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ORGANIZING FOR OPEN INNOVATION: EXPLORING EMERGING ISSUES, CHALLENGES, AND OPPORTUNITIES

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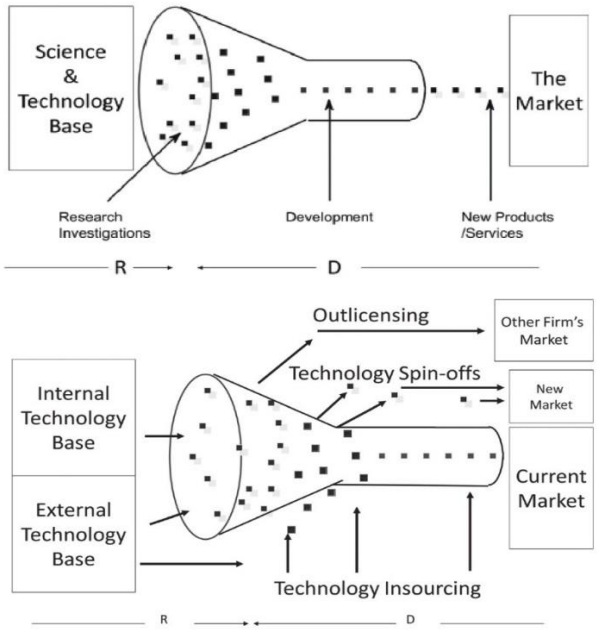
1 Introduction

1.1 Introducing the concept of open innovation

Defined as "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model" (Chesbrough & Bogers, 2014, p. 17), open innovation is nowadays a widespread innovation management paradigm (Chesbrough & Bogers, 2014; West & Bogers, 2017). Although early forms of open innovation can be dated back centuries ago (Formica & Curley, 2018), the term "open innovation" was only first used in 2003 in a book published by Henry Chesbrough to indicate a shift of paradigm from closed to open industrial innovation processes. As outlined in Chesbrough (2003), at the turn of the millennium, the distribution of knowledge has gradually shifted away from large, central, and vertically integrated R&D laboratory systems to more disintegrated networks of innovation that connect companies to more variegated pools of knowledge such as suppliers, customers, universities, research labs, consultants, and start-up firms (Chesbrough & Bogers, 2014; West & Bogers, 2017). As main erosion factors that led to the decline of a closed model of innovation and the rise of an open model Chesbrough (2003) has identified increasing mobility of trained engineers and scientists, increasing importance of venture capital, greater dissemination of knowledge throughout the world, increased quality of university research, and increased rivalry between companies in their product markets. Figure 1.1 and Table 1.1 outlines the main differences between the two models.

Figure 1.1 Closed (above) and open models (below) of innovation



Source: Chesbrough, 2012

Table 1.1 Closed and open innovation principles

Closed innovation	**Open innovation**
The smart people in our field work for us	Not all of the smart people work for us so we must find and tap into the knowledge and expertise of bright individuals outside our company
To profit from R&D we must discover, develop, produce and ship it ourselves	External R&D can create significant value; internal R&D is needed to claim some portion of that value
If we discover it ourselves, we will get it to the market first	We don't have to originate the research in order to profit from it
If we are the first to commercialize an innovation, we will win	Building a better business model is better than getting the market first
If we create the most and best ideas in the industry, we will win	If we make the best use of internal and external ideas, we will win
We should control our intellectual property (IP) so that our competitors do not profit from our ideas	We should profit from others' use of our IP, and we should buy others' IP whenever it advances our own business model

Source: Adapted from Chesrbrough (2003)

Open innovation scholars have identified and analysed several practices. The two main dimensions of open innovation are known as inbound and outbound open innovation (Chesbrough & Crowther, 2006). More specifically, in the inbound model, a firm increases its innovativeness by using, in addition to in-house R&D, also knowledge and technology provided by external actors. Conversely, in the outbound model, firms seek for external organizations that are better suited to commercialize their innovation. Subsequently, Enkel et al. (2009) suggested a third dimension, the coupled model of open innovation, which refers to co-creation processes combining inbound and outbound flows. Bigliardi and Galati (2016) have provided a categorization of open innovation practices based on these three dimensions, as shown in Table 1.2.

Table 1.2 Open innovation practices

Practices	**Definitions**	**Main references**
Inbound		
Customer involvement	Directly involving customers in the innovation process (e.g. by developing products based on customers' specifications)	Von Hippel (1986), Gassmann (2006), van de Vrande et al. (2009), Spithoven et al. (2010), Burcharth et al. (2014)
External networking	Systematically collaborating with external partners to support the innovation process (e. g. with universities or research centres, other firms)	Chesbrough (2003), Gassmann (2006), van de Vrande et al. (2009), Lee et al. (2010), Wynarczyk et al. (2013), Burcharth et al. (2014), Harland and Nienaber (2014), Holzmann et al. (2014), Montelisciani et al. (2014)
Inward IP licensing	Buying or using external IP (e.g. patents)	Chesbrough (2003), Gassmann (2006), van de Vrande et al. (2009),

		Lee et al. (2010), Wynarczyk et al. (2013), Burcharth et al. (2014)
Internet exploration	Systematically using internet to search for innovative ideas or technologies	Burcharth et al. (2014)
Know-how acquisition	Purchasing R&D work from others	Gassmann (2006), Wynarczyk, Piperopoulos, and McAdam (2013), Burcharth et al. (2014), Harland and Nienaber (2014), Holzmann et al. (2014)
Outbound		
Outward IP licensing	Selling patents licenses or know-how	Gassmann (2006), Lichtenthaler and Ernst (2009), van de Vrande et al. (2009), Lee et al. (2010), Wynarczyk et al. (2013), Dong and Pourmohamadi (2014)
Knolwedge exploitation	Making own unused innovations available to others for free	Chesbrough (2003), Lee et al. (2010), Wynarczyk, Piperopoulos, and McAdam (2013), Burcharth et al. (2014)
Knowledge provision	Actively participating in others innovation projects	van de Vrande et al. (2009), Lee et al. (2010), Wynarczyk et al. (2013)
Coupled		
Alliances with complementary companies	Combining the outside-in process (to gain external knowledge) with the inside-out one (to bring ideas to market)	Gassmann and Enkel (2004), Enkel, Gassmann, and Chesbrough (2009)

Source: Bigliardi and Galati (2016)

Early scholars have dedicated most of their efforts to investigate the inbound perspective of open innovation. More recently, scholars' efforts have also shifted to understand the outbound and the coupled model of open innovation (West & Bogers, 2014).

The open innovation model has spread over the years from large companies and high-tech sectors (Mortara, & Minshall, 2011; Parida et al., 2012), to a wide set of areas and domains, such as small and medium-sized enterprises (SMEs) (Brunswicker & Vanhaverbeke, 2015; Santoro et al., 2020; Scuotto et al., 2017; Van de Vrande et al., 2009), low-tech firms (Bertello et al., 2021*a*; Dooley & O'Sullivan, 2018), and online communities and not-for-profit organizations (Forliano et al., 2020; Randhawa et al., 2019; Schmidthuber et al., 2019). After the coronavirus outbreak, open innovation has also revealed to be crucial in the face of the pandemic, highlighting how collaborative innovation efforts between public and private actors and between industry and science have been playing a fundamental role in dealing with the COVID-19 crisis (Bertello et al., 2021*b*; Chesbrough, 2020). This has stimulated growing interest among academics to investigate the characteristics, evolution, and implications of open innovation.

