates to technologies that remain research projects without ever being able to penetrate the industry despite the apparent benefits they are able to provide to patients and/or medical staff. Given the high regulations, trust issues, and complexities associated adapting the technology to different hospitals, it seemed like pilot projects have their own status in the medical innovation pipeline. As one researcher explained: "Despite the great potential of certain technologies, whether or not it gets adopted depends on the cost of implementation and availability of investors to support development." Without discounting the importance of investing in medical research to the commercial success of new scientific discoveries in healthcare, "the biggest challenge is to explain one's own research needs to potential collaborators, to translate what we are doing in an adapted language" stressed another medical researcher.
4.4.3 Scaling

Emerging digital technologies need to comply with existing sociotechnical arrangements in terms of the regulatory, strategic, and cultural requirements to be well-accepted by the market. Scaling activities are targeted at ensuring this compliance. For example, in our field study we saw evident gaps between the value-creating potential of certain technologies and their commercial success. Many of the founders frequently lacked the links with industry actors to adequately promote their technologies. As an intermediary, ITMT has been playing an important role in scaling up these technologies and helping to adapt them from one hospital to another depending on each hospital's own practices and data governance protocols. Scaling here refers to the intermediation process targeted at ensuring the alignment between a certain innovation and its sociotechnical requirement.

4.4.3.1 Scaling technologies

The first approach to scaling focuses on adapting the innovation to the particular needs and conditions of the local healthcare system. This entails bringing together complementary constellations of actors, including patients, physicians, researchers, and industry actors to co-create solutions in an actual hospital setting, or in the words of one informant "*translating from academic research into practice*". While this process ensures that an emerging technology will have a readily available market, it does potentially bound its outcome to the particularities of a given context. Thus, for all its emphasis on specific user needs, ITMT realizes its ambitions of scalability in at least two ways.

First, it enables researchers and entrepreneurs to develop and test their technologies in accordance to the requirements of affiliated hospitals. This ultimately ensures a smooth implementation and validates the feasibility of the technology for addressing a concrete market demand. Both users and hospital representatives are implicated right from the start of the innovation process to ensure that a certain technology is "*adapted to the specific culture of each hospital*" (hospital representative). As one research physician highlights:

"...the integration of new innovation is one of the major challenges facing the healthcare system in the region...the solution is to showcase the value of the innovation by first putting it into the hands of the users and second to measure its effectiveness...[ITMT] living lab approach solves the first issue."

Second, ITMT leverages its extensive network to facilitate the systematic integration of promising technologies. It is *"capable to identify the leaders that are responsible for the implementation of the technology in hospitals"* (Entrepreneur). It also builds on informal connections to identify potential barriers and opportunities for scaling up innovations. Another entrepreneur notes

"It [ITMT] helps identify risks, validate strategies, networking...it is connected with pretty much all major actors operating in medical technology...so it's like there is a cartography in our disposition"

To this end, scaling up emerging digital technologies are effectively supported by validating their operational feasibility in an actual hospital setting and making sure they can be well adapted with those that are typically used by the wider healthcare system.

4.4.3.2 Scaling ecosystem capabilities

In parallel, the scaling process also unfolds at the level of the ecosystem through reinforcing its underlying infrastructure making it more receptive to emerging innovations. From our discussion with informants, we kept noticing an emphasis on the strength of Montreal's innovation ecosystem. However, this emphasis has been mostly on research production, but less so on research commercialization. Despite the good intentions, many entrepreneurs have been collaborating with ITMT primarily to validate their technologies in local hospitals in Montreal to then go on to commercialize them elsewhere.

The growing awareness to this phenomenon drove different IIs in the region to work together more closely to bridge these persistent gaps the regional ecosystem. For example, all representatives from other intermediaries (e.g., business incubators, accelerators, and innovation centers) that we have interviewed perceived themselves as complementary to one another, all serving the same purpose to transfer research to practice. This apparent synergy between regional IIs have facilitated the identification of successful innovation-support practices to be replicated for other projects. As one informant notes "when ITMT was launched, living labs were a little new here, so others had the opportunity to learn from it by integrating the needs of the end users at the center" (Vice-president of a regional innovation center).

The alignment between science, technology, and policy has been always critical for ensuring that digital transitions in hospitals go on as planned. The most notable example involves data governance. Access to data has been a primary challenge limiting the adoption of new digital technologies in healthcare. As best expressed by a senior innovation consultant in the region: *"The access to data is the major hurdle the innovation process [in healthcare], the other challenge is providing the capabilities to organizations to leverage this data."* In other cases, there seemed to be a general disconnect between different research domains. For example, *"despite the significant advancements being made in AI research in Montreal, these are not well transferred to other sectors, and this is concerning"* highlights one medical researcher.

The contributions of ITMT have been particularly salient in addressing these challenges. We found that IIs did more than just assist in accelerating the pace of diffusion of emerging technologies, they also played a critical role in developing the innovation capacity of their regional ecosystem. From our field study, we note that ITMT has been an active collaborator with industry actors, policy-makers, and other intermediary organizations for addressing pressing innovation challenges and adapting their innovation-support practices accordingly. As ITMT's founder emphasized:

"it's not enough to support development, the innovation needs to be transferable, which is still less concrete than the development. What [ITMT] is doing is creating the right conditions for an innovation to be transferable.

4.5 Discussion

Throughout this paper, we have sought to understand how IIs contribute to the diffusion of emerging digital technologies. We base our analysis on the healthcare sector in Montreal, Canada while tracing the emergence of an intermediary set up particularly to spur innovation and bring about digital transformative changes. Interviews with 85 leading actors in the ecosystem, coupled with supplementary discussions, meetings, and follow-ups have guided our iterative analysis of this case. Taken together, our field study reveals three interrelated innovation-support processes underpinning the diffusion of emerging digital technologies: sourcing, mobilizing, and scaling. For each of these processes, the intermediary had to balance the need for co-creating tailored solutions to specific clinical demands (i.e., technology-focused intermediation) with the need for reinforcing the existing infrastructure to enable effective implementation (i.e., ecosystem-focused intermediation). These processes form the foundation of our integrated theoretical model that is depicted in Figure 4.4. The broader ambition is to align the value proposition of a given technology with the needs and capacities of the innovation ecosystem.

Insert Figure 4.4 about here

Placing IIs at the meso-level allowed us to distill their contribution to both the development of the technology itself and to that of the broader ecosystem. Starting with sourcing activities, IIs play a leading role in identifying promising technologies and ensuring the involvement of key market actors whose contributions are necessary for their successful development. By providing a common platform for open collaboration, intermediaries contribute to legitimizing ecosystem-based co-creation (Thomas & Ritala, 2021) making it easier for members to perceive benefits from engaging in collaborative innovation activities (Woolley & MacGregor, 2021). This is often accomplished using a range of persuasion strategies designed to ensure commitment and trust between participants while implementing specific mechanism for aligning their respective contributions (Wareham, Fox, & Cano Giner, 2014).

We also show that IIs do more than just broker multilateral relations; they also play a critical role in mobilizing stakeholders, namely through orchestrating the right conditions to innovate (Dhanaraj & Parkhe, 2006; Klerkx & Leeuwis, 2008), thereby creating what some scholars refer to "ecosystem additionality" (Goswami et al., 2018) to denote improvements in the resources and the structures in place (e.g., knowledges, skills, expertise, connections, and platforms) for facilitating the validation of new technologies and entrepreneurial ventures. In the initial stages of development, the high uncertainty over the value-added of digital technologies and the little evidence over their effectiveness often result in a reluctance to their adoption (Ni et al., 2020). The role of intermediaries is particularly salient at this stage through orchestrating the support needed to convey the viability of these new technologies to investors and potential adopters (Dattée et al., 2018).

As the innovation process moves from prototyping towards implementation, IIs become more engaged in sponsoring activities that focus primarily on the scalability of the innovation outcomes. Underlying the notion of scalability is the assumption that the technologies developed in a unique local setting can be turned into generalizable solutions that can be implemented across contexts (Engels et al., 2019). Thus, in contrast to brokering and orchestrating, sponsoring entails a more targeted support for scaling particular technologies to ensure their commercial success (e.g., Alaassar, Mention, & Aas, 2021; Assenova, 2020; Breznitz & Zhang, 2019). It necessitates balancing between designing bottom-up solutions to specific problems while ensuring scalable strategies for economic feasibility.

4.5.1 Implications to theory and practice

The innovation diffusion approach presented in Figure 4.4 as a pathway to facilitate the adoption of emerging digital technologies highlights the multidisciplinarity and collaborative-nature of contemporary innovation activities. What is novel in our inductive model is the focus on intermediation as a means to alleviate both technical and systematic constraints to innovation diffusion. By studying what worked best and under what conditions, we document how successful intermediation practices look like and under which stages they are perceived to be most effective. We note that the intermediation unfolds simultaneous across two levels, the level on technology itself (i.e., technologyfocused intermediation) through ensuring that a specific technology is developed in accordance to the needs and demands of the local market and at the level of the ecosystem (ecosystem-focused intermediation) through motivating, equipping and reinforcing ecosystem participants to capture the opportunities brought forth by these technologies. These findings provide three primary contributions.

First, we highlight how IIs respond to the emerging needs of entrepreneurs and researchers by adapting their support activities to the different stages of the innovation process. Although much of the research on IIs has focused on traditional brokering functions designed to foster stronger links between disparate actors (Berbegal-Mirabent et al., 2012; Van Gils & Rutjes, 2017), we show that while brokering is indeed necessary, it is not sufficient for understanding innovation diffusion—that is, taking new discoveries from research labs to the market. Our results remain in line with recent studies (e.g., Agogué et al., 2017; De Silva et al., 2018; Rossi et al., 2022) advocating a more dynamic approach to intermediation that evolves in response to emerging innovation challenges. This study, however, extends prior work by offering a much-needed multi-level perspective on intermediaries (Goswami et al., 2018) by distinguishing between technology-focused and ecosystem-focused intermediation.

Second, we argue that intermediation is not only about supporting innovation *within* ecosystems, but also about supporting the innovation ecosystem *itself*. For example, we saw that the implementation of digital technologies requires complementary

changes that extend beyond the development of the technology to also include changes in the regulatory frameworks, procurement processes, skills and capabilities, and individual perceptions. In other words, even a certain technology has obvious value-creating potential, its commercial success remains contingent on a range of institutional (competitive pressure and trading partner readiness), organizational (resources, capabilities, and perceived value), individual (e.g., trust and skills) factors that also need to be taken in account (Dąbrowska et al., 2022; Hermes et al., 2020). It is in this particular context where IIs are set to offer their unique contributions.