1.2 Aim of the dissertation and summary of chapters

Recent reviews of and call for papers for open innovation studies (see, for instance, Bogers et al., 2017; Randhawa et al., 2016; Stanko et al., 2017) have identified several promising streams of research to move open innovation research forward. This dissertation aims to shed light on these emerging and/or under-explored topics from the lens of organization studies. The open innovation field of studies has followed a practice-based approach that explains to some extent why research on open innovation has not strong theoretical foundations. Most of the theorization on open innovation comes from strategy and management scholars (Vanhaverbeke & Cloodt, 2014), while organization studies still play a marginal role in explaining open innovation practices. However, to gain a more comprehensive understanding of open innovation in an increasingly complex and dynamic environment is essential to develop a critical understanding of organization theories and their use in the framing process of the organizing processes of open innovation. This dissertation thus aims to lay the groundwork for further reflection on how organization studies can provide both theoretical and practical insights to address open innovation as well as how open innovation practices can inspire new organizational research. With this purpose, I explored three emerging topics in the field of open innovation studies: the dark sides of open innovation[1], the human side of open innovation, and the contribution that open innovation can give to address grand challenges. As a specific context to address the first issue, I selected small- and medium-sized enterprises (SMEs) to identify the challenging barriers that they face in collaborative projects. Due to their specific characteristics, SMEs cannot benefit from open innovation in the same way as large firms (Spithoven et al., 2013; Usman et al., 2018; Vanhaverbeke, 2017), prompting scholars to move beyond research on high-tech and/or large companies to explore SMEs. In Chapter 2 of this dissertation, I will present an overview of barriers to open innovation (and related streams of literature such as value co-creation and innovation network) in SMEs, and then, in Chapter 3, I will introduce the empirical results of a qualitative study that I have conducted to investigate the challenges that low- and medium-low tech SMEs experience in collaborative projects based on pre-competitive R&D. This chapter will also propose organizational solutions to improve the management of these projects in the face of the identified barriers.

In Chapters 4 and 5 I will move my focus to the human side of open innovation. Seven years after Chesbrough's first conceptualization of open innovation (Chesrbough, 2003), Gassmann, nd colleagues (2010) assessed the future of open innovation and recognized that most research was still neglecting the human side. A few years later, another influential review of the literature explicitly

[1] We intend here the concept of dark side as referring to the drawbacks to openness (see Stanko et al., 2017).

stated that “we still know little about how individuals who take up the open innovation role draw upon their networks to support them in this role” (West et al., 2014, p. 809). Given the increasing awareness that much more research is required to address the human side of open innovation, has made research on the microfoundations of open innovation flourish. Chapter 4 will be dedicated to providing an overview of these studies, outlining, at the end of the chapter, a research agenda on promising avenues for future research. In Chapter 5, instead, I reflect on the how studying the microfoundations of open innovation can contribute to organization studies and then I present the results of an empirical study that I have conducted to unveil the individual skills and abilities that are influent for developing relational capabilities when organizations practice the coupled mode of open innovation.

In Chapter 6 I address the third topic of this dissertation exploring the role of open innovation in the face of grand challenges. We must all recognize that organizations are increasingly called to deal with complex issues such as climate change, energy and water supply, poverty, inequality, and overpopulation. A new way of conceiving open innovation is thus necessary that considers not only firms’ competitive advantage but also the common good. Open innovation scholars have started reflecting beyond openness across organizational boundaries to explore the role of openness at the societal level only recently (Bertello et al., 2021*b*) but we still have limited evidence on how open innovation works when societal needs are at stake. Chapter 5 outlines some organizational factors that are relevant for organizing open innovation in the face of grand challenges.

Finally, Chapter 7 will reflect on the theoretical implications of organizing open innovation. In particular, I will reflect on how theoretical approaches beyond the traditional theories of the firm could help to support conceptually the role of open innovation from the perspective of organization studies while Chapter 8 will conclude this dissertation by summarizing what brought to life.

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2. When is open innovation challenging? Insights from research on SMEs

2.1 Introduction

Since its first theorization in 2003 (Chesbrough, 2003), the open innovation body of literature has attracted the attention of several scholars (Dahlander & Gann, 2010; Enkel et al., 2009; West & Bogers, 2014), focusing principally on contexts where open innovation is expected to work and providing insights from high-tech and/or large companies as early adopters of this strategic approach to innovation (Bagherzadeh et al., 2019; Ferraris et al., 2020; Ferraris et al., 2017; Wang et al., 2015). Only recently, the field of investigation of open innovation has assumed SMEs as an area of inquiry (Agostini & Nosella, 2019; Bertello et al., 2021; Mei et al., 2019; Odriozola-Fernández et al., 2019). Due to their specific characteristics, SMEs cannot benefit from open innovation in the same way as large firms (Spithoven et al., 2013; Usman et al., 2018; Vanhaverbeke, 2017), suggesting scholars explore both when and how open innovation works and when and how it does not work in SMEs.

The increasing relevance of open innovation practices among SMEs is confirmed by recent systematic reviews and bibliometric analysis that have tried to summarize existing research and to provide avenues for future research (Hossain & Kauranen, 2016; Odriozola-Fernández et al., 2019; Usman et al., 2018). In their contribution to the book "Researching open innovation in SMEs" (Vanhaverbeke et al., 2018), Usman et al. (2018) have identified challenges to open innovation as one of the most relevant themes.

SMEs contribute to the backbone of productive systems by employing in most of the countries the vast majority of the national workforce and accounting for most of the value added, accounting for over 99% of all businesses and more than 60% of all jobs created (Usman et al., 2018). Before exploring the barriers to open innovation in SMEs, it is important to outline the main characteristics that differentiate SMEs from large firms. First, we must notice that criteria for defining SMEs change from country to country. Following the indications of the European Commission, SMEs have a number of employees that does not exceed 250, with an annual turnover lower than €58 millions (Scuotto et al., 2017*a*). These are thus the thresholds that we consider to differentiate SMEs from large firms. However, the literature has investigated a large number of distinctive elements that go beyond the number of employees and turnover. Table 2.1 outlines differences in terms of structure, processes, procedures, behavior, and people.

Table 2.1 Comparison between SMEs and large firms

	SMEs	**Large Firms**
Structure	Flat and flexible structure Rapid response to environmental changes	Hierarchical and rigid structure Slow response to environmental changes

Processes	Strategic process incremental and heuristic	Strategic process generally deliberate and formal
Procedures	Informal rules and procedures, Low degree of standardization and formalization	Formal rules and procedures High degree of standardization and formalization
Behavior	Mostly organic Fluid culture	Mostly bureaucratic Culture inertia
People	Individual creativity Pioneers and entrepreneurs Modest base of human resources, financial resources and know-how	Individual creativity stifled Professionals and technocrats Ample base of human resources, financial resources and know-how

Source: Adapted from Dufour and Son, 2015

Although we must recognize that not all the SMEs present exclusively the characteristics of the left column and not all the large firms do reflect the characteristics of the right column, this comparison is useful to reflect on the possible contribution of open innovation to SMEs.

As outlined in Table 1, one of the differences between SMEs and large firms lies in the structure. SMEs tend to have a more flexible and less structured organizational structure than large firms which correspond to greater flexibility in responding to environmental changes and rethinking business strategies (Parida et al., 2012; Dufour & Son, 2015; González-Benito et al., 2016). Given the more limited size, the decision-making processes in SMEs are often centralized around the figure of the entrepreneur and few managers (Zahra & Filatotchev, 2004; Santoro et al., 2020). This allows those in decision-making positions to manage divergent and dynamic situations, stimulating their creativity (Dufour & Son, 2015).

Procedures are different as well. SMEs tend to rely more on informal rules and procedures, with lower degrees of standardization and formalization (Brunswicker & Vanhaverbeke, 2015; Dufour & Son, 2015; Lee et al., 2010; van de Vrande et al., 2009). Consequently, the company will be more likely to develop a fluid culture and less bureaucratic communication and behavioral processes that foster innovation. However, the literature often conflicts, sometimes revealing that SMEs have a greater propensity for risk and experimentation, sometimes highlighting SMEs' reluctance to change and lack of openness to external sources of knowledge (not-invented-here (NIH) and not-shared-here (NSH) syndromes) (Kaur, Naqshbandi, & Jayasingam, 2014; Parida et al., 2012; Santoro et al., 2018*a*).