Third, we posit that the adoption of new digital technologies in organizations does not necessarily entail fundamental changes to existing innovation diffusion theories, but rather requires a shift in emphasis from implementation to co-creation. Co-creation makes room for the variety innovation-supporting intermediaries whose actions (and interactions) help shape the technology development trajectory (Clayton et al., 2018; De Silva et al., 2021). An ecosystem approach is therefore a good starting point to understanding innovation diffusion, particularly in highly regulated sectors, such as healthcare. From this perspective, innovation is no longer understood to emerge independently from R&D labs but is rather the result of coherent efforts between a range of locally-embedded actors, institutions, and artifacts that co-evolve in a region (Adner & Kapoor, 2010; Jacobides et al., 2018). Without considering the interests of different stakeholders, emerging technologies can either become too contested (or costly) to implement or turn into a mechanism that exacerbates wealth concentration among few organizations that are able to leverage their possible benefits.

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Table 4.1. Interview data

	Description	Number of respondents	Interview duration
ITMT	Director	1	55 minutes
informants	Deputy Director	1	73 minutes
	Project Manager	3	From 55 to 58 minutes
	Senior Advisor, Project Valuation	5	From 35 to 55 minutes
Ecosystem Informants	Clinicians, physicians, medical researchers, and hospital representatives	23	From 29 to 78 minutes
	Mentors, innovation researchers, and government representatives	16	From 36 to 81 minutes
	Founders, entrepreneurs and industry representatives	22	From 22 to 65 minutes
	Other intermediaries (e.g., incubators,		From 29 to 65
	accelerators, and innovation centers)	14	minutes
	Total	85	





Figure 4.2. The innovation co-creation process



Figure 4.3. Data structure



Figure 4.4. Intermediation process underlying the diffusion of emerging innovation



Chapter 5 Supporting entrepreneurship in times of crisis: The role of intermediaries in fostering resilience

Abstract

Supporting entrepreneurship has become an explicit priority during to a crisis. The challenge, however, is to understand why and how entrepreneurial support organizations—intermediaries that manage and monitor the development of new ventures—could serve as effective mechanisms to respond to emerging business challenges in such context. In this paper, we blend organizational sponsorship and resilience theories to explain the evolutionary dynamics of entrepreneurial support organizations during a crisis. We show that the resilience of both local businesses and that of the broader ecosystem can be reinforced through the adaptive behaviors of these support organizations. Our analysis is grounded in observations, interviews, discussions, and archived data gathered during an in-depth case study investigating the impact of the Lebanese crisis on the state of the country's entrepreneurial ecosystem. We discuss the implications of this research on theories and practice of resilience and entrepreneurship in times of crisis.

Keywords: Organizational sponsorship, business incubators, organizational resilience, crisis management

5.1 Introduction

With the seemingly growing likelihood of crises (e.g., economic recessions, conflicts, political unrest, and natural disasters) and the devastating consequences they may have on small businesses and new ventures (Kim, 2021; Kuckertz et al., 2020), the context of crisis has been gaining increasing momentum in entrepreneurship research (e.g., Doern, Williams, & Vorley, 2019; Dushnitsky, Graebner, & Zott, 2020; Korber & McNaughton, 2017; Williams & Vorley, 2015; Williams & Shepherd, 2016). Much of this research focuses on external intervention mechanisms, often referred to as "organisational sponsorship" (Flynn, 1993) designed to foster and protect new businesses by mediating the relationship between them and their broader environment (Amezcua, Ratinho, Plummer, & Jayamohan, 2020; Amezcua, Grimes, Bradley, & Wiklund, 2013; Jourdan & Kivleniece, 2017). Chief among these interventions are entrepreneurial support organizations—entities founded specifically to support the emergence, development, and survival of new ventures. Such entities are now prevalent in many parts of the world and are actively being promoted by policy-makers, universities, research institutes, and other interested parties as a remedy for some of the most pressing innovation and business development challenges (Bergek & Norrman, 2008; Bergman & McMullen, 2021).

In contrast to government-led initiatives that aim to encourage regional entrepreneurship through direct subsidies or other forms of public financing (Ratinho, Amezcua, Honig, & Zeng, 2020), entrepreneurial support organizations represent a type of innovation intermediaries (e.g., business incubators, accelerators, science parks and so on) that are set up to facilitate the emergence and growth of new businesses and accelerate the commercialization of their innovations (Bergman & McMullen, 2021; Howells, 2006; Klofsten & Lindholm Dahlstrand, 2002). They do so directly via extending essential resources, services, and guidance to individual ventures and indirectly by reinforcing networks and partnerships within and across technical and business domains (Busch & Barkema, 2020; Chan & Lau, 2005; Clayton, Feldman, & Lowe, 2018). Though questions still remain about their effectiveness (see e.g., Blair, Khan, & Iftikhar, 2020; Dvouletý, Longo, Blažková, Lukeš, & Andera, 2018; Gimmon & Levie, 2021; Gonzalez-Uribe & Leatherbee, 2018; Schwartz, 2011; Tamasy, 2007), these entities are now taken for

granted within policy-based and academic circles as an effective mechanism for fostering productive entrepreneurship (Amezcua et al., 2020) and an important driver for stimulating economic development in a region (Chan & Lau, 2005; Phan, Siegel, & Wright, 2005).

Prior research offers a several explanations for the likely success of entrepreneurial support organizations. One line of inquiry focuses on the particular strategies used by to help new businesses buffer their resource dependence upon their external environment. This work characterizes the external environment as a source of threats (or potential liability) for new entrants (Lynn, 2005; Shepherd, Douglas, & Shanley, 2000). Faced with such environmental threats, new entrants can thereby rely on the support provided by these intermediaries to strengthen their business developmental activities without having to directly confront external competitive pressures (Scillitoe & Chakrabarti, 2010). A complementary line of inquiry focuses on entrepreneurial support strategies designed to bridge new entrants with their environment through promoting network formation, strategic partnerships, and serendipitous encounters (Busch & Barkema, 2020), the corollary being that the interactions between entrepreneurs and other actors in their ecosystem would eventually enable them to identify and leverage emerging market opportunities (Van Rijnsoever, 2020). The environment here is considered less of a threat but rather a source of competitive advantage for the focal firm.

Jointly, these perspectives attest to the benefits that entrepreneurial support organizations provide to help new ventures navigate crisis-related challenges by providing a *buffer* against external threats and a *bridge* to new relational connections (Hoffman, 2018; Lenox & Chatterji, 2018). However, these streams leave unexplored another likely contributor to their success: the "fit" between existing support activities and evolving business needs/priorities. As a result, much theorizing attributes organizational sponsorship to flow in only in one direction such that a sponsoring institution (e.g., university, corporation, or government agency) articulates goals and priorities to an intermediary organization (e.g., business incubator or accelerator), which then translates it into action by influencing the type and behavior of individual entrepreneurs, but never vice versa (Bergman & McMullen, 2021). However, this unidirectional perspective might

have concealed a reciprocal relationship where the act of supporting entrepreneurs itself can provide unique capabilities for the organizations providing this support, potentially improving their effectiveness over time. Yet, how or whether this reciprocal relationship could unfold remains unclear. Bridging and buffering strategies may well contribute to an organizational sponsorship's success, but it does not reveal exactly why some entrepreneurial support organizations are more successful than others, particularly when business needs and priorities shift. The purpose of this paper is to address this question.

Drawing from an in-depth case study tracing the evolution a business incubator as it responds to evolving business needs in the midst of the Lebanese crisis, we investigate what role do entrepreneurial support organizations play in such context, what major challenges they are likely to face, and how they differ in their capacity adapt to evolving business demands. The case is particularly interesting because the incubator was not only able to accelerate its growth during the crisis, but was also successful in fostering the emergence and growth of local businesses and addressing region-specific challenges, thereby promoting resilience on a broader scale. Using data from our case study and building on the growing research at the intersection between entrepreneurship, resilience, and crisis management, we introduce a theoretical framework showcasing how the set of experiences, processes, and learned behaviors that develop over time from managing business development activities (i.e., business support capabilities) enable business incubators to become more resilient to changes in market demands, contributing simultaneously to the resilience of individual ventures (i.e., local business) and to that of the broader social system in which they are embedded in.

From this vantage point, we argue that rather than considering entrepreneurial support organizations simply as a means to transfer resources and services to entrepreneurs or as static, locally-confined spaces, it would be more helpful to focus more on the ways through which they effectively adapt to establish a "fit" with evolving business needs. From a crisis management standpoint, our study shows that promoting the resilience of regional entrepreneurial ecosystems can go beyond top-down governmental policy initiatives to also include the range of intermediary interventions that can be critical to help businesses navigate crisis-induced challenges. Taken together, our exploratory

study provides a basis to theorize about the underlying dynamics of entrepreneurial support organizations and sharpen the connection between crisis management and resilience—two constructs that are becoming increasingly important for understanding the growth and survival of new ventures.

5.2 Theoretical background

5.2.1 The logic of entrepreneurial support

In the simplest sense, "entrepreneurial support" refers to the range of strategies, programs, and initiatives aimed at facilitating the pre-start, early stages, and growth of new ventures (Hanlon & Saunders, 2007; Ratinho et al., 2020). While some form of entrepreneurial support is provided directly through government-led programs, such as the Small Business Innovation Research (SBIR) and the Small Business Technology Transfer (STTR) programs in the U.S. (Lerner, 2000), others are provided through intermediary organizations whose central role is to help business development while simultaneously containing the cost of their potential failure (Clayton et al., 2018). These organizations are usually recognized under different names (e.g., business incubators, accelerators, innovation centers, science parks, etc.) depending on the scope of their activities, their temporal life span, and their underlying objectives. To the extent that entrepreneurial support is the operationalization of the phenomenon of promoting the development and survival of new ventures, an entrepreneurial support organization is an enabling intermediary (rather than an essential condition) for facilitating this process (Hackett & Dilts, 2004). This distinction is not trivial because the mere existence of these organizations does not, in and of itself, necessarily translate into more productive entrepreneurial activity in a region.

The theory of organizational sponsorship, first introduced by Flynn (1993), has been the most influential in delineating the entrepreneurial support process and highlighting its potential shortcomings. In essence, the theory argues that organizational sponsorship (i.e., the external intervention of supporting businesses development) helps foster new ventures by allowing them to *buffer* threats from the external environment and/or *bridge* relations with potential resource providers. However, this form of intervention also entails negative consequences as businesses become overly dependent on the resources provided by the sponsoring organization, potentially limiting their survival prospects (Flynn, 1993). Recent developments in this theory (e.g., Amezcua et al., 2013; Bergman & McMullen, 2021; Dutt et al., 2016; Sagath, van Burg, Cornelissen, & Giannopapa, 2019) have further recognized four enabling mechanisms (Figure 5.1) through which organizational sponsorship can help new ventures grow beyond early development stages: (1) resource provision, (2) competence development, (2) network formation, and (4) infrastructure support.

Insert Figure 5.1 about here

The first generation of entrepreneurial support organizations, popularized in the early nineties, focused primarily on the provision of basic infrastructure (e.g., working space) and seed capital usually in exchange for small equity stakes in promising ventures (Phan et al., 2005). Many of these organizations also provided the necessary resources (e.g., technologies, prototyping equipment, and subsidies) to help new ventures overcome their "liability for newness" (Cafferata, Abatecola, & Poggesi, 2009; Stinchcombe, 1965), commercialize/scale-up their offerings (Clayton et al., 2018), and improve their survival prospects (Dettwiler, Lindelöf, & Löfsten, 2006; Pauwels, Clarysse, Wright, & Van Hove, 2016; Schwartz, 2013). A particular emphasis has later been placed on facilitating *network* formation between nascent entrepreneurs and other actors in the ecosystem through deliberate efforts to introduce tenants to each other, connecting start-ups with peers from similar industries, introducing promising start-ups to potential investors, and/or providing entrepreneurs with the right skills to develop and manage their own networks (Van Rijnsoever, 2020). Subsequent models have started to introduce more specialized mentorship services (e.g., guidance, consulting, and training) and tailored support programs for entrepreneurs to develop their business and technical competencies (Kohler,

2016). Because these organizations are deeply embedded in their local ecosystem, they are essentially well-positioned to address the immediate needs of local entrepreneurs and ensure that emerging opportunities can be identified and adequately captured.

Despite the rapid proliferation of these intermediaries, evidence over their effectiveness has remained equivocal at best (Gimmon & Levie, 2021; Hackett & Dilts, 2008; Lukeš, Longo, & Zouhar, 2019). This has prompted recent calls to extend the focus beyond simply the type of support that these organizations provide towards understanding how this support can be better adapted to emerging business needs (Bergman & McMullen, 2021; Clayton et al., 2018). These calls have therefore invited us to consider entrepreneurial support organizations as a main unit of analysis looking particularly at how these entities can learn, improve, and evolve over time in response to the changing demands and priorities (i.e., how they adapt to shifts market conditions). Thus, a more pertinent starting point for theorizing about their effectiveness would be consider entrepreneurial support organizations not as static entities, but more as dynamically evolving organizations able to develop new capabilities for better responding to business development demands, thereby becoming more or less effective over time (Figure 5.2). An extreme context of a crisis would be an ideal starting point to explore these dynamics (Hällgren, Rouleau, & De Rond, 2018) as it is in this particular context where support for businesses and new ventures is needed the most.

Insert Figure 5.2 about here

5.2.2 Entrepreneurship in times of crisis: A general overview

Research on entrepreneurship in times of crisis has been gaining increasing significance over the past decade (see e.g., Doern et al., 2019; Giones et al., 2020; Korber & McNaughton, 2017 for a general oveview). This literature has traditionally dealt with a crisis as an unforeseeable and extreme event that is usually accompanied by a hostile

and potentially disrupting threat to organizations (Dutton & Jackson, 1987; Mitroff, Shrivastava, & Udwadia, 1987; Preble, 1997; Shrivastava, Mitroff, Miller, & Miclani, 1988), thereby requiring an immediate organizational response, for better or for worse (Quarantelli, 1988). Among the most common definitions of a crisis used in the field is that of Pearson and Clair (1998: 66) describing a crisis as "a low probability, high-impact situation that is perceived by critical stakeholders to threaten the viability of the organization". Accordingly, effective crisis management involves minimizing any potential threat hindering an entity's successful recovery and adaption.

In contrast to "crisis management", which primarily deals with maintaining normal functioning following un(expected) operational disruptions (Preble, 1997), resilience has been used captures a organization's ability to grow through adversity (DesJardine, Bansal, & Yang, 2019) and takes into account the processes by which it acquires, combines, and mobilizes resources before, during and after a crisis event (Williams, Gruber, Sutcliffe, Shepherd, & Zhao, 2017). Notably, the notion of resilience in entrepreneurship has remained very much in line with the broader literature on organizational resilience (see Hillmann & Guenther, 2021; Linnenluecke, 2017), but with much more emphasis on entrepreneurial activity as the final outcome. Yet, a gradual shift in entrepreneurship research towards a more dynamic and effectual approach has motivated amore processual notion of resilience (Figure 5.3) that captures the ways in which an ex-ante resilient capacity (i.e., a priori resilience conditions) can be transformed into action (e.g., Davidsson & Gordon, 2016; Grube & Storr, 2018; Haase & Eberl, 2019; Kuckertz et al., 2020).

Insert Figure 5.3 about here

In this paper, we rely on the resilience process framework depicted in Figure 5.3 as our theoretical lens for examining the evolutionary dynamics of entrepreneurial support

organizations during a crisis. That is, we focus on the entrepreneurial support organization as our unit of analysis while taking its resilient response in the face of crisis-induced changes as an indicator of its success. Understanding the way these intermediaries evolve in response to emerging business demands is both theoretically and practically interesting because it determines why and how some organization can become more effective in supporting entrepreneurs and small business (Amezcua et al., 2013) and represents an important component of the "Grand Challenge" of managing in times of crisis (Van Der Vegt, Essens, Wahlström, & George, 2015: 971).

5.3 Methodology

Because little theory and empirical evidence exist on how entrepreneurial support organizations navigate crisis-related challenges, we undertake inductive case study approach to address our research question (Strauss & Corbin, 1998). Case studies have become increasing popular in entrepreneurship and crisis management research over the past decade because of their advantages in building/elaborating theories and extracting generalizable observations that can be applicable across similar contextual conditions (Gibbert and Ruigrok, 2010; Yin, 2014). We follow the method outlined by Gioia, Corley, and Hamilton (2013) to collect and analyze our data while focusing the context of the phenomenon and the ways in which it could enrich existing theories on organizational sponsorship, resilience, and crisis management. Our work draws on several periods of observation, a dozen of interviews, and extensive document analysis (Table 5.1) tracing the successful evolution of a business incubator (IncubaTech thereafter) amid the unfolding series of Lebanese crisis-economic/political turmoil (2019; ongoing), Covid-19 pandemic (2020; 2021), and port explosion (2020). These events have triggered major gaps in Lebanon's entrepreneurial ecosystem creating unprecedented challenges for intermediary organizations to continue supporting local businesses. The duration of the fieldwork allowed us to cover a range of key moments in the evolution of the business incubator, including its early challenges, strategic focus, new program development and expansion, as well as day-to-day operating dynamics.

5.3.1 Data collection

We rely on a dual method approach for data collection, combining (1) interviews with key informants to gain an in-depth account of the motivation, entrepreneurial support strategies, and accompanying expectations for the incubator in response to the unfolding crises and (2) an analysis of relevant documents and archival material to examine the impact of these activities on the regional entrepreneurial ecosystem (Williams & Vorley, 2015). Interviews included semi-structured discussions with directors and senior managers from IncubaTech along with mentors, entrepreneurs, and other key actors in the Lebanese entrepreneurial ecosystem (e.g., VCs, innovation centers, and university incubators). Another particularly valuable source of information was the wealth of documented secondary interviews with different entrepreneurs that are (or have been) part of IncubaTech business support programs. These interviews provided a comprehensive account on their experiences in setting up and scaling their ventures during the crisis. Additional data was acquired from archival materials, including corporate documents and external analyst reports. We also visited the premises on several occasions to discuss what business incubation looked like during the crisis and what key challenges businesses and entrepreneurs have been facing. This varied data allowed triangulation among multiple sources, strengthening the reliability of the resulting conclusions (Gioia et al., 2013).

Insert Table 5.1 about here

Interviews were semi-structured and designed to gain a deeper understanding of the entrepreneurial support process during the crisis, including (1) the major crisisinduced challenges affecting the local entrepreneurial ecosystem, (2) the key initiatives/mechanisms put in place to help entrepreneurs respond to those challenges, and (3) an assessment of these initiatives/mechanisms in promoting entrepreneurship and business development. We relied on two types of informants: Internal informants including senior executives and managers from IncubaTech that are the most familiar with the organization's history, activities, envisioned trajectory and the ones responsible for its strategic direction. External informants consisted of other key members from the Lebanese entrepreneurial ecosystem that could provide an outsider perspective on the state of the country's entrepreneurial ecosystem, the challenges that local entrepreneurs are facing, and the desired solutions/initiatives that need to be put in place to address those challenges. Follow-up interviews were also conducted with the managing director of the incubator in order to discuss specific events in greater detail, clarify issues that were left open, and validate the emerging model. Given that the crisis was still unfolding at the time, the interviews provided real-time data free of retrospective bias.

We reviewed in parallel supplementary archival documents as a way to validate key themes and discussion points covered in prior interviews, document the activities developed by IncubaTech during this period, and determine the implications that these activities had. This review covered internal company documents and external analyst reports from the year 2019 (the start of the Lebanese crisis) until 2022, including the organization's impact reports ,193 internal news updates, and 4 external reports on the state of the incubation industry and the entrepreneurial ecosystem in the region totaling over 420 pages of text. This analysis was further complemented by observing testimonies from 23 different entrepreneurs that were part of IncubaTech's incubation programs as well as full Demo Day sessions joined by analysts, investors, partners, and mentors. Taken together, the data yield a comprehensive and accurate account of the organization's business support activities and performance during the crisis.

5.3.2 Data analysis

We began the data analysis by synthesizing interviews and archival material into a comprehensive account detailing the business incubator's activities during the crisis. We focused particularly on the factors that drove the rapid evolution of incubator and the ways it was able to balance its own growth with that of its resident ventures. After completing an initial case analysis, we adopted an iterative, inductive approach to extract relevant factors and tensions affecting the incubation process during the crisis. Here, we build on previous research on organizational sponsorship (Amezcua et al., 2013; Flynn, 1993), entrepreneurial support organizations (Bergman & McMullen, 2021; Clayton et al., 2018), and the literature at the intersection between crisis management and organizational resilience (Hillmann & Guenther, 2021; Williams et al., 2017) as the analytical themes that guided our analysis and interpretation of our empirical data. Our goal was to understand how entrepreneurial support organizations (business incubator in our case) can become more resilient to shifts in market conditions (i.e., changes in the needs and priorities of local businesses and entrepreneurs). We define "entrepreneurial support" as an intermediary intervention of managing and monitoring the development of emerging ventures. By resilience, we are referring to the process of responding to adverse exogeneous changes (e.g., crises, disturbances, or challenges) or endogenous pressures (e.g., internal operational disruptions) that ultimately leads to a favorable outcome.