A serious trap for SMEs is the scarcity of resources as SMEs often suffer from a significant lack of human capital, financial resources, and know-how (Caloghirou et al., 2004; Lee et al., 2010; van de Vrande et al., 2009). This scarcity of resources may generate a paradox. While practicing innovation, SMEs face the tension of depending on external partners to complement their internal innovation

activities while having limited resources to manage such open innovation processes (Radziwon & Bogers, 2019).

To summarize, some characteristics of SMEs may facilitate open innovation while others may hamper it. Moreover, the influence of a specific characteristic can be contingent and play an ambiguous role. However, we have few limited empirical insights on the barriers to open innovation in SMEs.

2.2 Barriers to open innovation in SMEs: an overview

The first academic work that comes to open innovation scholars' mind when you mention open innovation in SMEs is the article co-authored by van de Vrande et al. (2009). Although the overarching scope of the paper is to explore whether open innovation practices are applied by SMEs, the research is articulated around trends, motivations, and perceived challenges of SMEs with regards to open innovation. This study collected data from a sample of 605 innovative SMEs in the Netherlands, providing robust insights. Table 2.2 shows the intensity of the recurrence of the hampering factors, integrating them with the nature of open innovation practices. As main results, the authors found that organization and corporate culture-related issues are the most important barriers, followed by availability of time and resources and administrative burdens. In particular, with regards to organization/culture-related issues, SMEs experience problems in balancing innovation and daily tasks, communicating their problems, aligning with partners, and organizing innovation. According to the results of the survey, organization/culture barriers seem to be more relevant in technology exploration (i.e., innovation activities to capture and benefit from external sources of knowledge to enhance current technological developments) rather than exploitation (i.e., innovation activities to leverage existing technological capabilities outside the boundaries of the organization). As for the availability of time and resources, they represent a barrier for almost all the open innovation practices investigated by van de Vrande et al. (2009), even when the intensity is not particularly high. Administrative burdens, instead, are particularly prominent when SMEs are provided with governmental subsidies and grants.

Table 2.2 Hampering factors when adopting open innovation practices in SMEs

Category	Example	Technology exploitation			Technology exploration		
		Venturing (n = 40) (%)	Employee involvement (n = 88) (%)	Customer involvement (n = 68) (%)	External networking (n = 53) (%)	External participation (n = 45) (%)	Outsourcing R&D (n = 57) (%)

Administration	Bureaucracy, administrative burdens, conflicting rules	28	-	-	10	13	19
Finance	Obtaining financial resources	10	-	-	5	-	4
Knowledge	Lack of technological knowledge, competent personnel, or legal/administrative knowledge	5	-	-	-	5	-
Marketing	Insufficient market intelligence, market affinity, marketing problems of products	10	-	-	-	5	-
Organization/culture	Balancing innovation and daily tasks, communication problems, aligning partners, organization of innovation	35	-	30	48	75	36
Resources	Costs of innovation, time needed	5	17	10	7	-	10
IPR	Ownership of developed innovations, user rights when different parties cooperate	-	-	10	5	-	-
Quality of partners	Partner does not meet expectations, deadlines are not met	-	-	-	24	-	28
Adoption	Adoption problems, customer requirements misjudged	-	-	14	-	-	-
Demand	Customer demand too specific, innovation appears not to fit the market	-	-	28	-	-	-
Competences	Employees lack knowledge/competences, not enough labor flexibility	-	23	-	-	-	-

Commitment	Lack of employee commitment, resistance to change	-	51	-	-	-	-
Idea management	Employees have too many ideas, no management support	-	8	-	-	-	-
Other		7	-	8	1	2	3
Total		100	100	100	100	100	100

Source: van de Vrande et al. (2009)

Challenges to open innovation adoption in SMEs have also been studied by Bigliardi and Galati (2016). In their studies, the authors identify barriers to the adoption of open innovation in SMEs and investigate if different behaviors exist among SMEs concerning the hindering factors. As for the first objective, the authors identified, through a literature review, the list of 17 items, then reduced to a set of 13 items after the implementation of a factor analysis based on a survey of 157 SMEs. These items have then been grouped to identify four constructs that summarise the main barriers for SMEs in adopting open innovation: *knowledge barriers*, related to the loss of know-how or imitation by competitors; *collaboration barriers*, linked to the partners' opportunistic behavior or to the difficulty in finding the right partner, both in knowledge and cultural terms; *organizational barriers*, related to the lack of managerial skills needed to establish an effective collaboration with external players and to the resistance to change of the organisation; and *financial and strategic barriers*, including both economic aspects and a lack of strategic vision of the firms with reference to their innovative knowledge (see Table 2.3).

Table 2.3 Hindering factors to open innovation adoption in SMEs. Rotated component matrix.

	Components			
Items	**Knowledge barriers**	**Collaboration barriers**	**Organizational barriers**	**Financial and strategic barriers**
Loss of know-how	0.78			
Availability of internal and external relevant knowledge	0.75			
Problems linked to imitation	0.60			
Difficulties in finding the right Partners		0.75		
Opportunistic behaviour		0.73		
Cultural differences with partners		0.53		
Lack of adequate managerial Competencies			0.79	
Managerial complexities			0.74	

Cultural resistance inside the firm			0.63	
Administrative and legal burdens			0.58	
Economic/financial issues				0.77
Grant a technology to others without a comprehensive understanding of its potentia				0.76
Actual costs higher than planned Costs				0.56

Source: Bigliardi and Galati, 2016

As for the objective to identify different behaviors among SMEs about the hindering factors, the cluster analysis revealed three different categories of SMEs (in terms of size, industry, and barriers perceived). The authors found that the main hampering factors perceived by knowledge-intensive, high-tech and/or highly innovative industries are knowledge-related barriers domain. Moreover, SMEs from medium-innovative industries are mainly concerned with financial and strategic risks related to the implementation of the open innovation paradigm, as well as with knowledge barriers. Finally, SMEs operating in less innovative industries tend to give greater relevance to collaboration and organizational barriers.

Drawing on the study by Bigliardi and Galati (2016), Grama-Vigouroux et al. (2020) developed a theoretical framework to explore how SMEs, and more precisely small firms, collaborate with stakeholders in the process from closed to open innovation. To do so, they only kept 8 of the 17 hampering factors identified by Bigliardi and Galati, developing 9 additional factors from the literature at the intersection between open innovation and SMEs. Moreover, they consider these barriers as levers that could either positively or negatively impact the development of stakeholder engagement in SMEs' open innovation practices. These seventeen factors have then been categorized, adapting Bigliardi and Galati's framework, in five levers (i.e., knowledge, collaboration, organizational, financial, and strategic). The framework has been then empirically applied to two industrial SMEs, comparing one firm that had successfully evolved the innovation process from a closed to an open model with another one that struggled to implement open innovation. Among the several factors explaining this difference, the authors identified aspects concerning the open innovation activities performed by the firms, the ability to combine the five levers into a coherent open innovation approach, the ability to engage stakeholders, and the characteristics of the CEOs.

In a similar vein, Dufour and Son (2015) have identified, after a review of the literature, corporate culture, networking, organizational structure, and knowledge management systems as four potential

barriers to open innovation implementation in SMEs. As a next step, they applied the theoretical framework to a single case study to provide insights on how to overcome these barriers by analyzing the diverse organizational changes undertaken by the company during the open innovation implementation process.

Ullrich and Vladova (2016) proposed a weighing and decision process framework as a conceivable solution approach to increment projects' chances of success. According to their point of view, most of the existing literature focuses on the bright sides of open innovation processes while few articles have emphasized on the dark sides (for a comparison of bright and dark sides of open innovation, see Table 2.4).