We began extracting emergent themes related to: (1) how actors described the nature of the crisis and resulting challenges; (2) what initiatives were implemented to address those challenges; (3) what were the perceived benefits of these initiatives to individual entrepreneurs, the incubator itself, and the broader ecosystem; (4) what role did IncubaTech (and other support organizations) play in fostering innovation and business development during such period; (5) what were the major changes that occurred in the business incubation process as the result of the crisis (e.g., Covid-19, road closures, change regional priorities/business interests); and so on. We further condensed these broad themes into a set of codes and sub-codes. For example, we used codes such as "talent retention", "competence development", and "infrastructure sustenance" to capture the impact of the entrepreneurial support activities during the crisis. We also used codes such "visibility" and "track record" to account for the pre-crisis characteristics of the business incubators. We combined codes related to how IncubaTech recruited and trained new mentors and coaches as "expand network reach", codes related to how it worked with different sponsors and international donors to create new entrepreneurial programs as "secure new source of funding", and codes to related to how it addressed day-to-day operational disruptions (e.g., shifting to digital work structures, implementing crisis management modules, onboarding new ventures virtually) as "maintain/upgrade existing

operations". This process helped to clarify what entrepreneurial support looked like during a crisis and what were the main drivers of its success.

This approach was systematically applied to all available interview material, sorting data into broad themes then condensing it into codes in preparation for qualitative content analysis (Berg and Lune, 2012). We related simultaneous our interview data with case documents and archival material (e.g., internal reports and author's notes). Consistent with our inductive approach, we analyzed our data from a theoretical lens to define key dimensions and map their interrelationships while iterating between emerging dimensions and existing constructs from the literature. To support this process, we engaged in "temporal bracketing" (Langley, 1999) where we segment the incubator's performance during crisis into three episodes (consistent with our crisis management framework introduced in Figure 5.3), including (1) *pre-crisis characteristics* (e.g., existing resources and capabilities), (2) *resilient response* (e.g., reconfiguring existing operations, adapting entrepreneurial support programs to the existing context, and catering to new market segments), and (3) *outcome* (e.g., implications on the organization itself, local businesses, and the ecosystem at large). Bracketing helped transform what seemingly appeared as static concepts into a dynamic process model.

5.4 Supporting Entrepreneurship in Times of Crisis: A Case Study

For almost two years now, Lebanon has been facing a compounded series of crises, starting with a political uprising in September 2019, followed by COVID-19 lockdowns, and lastly a large-scale explosion at the Port of Beirut on August, 2020. These events have triggered major gaps in the county's entrepreneurial ecosystem and created unprecedented challenges for local businesses to develop and scale up their operations. Being at the center of a very unique context, IncubaTech witnessed a surprising growth over the past two years benefiting largely from the development of new support initiatives that are designed to help entrepreneurs navigate the unfolding situation at hand. Its rapid evolution during one of the country's most severe crises might seem at odds with a conventional

business incubator trajectory¹⁶, but it was successful in nurturing local businesses and addressing specific market needs, thereby contributing to the revitalization of the country's broader entrepreneurial ecosystem. With the evident absence of formal governmental support and the deteriorating state of the country's business infrastructure, we wondered how this incubator was able to achieve and maintain its growth in such an unpredictable business landscape. This question motivated the current research project.

5.4.1 Case description

IncubaTech is a Beirut-based business incubator that provides a range of support services fostering innovation, technology, and social entrepreneurship. With over 12,000 m² of space, IncubaTech runs three co-working facilities, organizes workshops, events, and competitions, and operates a variety of different business acceleration and entrepreneurial support programs in different sectors (notably agri-food, cleantech, and information technology) in collaboration with local and international sponsors. In addition, the organization manages three venture capital funds and currently employs around 82 people across different divisions. In effect, IncubaTech defines itself as an *"ecosystem for entrepreneurs"*, providing a dynamic environment conductive of business development *"fostering innovation, technology and entrepreneurship in Lebanon"* (mission statement). Consistent with the general trend that entrepreneurship is seen as a remedy for economically challenged regions, its business development initiatives has been indeed successful in motivating a gradual recovery, supporting over 160 start-ups, 496 SMEs, and 28 programs in just over one-year period following the start of the Lebanese crisis.

Since its inception, IncubaTech has been recognized as a local flagship initiative and a go-to reference point for supporting entrepreneurs. Its spatial presence in key areas across the capital and established relations with major actors in the ecosystem have

¹⁶ A recent report by the European Business Innovation Centres (EU|BICs) examining the impact of the Covid-19 pandemic on the business incubation sector around the world, nearly half of the 62 respondents reported serious operational and financial challenges caused by lower demand for services and/or cancelled programmes and events while around 35% of those experienced liquidity constraints caused by lower working capital or loss in public funding.

enabled a relatively large degree of regulatory and organizational flexibility to create and customize new offerings. "When we saw that supporting entrepreneurs was not enough as a basic offering, we went into venture capital... we then worked with the central bank to design a new circular to further help companies expand through VC funding" describes its CEO. At the same time, the frequently changing (and generally unstable) situation in the country have seemingly granted it a certain level of preparedness for dealing with emerging operational disruptions. We label these initial organizational characteristics as a priori resilience characteristics to capture enabling factors that determine the success of a resilient response.

5.4.2 A priori resilience

During the first few months that marked the start of the Lebanese crisis, IncubaTech's assessment of the general situation began to emerge along with its struggles to address the country's adverse business conditions. It started with an abstract vision reflected by the general metaphor "*Building a Resilient Ecosystem for Entrepreneurs*" that was clearly visible on its website and corporate logos as a way to emphasize the organization's continued commitment to support local businesses navigate crisis-induced challenges. In a statement addressing the future of the business incubation industry, IncubaTech's operating director explained:

Our way of meeting entrepreneurs had changed and some of our revenue streams which come from the rental of facilities, including rental of offices, coworking and meeting rooms, were affected...With the team, we went through a crisis management mode, where we improved the general digitalisation of the team, ensuring that we maintain multiple structured weekly meetings as if we were in the office to make sure we continue to engage with the team...we had to adjust to our context, in particular the state of the economy.

This statement was reinforced by changes in the operating dynamics within the incubator including "implementing new onboarding methods for entrepreneurs, mentors, and new employees", "targeting new market segments", and "adapting the business incubation curriculum to crisis-management mode" (program director). By the start of
2020, IncubaTech had developed a sophisticated view of the situation and had established a more concrete strategy of what should be done to revitalize the country's struggling entrepreneurial ecosystem. It established a comprehensive set of programs and key initiatives for supporting local businesses and identified a range of economic sectors (notably energy and agriculture) that were most essential for stimulating gradual growth and recovery. This set of solutions was further accompanied with notable changes in its business incubation approach (e.g., funding structure, curriculum, goals and priorities, and local/international partnerships) and was facilitated primarily by the organization's (1) own idiosyncratic attributes (i.e., firm-specific factors), (2) constant exposure to market uncertainty/risk (i.e., market-driven factors), and (3) accumulated expertise in supporting businesses and new ventures in the region (i.e., business support capabilities), all of which collectively constitutes the incubator's *a priori* resilience characteristics (Figure 5.4).

Insert Figure 5.4 about here

5.4.2.1 Firm-specific factors

While conducting our interviews, we were often impressed by how senior managers described their strong commitment to find new ways to continue supporting local entrepreneurs, how the rest of the team seemed fully onboard to help navigate new changes, and how new support initiatives started to emerge almost from day one (field notes). For example, while many accelerators, and venture capital firms pursued growth strategies by looking for new investments elsewhere (discussions VC partners), IncubaTech endorsed local businesses and supported promising ideas grounded in the unique needs of the local context. Providing these services gave IncubaTech relatively more power in its community. One senior manager explained:

In the past two years, this ecosystem has been severely impacted with many organizations and entrepreneurs relocating outside. [IncubaTech] was able to adapt

quickly. For example, we expanded from 40 to 82 employees. The number of programs also grew. So the ecosystem in Lebanon was shrinking while IncubaTech itself was expanding and moving more and more toward its center.

Perhaps more importantly, the strong network ties and partnerships that have been established with key actors (e.g., mentors, coaches, industry leaders, and investors) over the years were particularly valuable for helping the organization develop, manage, and sustain new support programs, even during such a volatile context. As its founder proclaims, being "transparent" and "able to shift and respond to market demands" are perceived as a virtue and a core strength of the organization's identity. "*We have the know-how, the team, and the established relation with businesses and institutions that we learn from and apply locally*" describes its operation director to highlight strength of the incubator's core business support foundation. Resident entrepreneurs have also expressed how their involvement with mentors from IncubaTech allowed them to develop and scale their ventures via international partnerships "*that wouldn't be possible otherwise*" (entrepreneur).

Apart from its strong foundations and connection to its ecosystem, there is also a visibility factor, which is underscored by the physical appearance of its facilities. As highlighted by a senior manger:

"We run three sites in central locations across Beirut with our logo all over the place. So many investors already know, or at least are familiar with its activities giving it an additional reputational boost."

This series of interactions and fieldnotes show that the country's extraordinary situation created unique needs that IncubaTech improvised to address. This improvisation has been largely facilitated by the organization's own accumulated resources, successful track record, visibility, and established network and partnerships, all of which we label under firm-specific factors that constitute the first prerequisite condition for resilience.

5.4.2.2 Market-specific factors

Beyond these idiosyncratic factors, many organizations in the region have been already dealing with an unsettling business environment for some time, a condition that was further aggravated by the Covid-19 pandemic. From our fieldnotes, we notice that for many, navigating a crisis has become somewhat "*business as usual*" (entrepreneur). We refer to these themes as market-driven factors because they emerge from repeated efforts in handling market-related risks and contribute to strengthening the *a priori resilience* condition on a broader scale.

These market-driven factors were particularly salient during the Covid-19 outbreak. "We were already ahead of the curve... we've had roadblocks, entrepreneurs coming from different regions could not reach us...businesses had started moving into virtual conferencing way before the March lockdown" (Operations director, IncubaTech). Moreover, the evident weakness of formal governmental institutions over the years has accentuated the role of intermediaries (notably business incubators and VC firms) in shaping the local entrepreneurial ecosystem and guiding its trajectory.