Table 2.4 Comparison between bright and dark sides in open innovation research

Organizational		**Knowledge management**		**Legal**	
Bright sides	***Dark sides***	***Bright sides***	***Dark sides***	***Bright sides***	***Dark sides***
Diversification of R&D investments; Easier market entry; Resource acquisition advantages	Process coordination costs; Implementation costs; More faults in routine workflows	Broader base of ideas; Technological synergy effects; Improvement of the internal learning capacity through the transfer of external knowledge and learning routines	Strong dependence on external knowledge; Loss of key knowledge control; Loss of flexibility, creativity, and strategic power	Use of intellectual property as strategic assets; Monitoring of the uncertainty of value and protection level of others' patents	Lack in legacy for additional tasks; Intellectual property spillover; Different levels of contractual experience compared to big enterprises (as potential partners)

Source: Ullrich and Vladova, 2016

The decision process framework developed in the study is structured around an internal, external, and integrated analysis as well as a recommendation and decision phase. Piece by piece, the authors investigate the current situation and the innovation goals of the enterprise as an initial point for a decision for or against engaging in open innovation. Furthermore, they discuss the development of a software tool that automatically applies this framework and allows self-assessment by SMEs.

In its efforts to extend empirical insights beyond large companies and high-tech start-ups, the literature is gradually opening to the analysis of low- and medium-tech SMEs. In this regard, for instance, Bertello et al. (2021) explored the challenges that low- and medium-low tech SMEs face in pre-competitive collaboration by exploring three Italian regional projects based on university-industry-government collaboration. Their results are interesting, providing a longitudinal perspective on how challenges differ from one phase of the project to another one. More specifically, they have found that: (1) the main challenges in the initiation and planning phase are lack of innovation strategy

and a lack of partner mapping at the firm-level and goal incongruence and the presence of unknown partners at the project-level; (2) the major barriers in the execution phase of the project are inadequate information systems, time pressure, and lack of resources at the firm-level and goal redefinition, underestimation of partners' efforts, and numerosity and heterogeneity at the project-level; (3) relevant challenges in the closing phase are lack of commitment post-project at the firm-level and delays in goal achievement and ineffective policies at the project-level; (4) finally, the most recurring barriers in the transversal phase of monitoring and control are inadequate management control systems at the firm-level and bureaucratization at the project-level.

2.3 An introductory framework to the main barriers to open innovation in SMEs

Barriers and challenging factors to open innovation in SMEs have also emerged by other studies addressing open innovation more generally. A detailed and comprehensive analysis of these barriers has been presented in Table 2.5, where I have clustered these barriers, indicating major factors and main references for each of them.

Table 2.5 Main barriers to open innovation in SMEs

Barriers	**Factors**	**Main references**
Administrative barriers	Bureaucracy	Bertello et al. (2021); van de Vrande et al., (2009); Vanhaverbeke, (2017)
	Administrative burdens	Bertello et al. (2021); Bigliardi & Galati, (2016); Grama-Vigouroux et al., (2020); van de Vrande et al., (2009); Vanhaverbeke, (2017)
Financial barriers	Obtaining financial resources	Grama-Vigouroux et al., (2020); Radziwon, Bogers, & Bilberg, (2017); Teirlinck & Spithoven, (2013); van de Vrande et al., (2009); Verbano et al., (2015)
	Actual costs higher than planned	Bigliardi & Galati, (2016); Grama-Vigouroux et al., (2020); Teirlinck & Spithoven, (2013); van de Vrande et al., (2009); Verbano et al., (2015)
	Costly cooperation	Brunswicker & Vanhaverbeke (2015); Lee et al. (2010); Ullrich & Vladova, 2016
Knowledge barriers	Low absorptive capacity	Dufour & Son (2015); Grama-Vigouroux et al., (2020); Lee et al., (2010); van de Vrande et al., (2009); Vanhaverbeke (2017)
	Intellectual property management	Bigliardi and Galati, 2016; Deschamps et al., (2013); Lee et al. (2010); Ullrich & Vladova (2016); van de Vrande et al. (2009); Verbano et al. (2015)

	Fear of losing of know-how	Bigliardi & Galati (2016); Enkel, Kausch, and Gassmann (2005), Enkel, Gassmann, and Chesbrough (2009), Teirlinck and Spithoven (2013); Ullrich & Vladova (2016)
	Inefficient information systems	Bertello et al., 2021
Collaboration barriers	Cultural differences	Bigliardi & Galati, (2016); Grama-vigoroux et al. (2020); Teirlinck and Spithoven (2013); van de Vrande et al., (2009); Vanhaverbeke, (2017); Verbano et al. (2015);
	Opportunistic behavior	Bigliardi & Galati, (2016); Enkel, Gassmann, & Chesbrough, (2009); Grama-vigoroux et al. (2020); Vanhaverbeke, (2017); Verbano et al. (2015);
	Difficulties in finding the right partner	Bertello et al. (2021); Bigliardi & Galati, (2016); Enkel et al., (2009); Grama-Vigouroux et al., (2020); Guertler & Lindemann, 2016; van de Vrande et al., (2009); Vanhaverbeke, (2017); Verbano et al., (2015); Vrgovic et al., 2012
	Aligning with partners and communicating their needs	Grama-Vigouroux et al., (2020); Hossain & Kauranen, 2016; Van de Vrande et al., 2009
	Lack of mutual prior knowledge	Bertello et al. (2021)
Organizational barriers	Lack of competencies	Bertello et al. (2021); Bigliardi & Galati, (2016); Enkel et al., (2009); Teirlinck & Spithoven, (2013); van de Vrande et al., (2009); Verbano et al., (2015)
	Cultural resistance inside the firm	Bigliardi and Galati (2016); (2007); Dufour & Son (2015); Van de Vrande et al. (2009); Vanhaverbeke (2017); Verbano et al., 2015
	Difficulties in organizing for innovation	Bigliardi and Galati (2016); Van de Vrande et al. (2009); Vanhaverbeke (2017)
	Lack of organizational resources	Bertello et al. (2021); Dufour & Son (2015); Radziwon & Bogers, 2019; van de Vrande et al., 2009
Strategic barriers	Insufficient market orientation	Bigliardi and Galati, 2016; Kim & Park, 2010; Rahman & Ramos, 2013; van de Vrande et al. (2009), Verbano, Crema, and Venturini (2015)
	Conflicting goals	Bertello et al. (2021); van de Vrande et al. (2009); Verbano et al., (2015)
	Difficulties in evaluating the technologies	Bigliardi and Galati (2016); Grama-Vigoroux et al. (2020); Verbano et al. (2015)

	Difficulties in balancing innovation and daily tasks	Bertello et al. (2021); Brunswicker & Vanhaverbeke, (2015); van de Vrande et al. (2009)

Source: Author's own elaboration

As evidenced in Table 5 the first set of barriers regards administrative aspects. SMEs undertaking open innovation paths may be involved in administrative burdens that might become difficult to be managed when firms rely on informal systems. As pointed out by van de Vrande et al. (2009) bureaucracy tends to be particularly relevant as a barrier when SMEs receive public subsidies and grants since governments are highly inflexible, and opportunities to change partners and end prematurely programs are reduced.

As a second set of barriers, SMEs have to deal with financial and economic issues. They often engage in open innovation to overcome their lack of financial resources (Radziwon et al., 2017), however, the cooperation itself can become costly (Brunswicker & Vanhaverbeke, 2015; Lee et al., 2010; Ullrich & Vladova, 2016) while, at the operational level, costs tend to be higher than what planned.

Open innovation activities in SMEs are also particularly influenced by knowledge barriers. As mentioned in the introduction of this dissertation, open innovation refers to the "distributed innovation process based on purposively managed knowledge flows across organizational boundaries" (Chesbrough & Bogers, 2014, p.17). Managing inter-organizational knowledge is therefore an essential element for effective open innovation (Cillo et al., 2019; Martinez-Conesa et al., 2017; Santoro et al., 2018*b*; Scuotto et al., 2017*b*). However, knowledge management may be negatively influenced by several aspects. First, SMEs need to develop internal learning capacity to absorb external knowledge and be able to exploit it. Lower levels of absorptive capacity, defined by Cohen and Levinthal (1990, p.127) as a "firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends", may hamper open innovation processes. However, knowledge flows may also be curbed by SMEs' fear of losing know-how, especially when firms have fear of being imitated (Ullrich & Vladova, 2016). Another relevant problem is related to the management of intellectual property. As suggested by Bigliardi and Galati (2016), SMEs' managers should pursue an adequate and transparent intellectual property rights strategy with their partners, avoiding unclear or ambiguous situations in which an established (and potentially fruitful) collaboration could be compromised. As for the last two hindering factors mentioned, namely fear of losing know-how and intellectual property management, project-level agreements could mitigate the organization-level impact of these concerning issues, stimulating transparent collaboration through both formal and informal solutions.