"There has always been a gap between what comes out of a business incubator or accelerator and VC funding" argued the founder of a major regional VC firm, "we have already created a business angel program to fill this gap, but all of this disappeared since the start of the crisis, so we had to recreate another fund, select the most promising ventures, and invest in them...we did this in only 6 months, which is a record, despite the Covid-19, closures, and everything. And now we're doing the same again for SMEs."

The constant pressure to adapt and tailor new initiatives has enabled intermediary organizations in the region to become relatively highly receptive to changes in market demands. Thus, we note that despite differences in their market response strategies, the social-embeddedness of these intermediaries in their local ecosystem have made them more or less resilient to the unfolding crisis due to prior measures that were already put in place to deal with recurring challenges and ongoing market disruptions.

5.4.2.3 Business support capabilities

In addition to firm- and market-specific factors, internal informants (e.g., managing director, operations manager, and program director) kept referring to IncubaTech's ability to re-orient its activities and operations to adjust to the situation at hand, all indicating a capability-based understanding of organizational resilience (e.g. Duchek 2014; Williams et al. 2017). This ability was typically reflected in the incubator's experience in selecting and training mentors/coaches, forging new strategic partnerships, and perhaps more importantly "managing and developing new programs even during such a volatile context" (deputy director). We labeled these elements as *business support capability*, which we use to refer to as the accumulated set of experiences, processes, and learned behaviors that can be leveraged to deal with the challenges associated with launching and scaling new ventures.

The first key element that bolstered the incubator's business support capabilities is its accumulated experience in developing new programs and initiatives for addressing evolving regional priorities.

We started by focusing on technology, we then introduced agrifood then cleantech...we also gained expertise by providing services directly to businesses, and then to other support organization, and later we learned how to influence regional [entrepreneurship] policies (operations director)

We also recognized the ability to establish a strategic alignment between mentors and coaches with the needs/interests of businesses and entrepreneurs as another key component of an incubator's business support capabilities. IncubaTech's knowledge of the local entrepreneurial ecosystem and with it the knowledge of the key actors that are sufficiently motivated and capable to contribute to the formation of a quality pool of entrepreneurs has seemingly facilitated the process (discussion with program director).

A third indicator for business support capabilities was reflected in the incubator's ability to identify, collaborate, and work with potential resource providers, such as donors, sponsors, and investors, each with their unique needs and requirements. As the regional business analyst explains:

"I think the strength of its [IncubaTech] incubation approach is that its more geared towards practice as opposed simply to theory, which does not always capture what is actually happening on the ground."

This was particularly evident following Beirut's port explosion as IncubaTech was able to secure a significant share of fundings from international donors to develop new programs for helping small businesses and entrepreneurs that were most affected (fieldnotes). Thus, we recognize from our data the incubator's ability to develop new support programs, ensure the alignment between mentorship/coaching and business needs, as well as establish strong partnerships with key resource providers as key indicators of its business support capabilities.

5.4.3 Resilient Response

Our analysis of the impact of the Lebanese crisis on the state of the country's entrepreneurial ecosystem also revealed notable challenges that severely impacted local businesses and new ventures. The degradation of the country's operating infrastructure, the lack of access to capital, and the loss of specialized talent (notably skills related to technology and data analytics) have been cited among the most detrimental crisis-induced challenges faced by businesses (regional business analyst and industry reports). At the same time, we also recognized new support initiatives (e.g., grants, programs, working capital, etc.) being put it place specifically to address to such challenges. However, there was a substantial variation in how different support organizations described their response strategy. For example, one informant at a major innovation center explains:

"We are still operating near full capacity, the majority of our residents are now either entrepreneurs handling operations outsourced from abroad or large companies that had no choice but to relocate to a new site following the [port] explosion... As long as we are able to provide the minimum infrastructure, then they will continue to do just fine."

IncubaTech opted for a more proactive response, including "launching fundraising campaigns", "establishing linkages with new sponsors", "training new

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coaches and mentors", and "*promoting social entrepreneurship*" (program director). As the operations director describes:

One thing we introduced from early on was crisis management. This was a very important way to stabilize the community...We've offered several different types of support, we've lobbied for financing to help them, and recently we've worked with different donors and global communities to try to provide different types of training, grants and loans

During the early months of the crisis, new creative solutions started to emerge as pragmatic responses to the desperate need to address the deteriorating situation in the country. These solutions were primarily driven by the resourceful actions taken by managers to address immediate operational challenges (e.g., shifting to online incubation sessions, adapting the revenue structure of co-working facilities, and allocating more resources towards upskilling and training services). Indeed, many of the strategies that were used to help local businesses deal with these challenges were also applied internally within the organizations. *"Working with entrepreneurs is like working in lab, we learn from them and try to apply successful practices ourselves…learning is mutual"* highlights the incubator's deputy director:

As managers started to recognize potential opportunities brought forth by the crisis, the incubator's program repertoire began to evolve in different directions depending on regional priorities and shifts in businesses interests. These emerging opportunities necessitated active reconfigurations to the organization's existing incubation model further motivating a resilient response (Figure 5.5).

Insert Figure 5.5 about here

5.4.3.1 Resourcefulness

From our analysis, we noted that nearly all internal informants (e.g., executives and senior managers) have highlighted some creative solutions implemented by the organization to acquire, assemble, and work with available means (i.e., leveraging available resources) to adapt their operations to the situation at hand. As best described by the operations director: *"We were able to rely on our existing resources networks, knowledge, and trust to accommodate for the influx of support programs from the economic crisis while effectively growing our team."* We label these solutions *resourcefulness* to reflect the actions taken to identify creative pathways and new contingencies to available resources.

Interestingly, IncubaTech has strongly benefited from a growing interest from the international community to expand its network reach by partnering with new donors in order to develop additional services and new types of business support programs. As we observed and as was revealed by our informants, new initiatives were actively being developed to address shifting priorities and emerging demands. In a way, the absence of formal governmental institutions coupled with apparent weaknesses in the general business infrastructure has turned into an advantage for IncubaTech and an opportunity to fill this gap.

Unfortunately, governmental institutions fell short of providing the needed support for businesses, so international donors looked for other institutions that they could rely on, an institution that was transparent and had procedures and processes to help Lebanese entrepreneurs...so they turned to institutions such as [IncubaTech] (CEO)

The political situation has shattered the trust in public institutions. Investors and donors began looking for a reputable organization to manage their programs in Lebanon.

Given our successful track record and reputation, we were able to secure many of these investments (Deputy director)

Much of the new initiatives that were developed during the crisis were not much dependent on the actual constrained environment, but rather on the strategies and creative actions implemented by management to capture emerging opportunities (e.g., new funding sources, high demand for coworking spaces, and growing interest in digital upskilling and other specialized training services) and mitigate operational challenges (e.g., shifts in business priorities, loss of talent, closures, and operational disruptions). Thus, we found that the organization was indeed resourceful in customizing new business support initiatives for meeting the evolving demands of both businesses and donors. For example, in light of the adverse events following the port explosion, the incubator has partnered with a leading VC firm alongside a major donor to create a new investment initiative to save the most promising start-ups "…we said, let's chose the best in class of each of the ventures and help them cross this unfortunately economic crisis" (VC partner). Such initiatives have helped to drive additional investments into the country's already struggling business environment.

5.4.3.2 Entrepreneurial orientation

Despite early efforts to address the emerging challenges brought forth by the crisis through leveraging resources in creative ways, the nature and scope of these challenges has limited the extent to which traditional business incubation programs can remain effective and has even impacted the flow and type of entrepreneurs subscribing to these programs. During the early months, the incubator's main focus has been on balancing its own survival with that of its resident entrepreneurs. As time progressed, its strategy started to shift more and more towards strategic expansion into new sectors and regions (mostly in the surrounding the Gulf countries) with relatively close ties to Lebanese businesses:

"We gained a lot of experiences in the past two years on how to help small and medium-sized businesses... from here, there is a huge potential. We were able to leverage this expertise and the tools we already have to tap into new markets." (Operating director) To that effect, IncubaTech seemed to have recognized new opportunities to employ its expertise and resources in markets that can highly benefit from similar business support initiatives, while further bolstering and reinforcing its operations locally. We interpreted this response as an indicator of the incubator's entrepreneurial orientation, which we used to categorize the actions taken by managers to identify new value-creating opportunities for improving and/or expanding existing business support operations (i.e., targeting new markets and pursuing new sectors and trends).

Indeed, while conducting our interviews, it was not uncommon to observe new programs and initiative (e.g., loans, workshops, and training sessions) being created to address specific crisis-related challenges and then scaled up and integrated into the organization's core activities. For example, driven by the growing recognition of the importance of social entrepreneurship for the country's gradual recovery, IncubaTech has launched a new program targeted specifically at promoting social entrepreneurship. The program adopted a bottom-up approach to business incubation starting with establishing the proper social entrepreneurship infrastructure, which has been clearly absent in the region. In the words of the CEO:

"[the social entrepreneurship program] contributes not only to scaling up the start-ups to the growth stage, but to empowering ecosystem partners through capacity building and developing strategic linkages".

The social implications of this program were directly observed in the aftermath of the Beirut Port explosion as many of its graduate start-ups were fast to respond by helping in renovation and fundraising campaigns. As the program director explained, the success of this program has been largely facilitated by the team's ability to *"identify and mobilize active partners" (e.g., mentors, coaches, funders, and institutions), "design appropriate curriculum", and "strategically select, train, and help scale promising social ventures".* This has motivated IncubaTech to standardize the concept to enable its replication in another context. Yet, despite the great optimism expressed by its management, it remains to be seen how such programs and other similar initiatives can be replicated in other places considering the strong social embeddedness of the organization in its local ecosystem.

5.4.3.3 Agility

The general business infrastructure, at the time of this writing, is still facing a number of challenges that is impacting both the type of support needed by businesses as well as the priorities of key donors, investors, and funding institutions. One the one hand, a substantial amount of funding has been allocated towards providing basic business necessities focussing mostly on traditional sectors, such as energy or agriculture. "We saw a notable shift in regional priorities... the general trend seems to have moved away from opportunity-driven entrepreneurship towards necessity entrepreneurship" (regional business analyst). At the same time, the crisis has opened up new opportunities for businesses to develop scalable, digital-enabled solutions that can be developed internally at competitive costs and outsourced externally. As one VC partner notes, "during this period we saw many entrepreneurs learning new skills related to coding and marketing, for example, that they can be used to venture into surrounding countries...this has been a major opportunity for local businesses."