Barriers to collaboration are another set of factors that we have individuated. In this regard, difficulties in finding the right partners, and then aligning with them are two examples of typical problems that emerge in inter-organizational settings, especially when partners are unknown before setting the collaboration or when firms are not so good at communicating their needs and their goals. Moreover, collaboration may be hampered by opportunistic behavior that needs to be tackled through the right governance structure (Bogers, 2011).

One of the most significant barriers to open innovation in SMEs, however, concern organizational and cultural aspects. As suggested by Bigliardi and Galati (2016), these barriers are particularly relevant in less innovative firms. SMEs do not only lack financial resources, as aforementioned. They also often lack human resources and time. This means that they do not have enough resources to dedicate to open innovation activities, thus preferring daily operational activities. This partially reflects the paradox highlighted by Radziwon & Bogers (2019), according to which SMEs face the inherent tension of depending on external partners to complement their internal innovation activities while having limited resources to manage such open innovation processes. As for the cultural aspects, SMEs are often characterized by a sort of cultural resistance to innovate in collaboration with other organizations. This is often explained by using the terms "not invented here" and "not sold here" syndromes. The former results from a negative attitude toward knowledge (ideas, technologies) derived from an external source (Antons & Piller, 2015) while the latter describes protective attitudes in firms toward the external exploitation of knowledge (Lichtenthaler et al., 2010). As argued by Burcharth et al. (2014), the "not invented here" and "not sold here" syndromes influence negatively and separately the extent of use of inbound (practices related to the absorption of external knowledge) and outbound (active use or commercialization of knowledge outside a firm's organizational boundaries) open innovation practices.

The last set of barriers refers to the strategic aspects of open innovation. Among them, insufficient market intelligence and a limited understanding of customers' needs can represent hampering factors that compromise the outcomes of collaborative innovation. As for the goals that drive open innovation activities, they are often conflicting since any organization has its own, and this may lead to incongruences that compromise the outcome of the collaboration. In this regard, while strategy literature highlights the necessity to establish clear common goals (Hossain & Kauranen, 2016), organizational literature adopts a slightly different approach, suggesting the use of boundary objects and paradoxical management to suggest the possible coexistence of competing demands over time. Finally, SMEs may experience difficulties in evaluating the technologies that can result, for instance, as suggested by Bigliardi and Galati (2016), in granting a technology to others without a

comprehensive understanding of its potential, and, more generally, in difficulties in capturing value from technological collaboration.

To summarize, we have identified, based on previous literature, a significant number of typologies of barriers to open innovation in SMEs. Some of them are more related to open innovation in general (e.g., conflicting goals, opportunistic behaviors, cultural differences) while others are more context-specific so they can be considered more peculiar of SMEs (e.g., lack of time and human resource, obtaining financial resources, administrative burdens). However, the aim of this analysis is not to underline the ineffectiveness of open innovation practices in SMEs, but to lay the foundations for further research aimed at identifying some organizational mechanisms that make it possible to overcome these hindering factors. In this regard, the next chapter will focus on the empirical identification of the main barriers that low- and medium-low tech SMEs experience in open innovation projects, followed by practical insights for organizing at the project-level to overcome these barriers.

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3. Organizing pre-competitive and collaborative R&D in low- and medium-low tech SMEs: barriers and project-level responses.

3.1 Introduction

Although open innovation is increasingly investigated by scholars (Bogers et al., 2017), studies on open innovation in SMEs are still sparse (Bertello et al., 2021). We have, for instance, limited evidence of how SMEs collaborate with external partners to support the innovation process in university-industry-government collaboration. The literature on open innovation has traditionally differentiated inter-organizational projects into two macro-categories. The first category refers to pre-competitive collaboration. In this case, firms tend to collaborate with research organizations to develop basic research and experimental development (exploration phase of R&D). The second category, instead, refers to the commercialization phase of R&D. In this case, firms usually play a more prominent role compared to research organizations, and they also tend to rely more on collaboration with suppliers and customers. With regards to SMEs, horizontal collaboration with universities and/or research centers for the exploration stage of technology is less investigated (Lee et al., 2010; Narula 2004). Moreover, SMEs generally tend to achieve better performance in terms of innovation outcomes when they engage in the commercialization phase of R&D rather than its experimental and pre-competitive phase (Verbano et al., 2015). However, despite the difficulties in translating research output successfully from universities and/or research organizations (Spithoven et al., 2013), SMEs will be increasingly called to engage in horizontal partnerships to be competitive in an ever more complex and uncertain environment where addressing and adjusting basic research to their needs can become a driver of sustainability in the long term.

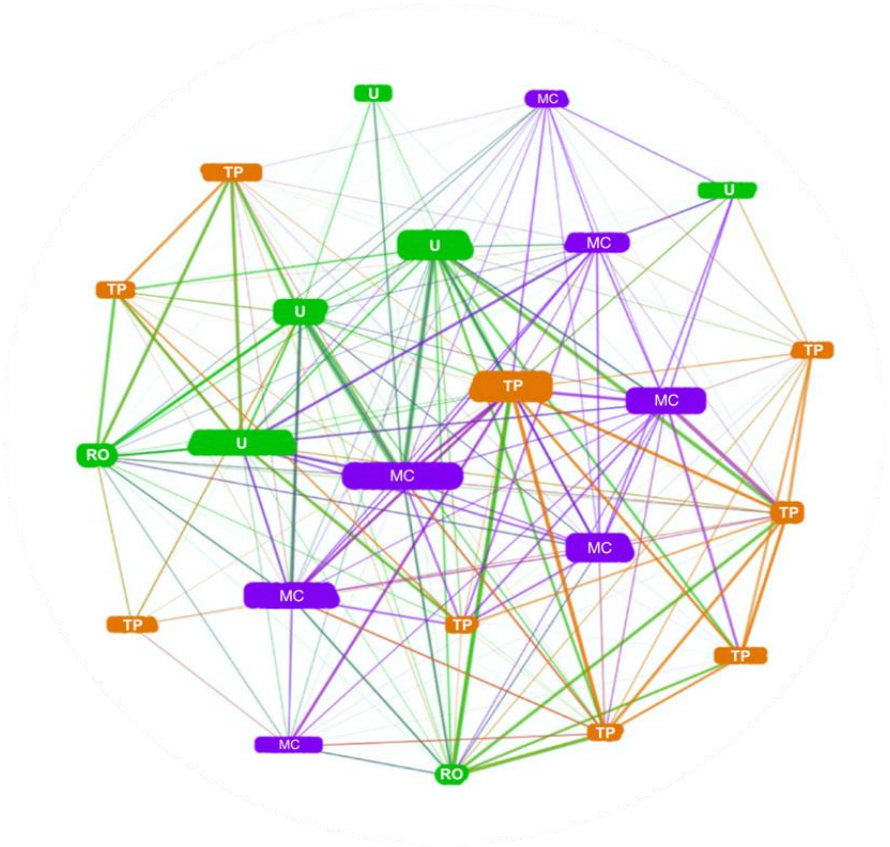
This chapter identifies barriers to open innovation in low- and medium-low tech SMEs in pre-competitive R&D. By doing so, it contributes to research open innovation in SMEs but also to the analysis of open innovation from an inter-organizational perspective as a level of analysis (Bogers et al., 2017). Moreover, this study also brings insights for organizing open innovation at the project-level.

3.2 Context of the empirical analysis

In this chapter, I will present the results of an empirical study that I have conducted by studying a Regional Industry 4.0 project in Italy, whose network was built around university-industry-government collaboration (Figure 3.1). Italy represents an interesting set for investigation due to the high number of SMEs which represents the 99% of enterprises active in the Italian economy (European Commission, 2018) and to the huge sums that Italian Regions are investing to stimulate the R&D propensity of SMEs. Moreover, the constitutional reform of 2001 has conferred to Italian regions a greater number of competencies regarding enterprise and innovation policies to facilitate peripheral governments' responses to local needs with the aim to speed up the diffusion of

experimental projects, stimulating in this way, the academic interest (Bellucci et al., 2019; Caloffi et al., 2018)

Figure 3.1 Network structure of the project



Source: Author's own elaboration. MC = manufacturing company; TP = Technology provider; U = University; RO = Research organisation

The project selected as a case study of this chapter was publicly funded by a regional government to *stimulate manufacturing SMEs' industrial research and experimental development*, as reported in the official documents. More specifically, the project had the target to build an integrated digital platform to improve transformation and production processes of food companies, in particular: analysis systems able to operate both through historical series and near real-time on the data collected by the sensors; microbiology/chemistry/rheology analysis techniques to detect the accumulation of toxic substances and/or pathogenic microorganisms; advanced statistical models based on both rule-based and machine learning approaches; network infrastructure for the transfer of data to an integrated control system. These common goals were then articulated in work packages and firm-specific objectives such as application of sensory tools for predictive analytics in manufacturing processes, set-up of a system of advanced methods for detecting abiotic contaminants in complex ingredients and food, spectroscopic methods for process control. SMEs were the end-users of the project, and

their collaboration with universities, research centers, and technology providers, as well as the government as funding body of the initiative, must be interpreted as an inbound model of open innovation, according to which these actors represent external partners that support SMEs' innovation processes through external knowledge and technology.

I focused my analysis on four low- and medium-tech SMEs to extend the open innovation perspective beyond the traditional settings of large and/or high tech firms that generally tend to be more familiar with open innovation practices.

According to the definition given by the Organization for Economic Cooperation and Development (OECD), the level of technology intensity in manufacturing companies can be categorized as low-tech, medium-low tech, medium-high tech, and high-tech. I have considered as low- and medium-tech those SMEs that do not exceed the threshold of 3% of R&D intensity (Hirsch-Kreinsen and Jacobson, 2008) and whose R&D expenditure absorbs less than 2.5% of total sales (Som et al., 2015). I thus developed an empirical study with the twofold aim to (i) investigate the barriers preventing low- and medium-tech SMEs from adopting inbound open innovation effectively, and (ii) individuate the project-level organizing mechanisms that could overcome these barriers.

3.3 Methodology

To gain a more accurate picture of the dynamics of social relations which take place in inter-organizational projects, I have developed an embedded case study (Yin, 2003) in which low- and medium-low tech SMEs are the sub-units of analysis. The phenomenon of interest has been examined in its real-life context through qualitative data based on interviews, observations, and archival data (Yin, 2017). The choice to focus on more than one sub-unit for my analysis followed the principles of replication strategy, increasing external validation of the findings, focusing the analysis on analytical rather than statistical generalizations.

Ford data collection, I have conducted 10 semi-structured interviews with SMEs and the other stakeholders of the project. Key informants were selected following a purposive sampling technique, according to their knowledge and availability (Kumar et al., 1993). I have first interviewed the four low- and medium-tech SMEs (i.e., the sub-units of analysis) and then the other actors of the project (government representatives, technology providers, universities, and research organizations). I could thus obtain in-depth and illustrative information on the various dimensions of the phenomenon under analysis, according to the views and perspectives of multiple actors. The protocol comprised a series of open-ended questions which were adapted according to the nature of the interviewee, in compliance with the twofold aim of this study.

The data from the semi-structured interviews were then triangulated with data from observations. The observations were conducted with other two researchers and consisted mainly in participation to the steering committee meetings and visits to companies for field inspections. Data were also collected by analyzing archival data, mainly in the form of project documentation, organizations' websites, and further documentation provided by the interviewees.

Data analysis followed an iterative process of matching emergent themes from the empirical data with the existing prior literature (Corbin & Strauss, 2014). The first step to be conducted was the open coding. In this phase, a comprehensive list of codes and memos from the material transcribed was generated by individuating any possible barrier hindering the effectiveness of open innovation. Next, a process of pattern searching was followed which resulted in the identification of second-order themes combining inductive and deductive reasoning (Miles et al., 2018). In particular, we combined our data with Table 5 of the previous Chapter. A final step consisted of the analysis of how project-level organizing can deal with these barriers.

3.4 Findings

In the data analysis, we have individuated ten main barriers that we have grouped in the 5 macro dimensions identified in the previous chapter (i.e., administrative, financial, knowledge, collaboration, organizational, strategic barriers) that are analyzed in depth in this section (Table 3.1).

3.4.1 Administrative barriers

The project relied on a strict monitoring process since SMEs were called to officially report the activities and tasks to obtain funds from the government, confirming previous literature arguing that administrative burdens are one of the most prominent barriers when firms receive government subsidies and grants (van de Vrande et al., 2009). Many of the actors involved in the projects have recognized that a decrease in documentation and reporting could reduce the efforts of many SMEs. The manager and CEO of an SME highlighted as he experienced "*Great difficulties in managing administrative issues and finding the appropriate resources"*.

More specifically, SMEs complained about the excess of documentation they had to produce and the excessive 'rigidity' of the platform on which they had to upload the documentation. Some tasks were perceived as too complicated, especially for those companies that have simplified accounting systems and limited human resources to devote to the project.

3.4.2 Financial barriers

The presence of financial incentives reduced the financial barriers, however, delays in the provision of funds represented a relevant concern, especially because the project was extended for a further period of 3 to 6 months due to the difficulty in completing the project objectives. The deferred payments required monetary disbursements which SMEs are not always able to manage by themselves. This significant drainage of the financial assets was perceived strongly from those SMEs which had not a project portfolio and/or those SMEs which used the money for ordinary operations, underlining limited innovation orientation.

3.4.3 Knowledge barriers

Some of the SMEs involved in the project were still tied to organizational and cultural logics that do not allow to fully benefit from knowledge transfer across organizations. They show a limited learning capacity, reflected in a reduction in the commitment both in terms of intensity of interaction with the external partners and internal support for the project activities. SMEs have traditionally been recognized as characterized by greater flexibility and reactivity due to their small size (Bigliardi & Galati, 2018; Brunswicker, & Vanhaverbeke, 2015), but there are still many cultural resistances such as the not invented here syndrome (Chesbrough, & Crowther, 2006; Dufour, & Son, 2015). While, on the one hand, the university-industry-government collaboration allows SMEs to recognize valuable external technologies through technology intermediation (Spithoven et al., 2010) on the other side, SMEs show a limited ability to appropriate these external technologies. Even whether the previous literature has highlighted that stakeholders such as universities and research centers can help SMEs in developing the ability to appropriate technologies (Ramos et al., 2009), there is still a huge amount of SMEs which have inefficient knowledge management systems to take advantage of participating in collaborative projects (Dufour & Son, 2015). Moreover, many times the managers find it difficult to recognize the importance of change course and they continue relying on old-fashioned management logics.

Another recurrent problem experienced by the partners of the project was the slowness and the ineffectiveness of SMEs in transferring data. This is not only due to a sort of reluctance to transfer information, but also to evident deficiencies in the information systems that made it difficult to obtain and communicate data to the other project's stakeholders. This caused slowdowns and frictions. During a steering committee, a partner from the University evidenced:

"We had to build a dashboard of indicators and we needed some specific data that we never received. The problem was not that they didn't want to transfer it, they simply didn't have that data".