Specifically, program managers seemed to recognize the potential limits of conventional business incubation approaches in such context and were working to establish a balance between a structured and well-established program curricula targeted at traditionally high-growth sectors (notably agrifood and cleantech) with more permeable and tailored programs for addressing emerging business challenges as they arise. One particular example was the range of new customized initiatives (coaching sessions, mentoring activities, business clinics, and personalized services) that were immediately launched to provide direct support to struggling local businesses during the Covid-19 pandemic (fieldnotes). We label this response as organizational agility consistent with Teece, Peteraf, and Leih (2016) to denote the active reconfiguration of existing models for enabling a rapid response to emerging opportunities and threats.

Notable changes also took place within the organization itself. During our interviews, we kept hearing the phrase "*most of the team is new hear*" reiterated by different informants. The exodus of experienced talent has perhaps been the most challenging aspect of the crisis for many businesses in the country (discussion with regional business analyst). Nearly all new employees were coming from different

industries with relatively little or no expertise in entrepreneurship "requiring a serious emphasis on training and onboarding strategies to make sure the team is integrated properly" (deputy director). Informants also pointed that "the challenge wasn't just recruiting, but also figuring out how to reinforce the morale and commitment of existing employees" (Director of a university innovation center). This has led to constant organizational restructuring within the incubator itself with more capital being allocated to human resources (almost doubling the number of employees), new positions being created, and new programs developed (notes and observations). Ultimately, the incubator's agility was evident in the active reconfiguration of its business support model and internal organizational restructuring for dealing with dynamic market changes.

5.5 Entrepreneurial support, intermediary intervention, and resilience: An emergent framework

We started this paper by asking: *why some entrepreneurial support organizations are more successful than others in adapting to emerging business development challenges*? While these intermediaries have been an object of inquiry for a while (e.g., Bruneel, Ratinho, Clarysse, & Groen, 2012; Pauwels et al., 2016), scholars has focussed more on the "content" of their support—what services they provide and to what extent they tend to yield desired outcomes—rather than on the way this support is being provided (Bergek & Norrman, 2008; Ratinho et al., 2020). To this end, we draw on a case study tracing the evolution of a business incubator as it navigates the recent series of Lebanese crises. We develop a theoretical framework explaining the way such organizations evolve to address emerging business development challenges and what prerequisite conditions are most relevant for facilitating this process. As illustrated in Figure 5.6, our framework considers both the characteristics of entrepreneurial support organizations as well as their resilient response, thereby differentiating between the act of supporting entrepreneurs from the factors contributing to its success. Insert Figure 5.6 about here

Findings from our study reveal two interrelated aspects that determine the success of entrepreneurial support organizations in navigating crisis-induced challenges. The first, which we label as firm- and market-specific factors to represent the organization's idiosyncratic attributes in terms of its accumulated assets and prior experiences in dealing with ongoing market disruptions. Specifically, we found that these characteristics serve as a catalyst for subsequent business support initiatives and play an important role in shaping an intermediary's successful response. The second element we label as *business support capabilities* to signify the set of developed experiences and learned behaviors that can be leveraged to deal with the challenges associated with launching and scaling new ventures. In this respect, we introduce the concept of "*business support capabilities*" as a way to theorize about effective practices for fostering innovation and productive entrepreneurship in a region. In effect, IncubaTech's exceptional growth during the crisis highlights what's possible when entrepreneurial support organizations exploit their established capabilities to effectively leverage, reconfigure, and mobilize the resources necessary for responding to emerging business development demands.

The concept of a business support capabilities is theoretically and practically important. Capabilities in general are central to a firm's long-term survival and success. Without developing unique and relevant capabilities, organizations may grow temporarily but ultimately struggle to compete over time. In our context, the introduction of business support capabilities as a novel theoretical construct provides an explanation for why certain entrepreneurial support organizations (e.g., business incubators, accelerators, science parks, innovation centers, and so on) that seemingly possess strategic assets and resources struggle to adapt when market environments shift. More broadly, it could explain potential variations in the effectiveness of different organizational sponsorship interventions as the accumulation and application of business development "know-how" would significantly contribute to the transformation and growth of selected ventures. Because many entrepreneurial support organizations do not take direct equity positions in these ventures—but often rely on rental income, services, and subsidies/grants—their success largely depends on how well they are able to leverage the right capabilities to select, nurture, and promote their incubatees.

In our model, we examine how the capabilities that develop over time through organizational learning and accumulating experience in supporting entrepreneurs (i.e., business support capabilities) can enable a resilient response to a crisis (Figure 5.6). The *resilient response* unfolds through a process as actors scramble make sense of the unfolding crisis, leveraging their existing resources to generate pragmatic responses to immediate needs as they emerge. These actions, which we labelled as resourcefulness, allow entrepreneurial support organizations to mobilize essential financial and non-financial (e.g., mentorship, coaching, and partnerships) gathered from multiple sources, often by appealing to their sense of commitment and identification with their community. We thereby show that their ability of these organizations to survive and thrive during a crisis is partly driven by their strong social embeddedness in their regional ecosystems. As revealed by our case study, even though the ideal mechanisms for supporting business and new ventures in such context were often contested, the broader vision, commitment, and priorities of the organization were not.

As the business incubator assessed available resources and took pragmatic actions, it began pursuing new value-creating opportunities for fostering innovation and business development in the region. Perhaps most importantly, the network ties and partnerships that helped to sustain new business support initiatives during the crisis differed significantly from those that were established prior to that period. These pragmatic actions would then invite further opportunities to expand existing operations and improve resulting outcomes, triggering more episodes of resource assessment and opportunity realization. We refer to this propensity to identify and seek new market opportunities as entrepreneurial orientation. This is in line with the recent literature defining entrepreneurial orientation as the pattern of value-seeking behavior (e.g., creation of complimentary organizational processes, routines, and structures) for responding to emerging opportunities and challenges (Anderson, Kreiser, Kuratko, Hornsby, & Eshima, 2015; Wales, Covin, & Monsen, 2020; Wales, Gupta, & Mousa, 2013).

Entrepreneurial orientation in such context invokes the reconfiguration of existing business incubation models for enabling a fast response to crisis-induced transformations (Figure 5.6). This response, which we label as organizational agility, can be reflected either by (1) mitigating adverse environmental conditions by making them insignificant to the organization (insulating the organization from crisis-induced challenges) or (2) generating novel operating strategies that are consistent with the new reality (adapting existing processes and structures to crisis-induced opportunities). The three response mechanisms highlighted in our model (i.e., resourcefulness, entrepreneurial orientation, and business agility) are well recognized in the entrepreneurship literature. To us, they most clearly reflected the insights that emerged from our data; however, it might necessitate that in some cases the definitions vary somewhat from some of the prior uses of the same terms. What is novel in our inductive model, however, is the focus on intermediary organizations and the ways by which they are able to adapt in response to emerging business development challenges.

Findings from this study contribute in three significant ways. First, to the field of entrepreneurship by showing how the resilience of both individual ventures and the broader ecosystem can be reinforced through the adaptive behaviors of entrepreneurial support organizations. Second, to sponsors and managers of these organizations by providing a theoretically sound and empirically-driven model that illustrates the characteristics of successful entrepreneurial support organizations and their underlying business incubation practices. Third, to policymakers by proposing extending the reliance on intermediary organizations as a way to promote business development and innovation.

5.5.1 Contribution to entrepreneurship research

The growing body of work at the interface of entrepreneurship, crisis management, and resilience has provided prolific insights on the mechanisms through which new ventures can anticipate, prepare for, and respond to adversity (Doern et al., 2019; Kuckertz et al., 2020). Much of this work has been conducted at the micro-level

investigating the cognitive and behavioral traits of individual entrepreneurs (e.g., Hayward, Forster, Sarasvathy, & Fredrickson, 2010; Smith, Smith, Kietzmann, & Lord Ferguson, 2022) or at the macro-level in terms of the nature of institutions, policies, and collective behaviors that support or constrain entrepreneurial activity in times of crisis (e.g., Williams & Vorley, 2015; Williams & Shepherd, 2016). However, equally important is the way these levels weave together and interact with each other to accommodate for environmental changes and crisis-induced disruptions.

In this paper, we highlight the important role of entrepreneurial support organizations as intermediaries that bridge the multilevel nature of resilience in entrepreneurship research. In line with recent work in this area (e.g., Clayton et al., 2018; Goswami, Mitchell, & Bhagavatula, 2018; Oriaifo, Torres de Oliveira, & Ellis, 2020), we argue that these intermediaries can ensure a smooth flow of resources and opportunities between otherwise disconnected ecosystem components, helping entrepreneurs navigate the complexity and uncertainty of a crisis. We suggest that instead of evaluating resilience solely in terms of the characteristics and behaviors of individual entrepreneurs or that of the broader ecosystem in which they operate, it is also important to focus on the connection that is enabled by intermediaries whose role can be central in times of crisis

This paper also made clear that past studies have overlooked the evolutionary dynamics of entrepreneurial support organizations, that is the how they emerge and change over time. While few articles exist on how these intermediaries can maintain their competitiveness and survival prospects over time (e.g., Bergek & Norrman, 2008; Bruneel et al., 2012; De Silva, Howells, & Meyer, 2018), the vast majority of studies are conducted from the entrepreneur's perspective, whereby these organizations act as means of access to valuable resources and opportunities (for recent reviews see e.g., Bergman & McMullen, 2021; Ratinho et al., 2020). Yet, given that organization-specific differences in capabilities between these organizations can make them more or less responsive to emerging business demands (Goswami et al., 2018), understanding the nature and origins of such capabilities is critical for improving the entrepreneurial support process (Hackett & Dilts, 2004). In this paper, we introduce the construct of business support capabilities

as a way to theorize about performance variations between entrepreneurial support organizations, especially when market environments shift.

Our findings also have implication for research on entrepreneurial ecosystems. The ecosystem approach suggests that entrepreneurial activity is primarily driven by various institutional, environmental, and sociocultural forces (Spigel & Harrison, 2018; Stam & Spigel, 2016) whose actions and interactions enable (or restrict) the emergence and growth of new ventures (Acs, Estrin, Mickiewicz, & Szerb, 2018; Spigel, 2017). Any effort to deliberately design or replicate strategies for stimulating entrepreneurship needs to be specifically tailored to a given regional context (Hillemane, 2020; Isenberg, 2011). Yet, evidence over why the effectiveness of such efforts may vary from one regional context to another remains scarce. We suggest that one reason for this variation is attributed to the diverse mix of locally embedded intermediary organizations that can directly or directly influence a entrepreneurial activity in a region. Thus, it might not simply be that the performance of individual ecosystem components is additive, but that the strength and quality of the connections between them will determine their collective performance in promoting entrepreneurial activity. Research has so far focused on intermediaries as a way to overcome business development constraints (e.g., survival, growth, and venturing), but has not clearly explained how they can directly contribute to the collective performance at a higher-order system level (Goswami et al., 2018). Thus, we move the literature forward by highlighting the importance of intermediaries in driving the collective performance of entrepreneurial ecosystems.

5.5.2 Contribution to entrepreneurial support practices

For managers, our findings highlight the conditions under which entrepreneurial support organizations are able to achieve and maintain their growth in response to changing market conditions. These organizations are advised to consider the relevance of their support interventions in relation to the unique sociotechnical context in which they unfold; to establish adequate formal and informal legitimacy in the ecosystem; to develop a strong network of mentors, donors, and experienced entrepreneurs; and to maintain a long-term vision that is unaffected by short-term market disruptions and exogeneous pressures. Central importance needs to be also given to organization-specific differences in business support capabilities that make some intermediaries more or less competitive, especially in the face of dynamically changing market conditions. However, the realization of such capabilities does not necessary equate to superior performance. A sufficiently strong resource-base that is underpinned by principles of good governance need to be present for these support organization to become considered as repositories of best practices in the creation and development of new businesses.

An interesting managerial tension that we also observed from our case study is the need to balance between scalable solutions that are mostly applicable to international contexts (i.e., scaled internationally) and locally-embedded initiatives that are tailored to unique region-specific challenges. Indeed, while many sponsors and donors tend to prioritize regionally-tailored initiatives aimed at fostering economic revitalization, entrepreneurs and businesses were more interested in developing scalable strategies focused primarily on external markets. Thus, a key concern remains how to align this local specificity with ambitions for scalability. Moreover, we have also observed that entrepreneurial support organizations are exposed to another tension between their vulnerability as organizations to crisis-induced adversity on the one hand, and their capabilities as "entrepreneurial agents" to leverage emerging opportunities that accompany a crisis on the other. While a crisis does indeed result in severe operational disruptions, it does however provide opportunities to develop new support initiatives for addressing emerging societal and business-related challenges. These tensions are certainly not new, but the extreme context of the crisis has revealed their relevance to supporting new ventures.

5.5.3 Contributions to business development policy

In terms of policy implications, our findings suggest that entrepreneurial support organizations play a unique role in fostering business development during a crisis, particularly in the absence of formal support institutions and clear regulatory frameworks. They are considered as neutral and competent actors by all accounts and are capable, to certain extents, to address evident gaps in regional economic development policies. Nevertheless, their effectiveness remains largely contingent on other entrepreneurial ecosystem components, not the least of which are early-stage support systems for ensuring an active and vibrant flow of entrepreneurial ventures (Nair, Gaim, & Dimov, 2022). While public funding is still a very important aspect for promoting these types of organizations and orient their activities toward "Grand Challenges", there also exist ample funding opportunities from other non-governmental actors, such as private investors, universities, organisational sponsors, and donors, for helping these organizations develop new tailored initiatives while staying competitive at the same time.

5.6 Conclusion

In this paper, we have argued that entrepreneurial support organizations represent an effective mechanism for fostering innovation and business development in times of crisis. We propose that under certain conditions the act of supporting entrepreneurs itself can generate new capabilities that can be internalized for reuse in other contexts, thereby considerably reducing the time and resources spent on developing, managing, and monitoring new entrepreneurial support initiatives. This operational efficiency ultimately feeds back into the organization's own performance in the form of strategic resourcefulness, entrepreneurial orientation, and agility, making it more or less responsive to radical changes in market demands. The model presented in this paper contributes to the growing research on supporting entrepreneurship in times of crisis and provides a basis for understanding the relationship between crisis management and resilience/survival of new ventures.

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Table 5.1. Data collection

Interview Material	# of Interviews
<u>Primary interviews</u>	
Deputy director)	3
Program director	1
Mentors and regional business analysts	2
Ecosystem informant (VCs,	
innovation centers, and university	4
incubators)	
Individual entrepreneurs	2
<u>Secondary interviews</u>	
Chairman / CEO	1
Operations Director	2
Individual entrepreneurs	4
Total	19
Archival Material	# of
	Documents
Internal company updates	193
External analyst reports	4



Figure 5.2. A dynamic perspective to entrepreneurial support organizations



Figure 5.3. Crisis management sequence in entrepreneurship research *adapted from Bundy, Pfarrer, Short, and Coombs (2017); Doern et al. (2019); Korber and McNaughton (2017)*



Figure 5.4. A priori resilience data structure



Figure 5.5. Resilient response data structure





Figure 5.6. Entrepreneurial support, intermediary intervention, and resilience

Chapter 6 General discussion and conclusion

Innovation intermediaries are increasingly becoming major components of national innovation policies. As they have grown in popularity, they have inspired a surge of interest in both, academic journals and the popular business press. This level of enthusiasm is often justified on the basis of understating what drives business development and how to expedite the commercialization of new products, services, and technologies. Prior research has established the value-creating potential of these support organizations. In this dissertation, I complement this work by exploring the dynamics that underpin their effective functioning. I explore these dynamics in four ways: (1) by integrating what we already know about innovation intermediaries and offering a constructive line of critique that could help move the literature forward; (2) by proposing an evaluation framework that illustrates how the different objectives between intermediaries can shape their activities and design structures; (3) by showing how the intermediation process facilitates the diffusion of emerging technologies. and (4) by identifying the characteristics and processes that help intermediaries better respond to the evolving needs of their ecosystem.

6.1 Summary of findings

The first study (Chapter 2) presents a systematic review of the literature outlining some major challenges that have potentially undermined its theoretical and practice significance. The review identifies the different roles assumed by intermediaries in the innovation process, describes the key challenges they are likely to face, and highlights the value-added outcomes they provide. What is still lacking, however, is a clear understanding of what causes and what and under what conditions. Building on these insights, I highlight four areas that could largely benefit from additional scholarly attention: (1) establishing stronger theoretical foundations to disentangle causal intermediation mechanisms and underlying outcomes, (2) more longitudinal analyses tracing the evolution of intermediary organizations beyond a single project, (3) exploring strategies for managing the interplay between value creation and value capture, and (4) identifying performance evaluation criteria for monitoring the effectiveness of innovation intermediaries in a theoretically meaningful way.

The second study (Chapter 3) focuses on the organizational design of innovation intermediaries. This study complements the first by showing how differences in their underlying objectives shape their innovation-support activities and outcomes. I address this question through a meta-synthesis of 38 case studies supplemented by an in-depth empirical analysis of the application of a MedTech living lab in healthcare. A key insight that emerged from this study is that each design model offers specific strengths and weaknesses depending on the unique objectives that an intermediary organization is set to achieve. For example, those specializing in the commercialisation of new technologies are better equipped to operate according to sustainable business model, but simultaneously require ongoing efforts to cater to the needs of specific organizations and sponsoring institutions to reinforce their legitimacy in the absence of key performance indicators. In contrast, intermediaries prioritizing community and social welfare can accommodate a wider array of stakeholders, but simultaneously risking their ability to sustain their activities over time. More broadly, I find that the effectiveness of intermediary organizations highly depends on ensuring an alignment between their innovation-support activities, design structure, and value proposition.

The third study (Chapter 4) shows how the involvement of intermediaries facilitate the diffusion of emerging digital technologies in healthcare. As an extension to the earlier two, this study highlights the multi-level nature intermediation activities. More specifically, results indicate the intermediation process unfolds simultaneously along two levels: (1) the first, which I label as "technology-focused intermediation", involves the set of activities designed to help co-create a specific technology in accordance to an existing sociotechnical context; (2) the second, which I label as "ecosystem-focused intermediation", captures the set of activities designed to motivate, equip, and reinforce ecosystem actors to be able to leverage the opportunities brought forth by emerging technologies. Each of these processes is underpinned by sourcing, mobilizing, and scaling strategies intended to align the requirements of specific technologies with the needs and capacities of potential users, thereby overcoming the key barriers to its diffusion. Hence, this paper shows that intermediaries do not only support innovation *within* ecosystems, but also support the innovation ecosystem *itself*.

The final study (Chapter 5) addresses the evolutionary dynamics of innovation intermediaries. This study extends the first three by showing why and how intermediaries can effectively adapt to shifts in innovation needs and priorities over time. I address this question using an in-depth case study examining the impact of the Lebanese crisis on the state of the country's entrepreneurial ecosystem. Drawing from interviews, observations, and secondary data, I found that in addition to the actions taken by intermediaries to ensure a resilient response to the crisis, there are some inherent factors, which I label as a *priori* resilience conditions, that determine how successful their response could be. Most notably, the accumulated set of organizational expertise in supporting business development and venture creation (i.e., business support capabilities) will influence whether or not timely measures can be implemented to motivate a resilient response. Furthermore, by their very nature, innovation intermediaries appear to be better equipped to deal with uncertainties as they are more likely to anticipate emerging market needs and adapt their activities accordingly. However, these organizations also face unique challenges associated with securing to new donors, identifying alterative sources of funding, and designing tailored initiatives to support local businesses and entrepreneurs.

Taken together, these four studies contribute to our understanding of *how intermediaries operate to sustain effective innovation-support systems*. The first study delineates the *theoretical foundations* of innovation intermediaries, examining how these entities have been studied to date and where the major gaps are. Taking these insights as a starting point, the second study looks relatively rigorously at the *organizational design* of intermediaries as a way to bridge persistent gaps pertaining to their governance, development, and monitoring over time. The third study builds on the second to explore the overall *intermediation process* underpinning the diffusion of emerging technologies. This study points to the multi-level nature of intermediation activities showing that supporting innovation goes beyond simply supporting the development of new products,

services, and technologies to also include supporting notable developments in the ecosystem itself (e.g., public policies, industry regulations, financing schemes, and appropriation regimes). The final study turns the attention to the *evolution* of intermediaries. In effect, this study complements the earlier three by highlighting a reciprocal relation between the act of supporting innovation within emerging ventures and organizational-level capabilities. This study reiterates the link between intermediation processes and system-level outcomes while also emphasizes the importance of maintaining a strategic "fit" between organizational design (strategies, operations, and innovation-support models) and evolving needs and priorities.

6.2 Limitations

While I sought to execute this dissertation in a coherent and rigorous manner, it still suffers from some limitations that warrant further discussion. First, the systematic literature review conducted for Study 1 is limited to a single database (i.e., the Web of Science). While this database was chosen because of the breadth of its interdisciplinary coverage that covers leading academic journals, particularly in the field of innovation management and entrepreneurship, some insightful publications might have been excluded from this analysis.