3.4.4 Collaboration barriers

One of the most important phases that influence collaboration for innovation is the partner selection process. Lack of prior mutual knowledge can represent a critical issue, especially when the network of firms is in part composed of organizations that are not usual adopters of open innovation practices. Moreover, in presence of lower trust, the less experienced SMEs have also shown a tendency to underestimate the work of the other actors and the time required to perform some tasks. Lack of mutual prior knowledge and underestimation of partners' efforts can also lead to opportunistic behavior since organizations do not trust each other anymore. These problems are amplified when the distance between partners is greater. Boschma (2005) has identified five forms of proximity that are considered essential for effective collaboration: cognitive, organizational, social, institutional, and geographical proximity. According to his perspective, innovation and interactive learning may be hampered by too little or too high proximity. More recently, Jaspersen, Rigamonti, Jensen, and Bysted (2018) investigated partner proximity preferences for process innovation in SMEs, while Kapetaniou and Lee (2019) narrowed the focus on the geographical dimension of SMEs, underlining the critical role of the spatial aspect on open innovation in SMEs. The project we have analyzed was developed at the regional level, so the geographical dimension of proximity was low. Even whether the results of Jespersen et al. (2018) show that SMEs prioritize geographic openness over regional clustering when process innovation is at stake, we found that SMEs were positively influenced by regional proximity. The more critical issues, instead, are related to the other dimensions, namely the cognitive, organizational, social, institutional, since low and medium-low tech SMEs were very different from technology providers, universities, and research centers, but also large firms. In this regard, they complained that large firms had different temporal structures, different organizational logics, and low willingness to collaborate with small firms. As a consequence, these SMEs tend to cover peripheral positions in the network and to benefit less from innovative collaboration.

3.4.5 Organizational barriers

Previous literature has already highlighted that SMEs need human resources with technical capabilities (Rolfo & Calabrese, 2003; van de Vrande et al., 2009) and managerial skills to effectively create value through the implementation of new technologies (Hossain & Kauranen, 2016; Radziwon et al., 2017). Most of the interviewees confirmed this scenario, revealing how they lacked human resources and competencies to take part effectively and timely in the project. In some cases, the top manager was personally involved in the project despite not having the time necessary to follow it, or the resources involved were not the same ones in charge of handling the business operations, rising the gap between research and business operation. The founder and CEO of an SME recognized that:

"We are a small company, you know, as a founder of the company I took care of following the project directly but as you can imagine is not easy to find the time".

So, the problem is that low- and medium-low tech SMEs experience not only a lack of competencies but this limitation is moderated by the lack of other organizational resources such as time and specific routines and capabilities that are of support of open innovation activities. This raises a paradox between the need on the one side to engage in open innovation activities and the lack of resources to manage such partnerships (Radziwon & Bogers, 2019). This is also reflected in difficulties to combine innovative activities with daily tasks since firms do not know which resources they can leverage to obtain satisfactory results in project-related activities.

3.4.6 Strategy barriers

Previous studies have recognized that SMEs have a propensity for open innovation and that the intensity of open innovation activities can be even higher for SMEs than for large companies in some contexts (Spithoven et al., 2013; van de Vrande et al., 2009). The results of these studies are valuable and based on large datasets, however, they prioritize high-tech companies and vertical collaborations oriented to the commercialization phase of R&D. This calls for further analyses on low- and medium-tech SMEs engaging in pre-competitive R&D projects. Compared to previous studies, which reported successful cases in which the strategies of SMEs were closely connected to their open innovation activities and the collaboration between large companies and SMEs resulted in positive outcomes (Vanhaverbeke, 2017), our research has found that the most traditional SMEs still lag behind. Our findings, aligned with Radziwon et al. (2017), show that the availability of money could be a decisive factor for joining a collaborative project, but it does not necessarily play a significant role in motivating SMEs to be more active in the project. On the contrary, this can stimulate opportunistic behavior and free-riding among partners. Collaborative practices, especially in R&D pre-competitive projects, take a long to result in fruitful outcomes, and most of the SMEs show short-term outlook which may affect negatively their engagement, with the consequence that they only focus on receive the public funds, reducing their efforts and seeing the projects as an end (obtaining funds) instead of a mean (to innovate). This is the reason why, contrarily to previous studies (e.g., Bigliardi & Galati, 2016), we have considered opportunistic behavior as a barrier principally attributable to the set of strategic rather than the collaborative domain.

Another barrier that we have individuated is related to the lack of strategic goals and clear ideas. This is in part due to the nature of the project, since low- and medium-low tech SMEs have never used Industry 4.0 technologies before and they had lacked a thorough understanding of the potential of these technologies for their business model. As a founder and CEO of an SME evidenced:

"I saw this project as an opportunity for my small firm. And I thought...why not trying? Curiosity incentivized our participation, although we were not yet sure on how to take advantage of it".

Table 3.1 The contribution of this study to the existing literature

Barriers	**Factors**	**Main references**
Administrative barriers	Bureaucracy	van de Vrande et al., (2009); Vanhaverbeke, (2017), **this study**
	Administrative burdens	Bigliardi & Galati, (2016); Grama-Vigouroux et al., (2019); van de Vrande et al., (2009); Vanhaverbeke, (2017); **this study**
Financial barriers	Obtaining financial resources	Grama-Vigouroux et al., (2019); Radziwon, Bogers, & Bilberg, (2017); Teirlinck & Spithoven, (2013); van de Vrande et al., (2009); Verbano et al., (2015), **this study**
	Actual costs higher than planned	Bigliardi & Galati, (2016); Christensen, (2005); Enkel et al., 2005; Grama-Vigouroux et al., (2020); Teirlinck & Spithoven, (2013); van de Vrande et al., (2009); Verbano et al., (2015)
	Costly cooperation	Brunswicker & Vanhaverbeke (2015); Lee et al. (2010); Ullrich & Vladova, 2016
Knowledge barriers	Low absorptive capacity	Bocken et al., 2014; Dufour & Son (2015); Grama-Vigouroux et al., (2020); Kalanje, (2009); Lee et al., (2010); van de Vrande et al., (2009); Vanhaverbeke (2017); **this study**
	Intellectual property management	Bigliardi and Galati, 2016; Deschamps et al., (2013); Lee et al. (2010); Ullrich & Vladova (2016); van de Vrande et al. (2009); Verbano et al. (2015)
	Fear of losing of know-how	Bigliardi & Galati (2016); Enkel, Kausch, and Gassmann (2005), Enkel, Gassmann, and Chesbrough (2009), Teirlinck and Spithoven (2013); Ullrich & Vladova (2016)
	Inefficient information systems	**This study**
Collaboration barriers	Cultural differences	Bigliardi & Galati, (2016); Grama-vigoroux et al. (2020); Teirlinck and Spithoven (2013); van de Vrande et al., (2009); Vanhaverbeke, (2017); Verbano et al. (2015);
	Difficulties in finding the right partner	Bigliardi & Galati, (2016); Enkel et al., (2009); Grama-Vigouroux et al., (2020); Guertler & Lindemann, 2016; van de Vrande et al., (2009);