Second, the Living Lab design framework presented in Study 2 is based on a handpicked sample of cases, the large majority of which are located in Europe. However, the European context might not be representative of all regions in which living labs are being established. While this analysis is further substantiated using a case study from North America, more research is needed to validate this framework in different settings.

Finally, the qualitative case studies conducted in Study 3 and Study 4 focus only on two specific forms of intermediaries (i.e., living labs and business incubators), which might have limited the generalization of their findings. Future research could examine the internal processes that occur in other forms of intermediaries in order to validate and refine some of the findings of the dissertation. More broadly, I encourage additional research on the evolution of these processes over time and across contexts, a step that helps motivate a move from a static to a dynamic depiction of intermediaries in the innovation context.

6.3 Future directions

Throughout these four studies, I have sought to shed more light on the underlying dynamics of innovation intermediaries. Despite the proliferation of interest in these forms of support entities and the ways by which they are being diffused by governments, universities, research institutions, and other interested parties, there has been scant attention to their design, management, and evolutionary processes. My intention was to raise more awareness toward these issues as a way to justify their practical utility in supporting regional innovation. I conclude this dissertation by highlighting the contributions that intermediary organizations can offer to the advancement of existing theories in innovation management.

First, the literature on open-innovation in particular (Chesbrough, Vanhaverbeke, & West, 2006; Chesbrough, 2003) may find intermediaries a useful mechanism by which firms may reduce the complexities associated with openness. Open-innovation is arguably the dominant paradigm for understanding the collaborative nature of innovation-related activities (Alam, Rooney, & Taylor, 2022; Obradović, Vlačić, & Dabić, 2021). However, the specific strategies used to create value through opening up the innovation process are often complicated by the same ones that are used to capture it (Wadhwa, Bodas Freitas, & Sarkar, 2017; Zobel & Hagedoorn, 2020), a phenomenon often referred to as the paradox of openness (Laursen & Salter, 2014). Innovation intermediaries may provide a way to reconcile these seemingly conflicting strategies. A fruitful contribution to this literature would be to explore how and when they are able to do so.

Similarly, innovation intermediaries offer an interesting approach for studying the diffusion of knowledge across firms and industries. Besides providing a useful context for data collection, innovation intermediaries capture how proximity and physical
infrastructure could facilitate knowledge transfer and exchange (Howell, 2022). Whereas efforts to prevent knowledge spillovers are thought to impede multilateral collaborations by restricting how strategic knowledge can be identified, exchanged, and combined (Oxley & Sampson, 2004), intermediaries can play a central role in mitigating such negative externalities and help create new forms of industry commons (Cohendet, Grandadam, & Suire, 2021). Therefore, new theories on knowledge management could highly benefit from incorporating the role of intermediaries in facilitating (or potentially hindering) the knowledge exchange process within and across industries.

Moreover, intermediaries provide an important addition to the modern innovation ecosystem framework (Adner, 2017; Shipilov & Gawer, 2020). The ecosystem construct suggests an organic and fluid relationship between interdependent, yet hierarchically independent components that co-evolve in a region (Ritala & Almpanopoulou, 2017; Thomas & Ritala, 2021). The complementarities between these components and the nature of their interdependence constitute the main driving force shaping the ecosystem's innovation capacity (Jacobides, Cennamo, & Gawer, 2018). It is in this particular context where intermediaries are set to offer uniquely valuable contributions. While each type of intermediaries could provide specific type of support to their regional ecosystem, there is also the potential for creating synergies where multiple intermediaries to coordinate their efforts to address ongoing innovation challenges (Clayton, Feldman, & Lowe, 2018; Ratinho, Amezcua, Honig, & Zeng, 2020). Thus, intermediaries offer a fruitful approach to explore how to reinforce the links between disparate, yet interdependent actors in the ecosystem and align their respective interests and contributions.

Another area in which innovation intermediaries can still offer interesting insights is that of technology clusters. Strategies for technology clustering are typically created as top-down initiatives for motivating research institutions, entrepreneurs, venture capitals, and R&D subunits of organizations to relocate in close proximity to each other. Doing so is assumed to encourage the permeability between the sources of industry expertise on the one hand, with that of scientific research on the other, thereby enhancing the collective innovation capacity of a cluster (Etzkowitz & Zhou, 2018). However, even with well-funded infrastructures and adequate public policy frameworks, physical proximity by

itself is not sufficient to attract technology-based ventures and foster technology development in a region (e.g., Lazzeretti & Capone, 2016; Letaifa & Rabeau, 2013). Theories on industrial clustering can therefore highly benefit from intermediation strategies to establish more integrated and synergetic technology support systems. As a result, innovation intermediaries offer a way to integrate top-down regional policies with bottom-up entrepreneurial initiatives to accelerate the development and diffusion of emerging technologies (Etzkowitz & Klofsten, 2005).

In addition to these advantages, the possible limitations and drawbacks of innovation intermediaries also requires careful attention. For instance, studies point to some negative externalities that stem from the networked nature of intermediation activities that can result in competitive information leakage (Cox Pahnke, McDonald, Wang, & Hallen, 2015) and incompatible business support strategies (Bergman Jr, 2021) potentially hindering rather than facilitating the innovation process. Thus, more work is needed to understand what types of organizations and individuals suffer the most from engaging with innovation intermediaries, and perhaps more importantly, what strategies can be implemented to alleviate some of the negative externalities that these intermediaries could have on different stakeholders.

6.4 Conclusion and final thoughts

Perhaps one of the most provocative, and yet most important, questions that still persists in the literature on innovation intermediaries is "*do they work*?". Despite the great credence accorded to these support entities by both, academics and policy makers alike, the lack of a strong evidence base for the justifying their effectiveness has been noted (e.g., Abootorabi, Wiklund, Johnson, & Miller, 2021; Bergek & Norrman, 2008; Paskaleva & Cooper, 2021; Pauwels, Clarysse, Wright, & Van Hove, 2016; Ratinho et al., 2020). For instance, in a recent study tracking a the performance of 142 high-technology new ventures supported by the Israeli government's Technology Incubator Program over a 20-year period, Gimmon and Levie (2021) report that the strongest indicator of the long-term success (and survival) of new ventures is not how much

intermediary support they receive, but rather their early sales performance, or what the authors referred to as early product–market fit. In an other study of the impact of accelerators in New Zealand, Blair, Khan, and Iftikhar (2020) argue that "after more than a decade of operations, long-term outcome and benefits of accelerators to New Zealand innovation ecosystem are still unclear" (p, 47). Similarly, Paskaleva and Cooper (2021) conclude from an in-depth analysis of literature on living labs that despite their 20-year history, there is still a lack of clear evidence required to evaluate their effectiveness and to support the claims being made by their proponents. So what could a lack of solid evidence over the effectiveness of innovation intermediaries mean to contemporary scholarship and practice?

In the entrepreneurship sphere, as best summarized by Davidsson (2021), it could mean that the "the quality of the opportunity ... is more important than the individual [entrepreneur]...despite both academics and investors putting more weight on the entrepreneurial agent" (p, 317). In other words, intermediaries could be better off supporting ventures that are able to show early commercial success rather than investing to help entrepreneurs develop their skills, expertise, and resources. Theoretically, this claim seems too narrow and based on the faulty assumption that only ventures that persist beyond a certain performance threshold are the best predictor of the effectiveness an intermediary support intervention. Thus, it limits the concept entrepreneurial success to economic value, thereby excluding other forms of productive entrepreneurship (e.g., creative, social, and sustainable entrepreneurship) that could also contribute to the welfare of a society, but whose contribution cannot be measured directly in monitory terms (Acs, Boardman, & McNeely, 2013; Saebi, Foss, & Linder, 2019). This opens up new debates on whether innovation intermediaries should only focus on "picking winners" or should continue providing the needed support individual agents to help them become/act more "entrepreneurial".

For innovation scholars, it could mean that the commercialization of scientific research/discoveries necessitates greater attention to market validation right from the initial conception of an idea until its successful implementation. The recent trend toward decentralization of innovation activities, as evidenced by new open-innovation

approaches such as crowdsourcing (Afuah & Tucci, 2012; Hoornaert, Ballings, Malthouse, & Van den Poel, 2017), distributed problem solving (Jeppesen & Lakhani, 2010), customer co-creation (Mahr, Lievens, & Blazevic, 2014), community-based innovation contests (Bullinger, Neyer, Rass, & Moeslein, 2010), and lead user engagement (Hienerth & Lettl, 2017; Schweisfurth & Dharmawan, 2019) might indicate a right step in that direction. The growing awareness to this phenomenon has also spurred interest in new forms of innovation intermediaries (as described in Study 2) to help foster multistakeholder collaborations to address complex societal problems.

For policy makers, the central concern is what value would society derive from these investments. So far (as shown in the review conducted for Study 1), the value created by innovation intermediaries is reflected across all three levels of analysis: the level of individual organization (i.e., businesses and entrepreneurs), network (i.e., nature and structure of relations), and ecosystem (i.e., the broader regional and industrial context). Yet surprisingly, very few studies examine this value at the level of the sponsoring organization that is responsible for setting up or managing these support entities. Instead, the dominant assumption is that as long as new technologies are being developed and/or new ventures are being created, then objectives are achieved. However, sponsors are usually driven by different goals, such as job creation, economic growth, knowledge production, and social welfare, to name a few. With these goals in mind, policymakers need to be more aware of the heterogeneity that exists between the different types of intermediaries they fund and the extent to which each may be suited to the objectives they seek to achieve. Therefore, contextual performance measures that take into account differences between institutional, cultural, and regional factors need to be developed for better evaluating the value created by innovation intermediaries as opposed to a "one size fit all" approach.

Finally, having conducted a comprehensive review on innovation intermediaries in general, and an in-depth examination of living labs and business incubators in particular, I conclude that despite significant theoretical and empirical advancements, the existing body of work sill lacks an adequate framework to inform policy makers, researchers, and practitioners on how best evaluate the performance of these support entities and benchmark their outcomes. As a result, the innovation intermediary construct seems to have become an umbrella term used to describe any organization involved in supporting the development of innovation without enough specificity to the exact nature this support and its desired outcome. Also, as noted by several scholars (e.g., Bergman & McMullen, 2021; Paskaleva & Cooper, 2021; Ratinho et al., 2020), studies on innovation intermediaries need to be contextualized in such a way that any analysis of their underlying outcomes is interpreted in relation to who is being supported, for what purpose, and under what conditions. I hope that this dissertation (and the studies in it) could provide additional transparency on these issues and encourage future work to address not only on the ways in which intermediaries help nurture and support innovation-related activities, but also how these intermediaries themselves can be better managed, monitored, and possibly improved over time.

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