		Vanhaverbeke, (2017); Verbano et al., (2015); Vrgovic et al., 2012
	Aligning with partners and communicating their needs	Grama-Vigouroux et al., (2020); Hossain & Kauranen, 2016; Ullrich & Vladova (2016); Van de Vrande et al., 2009; this study
	Lack of mutual prior knowledge	**This study**
	Underestimating partners' efforts	**This study**
	Lack of coordination with large firms	**This study**
Organizational barriers	Lack of competencies	Bigliardi & Galati, (2016); Enkel et al., (2009); McAdam et al. (2014); Teirlinck & Spithoven, (2013); van de Vrande et al., (2009); Verbano et al., (2015); **this study**
	Cultural resistance inside the firm	Bigliardi and Galati (2016); (2007); Dufour & Son (2015); Van de Vrande et al. (2009); Vanhaverbeke (2017); Verbano et al., 2015; **this study**
	Difficulties in organizing for innovation	Bigliardi and Galati (2016); Van de Vrande et al. (2009); Vanhaverbeke (2017)
	Lack of organizational resources	Bertello et al. (2021); Dufour & Son (2015); Hossain and Kauranen, 2016; Radziwon & Bogers, 2019 van de Vrande et al., 2009; **this study**
	Difficulties in balancing innovation and daily tasks	Abouzeedan et al., (2010); Brunswicker & Vanhaverbeke, (2015); Hossain and Kauranen, 2016; van de Vrande et al. (2009); **this study**
Strategic barriers	Insufficient market orientation	Bigliardi and Galati, 2016; Kim & Park, 2010; Rahman & Ramos, 2013; van de Vrande et al. (2009), Verbano, Crema, and Venturini (2015)
	Conflicting goals	Hossain et al. (2010); Hossain and Kauranen, 2016; van de Vrande et al. (2009); Verbano et al., (2015)
	Difficulties in evaluating the technologies	Bigliardi and Galati (2016); Grama-Vigoroux et al. (2020); Verbano et al. (2015)
	Difficulties in balancing innovation and daily tasks	Abouzeedan et al., (2010); Brunswicker & Vanhaverbeke, (2015); Hossain and Kauranen, 2016; van de Vrande et al. (2009)
	Opportunism	Bigliardi & Galati, (2016); Enkel, Gassmann, & Chesbrough, (2009); Grama-vigoroux et al. (2020); McAdam et al. (2014); Vanhaverbeke, (2017); Verbano et al. (2015); **this study**
	Lack of clear goals	**This study**

Source: Author's own elaboration

3.5 Managerial insights

In this section, I will outline a list of possible project-level organizing principles to counteract the barriers encountered by low- and medium-low tech SMEs. The list does not only include the mechanisms implemented in the project but also suggestions that the interviewees have provided based on their participation in other university-industry-government collaborative projects.

The first barriers that I have discussed in the previous section are administration and financial barriers, and, more specifically, administrative burdens and delays in funding. As regards the administrative aspect of the projects, considering that SMEs often have basic accounting systems and that relying on external consultants could represent an excessively expensive and detrimental cost for SMEs, the projects should consider creating a special body that can support SMEs with coaching activities for project reporting. At the financial level, instead, SMEs have required policies to avoid companies being forced to face too high disbursements of money. As a CEO from an SME argued:

"*We should be assisted financially since the delayed reception of funds could be problematic [...]. Governments should allow us to rely on advanced funding and credit facilities from banks".*

Another set of barriers regards the organizational and cultural aspects of firms. Organizational structure, human resource management, and cultural issues are among the most challenging factors to SME engagement in inter-organizational collaboration for innovation (Bigliardi & Galati, 2016; Dufour & Son, 2015; Radziwon, & Bogers, 2019, van de Vrande et al., 2009). In this regard, projects must be structured so that SMEs are incentivized to hire young and competent talent who ensure continuity even once the project is finished. Some interviewees reported the example of projects that have allocated part of the funds for training and internships in the domain of Industry 4.0, giving young people the opportunity to acquire technological competencies through specific courses while taking actively part in the projects alongside specific firms, combining theory and practice. As a Professor said:

"It is through the comparison between people of different ages and roles that firms can create value, innovate, and address the challenges of digitalization. The effective integration of managers' experience with the young people's technology skills can stimulate innovation in SMEs".

Further improvements could be made to increase capabilities and internal commitment in SMEs. Policymakers should provide additional funds not only for the formation of new talented resources during the course of the project but also for their integration at the end of the project. Too often, these talents are not retained in the companies. Further incentives should also be provided to encourage the engagement of current employees. In fact, usually SMEs select few people to dedicate to the project,

while the rest of the firm remains disconnected from that. Inter-organizational projects, instead, should be a stimulus for the whole organization. Only in this way, it becomes possible to absorb knowledge from these projects and to put in place effective innovative processes.

Opportunistic behavior and free riding have emerged as possible negative outcomes when multi-stakeholder collaboration is at stake and when public funding is provided (Enkel et al., 2009; Verbano et al., 2015). The short-term perspective of some firms, more oriented towards obtaining funds rather than innovating, negatively influenced the outcome of the projects. To reduce opportunistic behavior, who is in charge to lead the project must be ready to review the budget that is allocated to the partners according to the results they achieve. This requires great project management skills and also collaboration from the other partners, as well as greater flexibility and low bureaucracy, which is not so easy when a governmental institution is directly involved as a funding body.

Our study also suggests that many SMEs still struggle to combine innovative activities with their daily tasks and do not have a clear understanding of the objectives of their collaboration, nor the resources they must put in place to obtain satisfactory results and actively contribute to the development of the network. Considering the inclusive logic of the projects under analysis (involving low- and medium-low tech SMEs in collaborative innovation), it would be necessary to provide tutoring for SMEs at project-level. However, the organizations leading the project cannot afford this task in the long-term since they cannot provide them with continuous training. Thus, SMEs, especially when they are at their first experiences in the field of open innovation, should be tutored from a third part which has no conflicts of interest. As the project manager stated:

"SMEs need to be tutored and coached from the beginning of the project. They do not know at all the potential of these projects and they limit themselves to only perform the basic tasks".

Collaboration among different stakeholders often leads to frictions and misunderstandings. It is important to pay particular attention to the selection phase of the project, which is not yet deeply investigated by the literature. In this regard, projects should pay particular attention to the numerosity and the heterogeneity of the consortium as well as they should establish clear and rigorous criteria during the creation of the consortium. The project leader should know almost all the firms that join the project to avoid including an excessive number of unknown companies. This mutual knowledge, however, should be reflected in a project plan that considers all the parties' needs from the beginning. To incentivize mutual understanding among different partners, it is also essential to increase trust. In this regard, visits to firms and informal sessions during the steering committee meetings could leverage informal mechanisms of knowledge exchange and social control.

Finally, the participant observation, combined with interviews, revealed as collaboration with start-ups tends to be more beneficial than collaboration with large companies as traditional SMEs tend to identify themselves more with startups, taking inspiration from their dynamism. Hence, governments should organize these projects by using start-ups as driving and bridging forces.

A summary of the major findings is summarized in Table 3.2.

Table 3.2 Project-level organizing to overcome barriers

Barriers	**Project-level response**
Administrative barriers	Coaching activities for project reporting
Financial barriers	Advanced funding and credit facilities
Knowledge barriers	From training to hiring
Collaboration barriers	Incentivizing proactivity and longer-term relationships
	Rigorous partner selection process
	Fostering collaboration between SMEs and start-ups
	Incentivizing mutual understanding
Organizational barriers	Training and internship
Strategic barriers	Re-allocating budgets along the process
	Tutoring SMEs from a third part

Source: Author's own elaboration

3.6 Conclusion

This study has extended empirical understanding of the barriers that SMEs may experience in open innovation. I framed the research in a niche context since I developed an embedded case study to consider barriers to open innovation in a pre-competitive project based on university-industry-government collaboration, analyzing as a sub-unit of analysis low- and medium-low tech SMEs. The reason is twofold. The first is theoretical, since low- and medium-low tech SMEs and pre-competitive R&D projects are two contexts of analysis still quite underdeveloped in the open innovation literature. The second one is practical since practitioners often lament difficulties in practicing open innovation in this specific context. This study was thus not only oriented to identify the barriers but also to propose some organizational responses at the project-level. The reason for this approach is twofold. First, shedding light on the dark sides of open innovation, highlighting the possible barriers that organizations may encounter when they interface with open innovation, is an increasing necessity to move this research stream forward. This is even more relevant due to the increasing amount of public spending that is devoted to stimulating collaborative innovation among SMEs (De Marco et al., 2020). Second, these barriers may somehow indicate that some organizations are not ready to engage in open innovation, and this should be considered carefully. However, we must also be aware that project-

level organizing may smooth these barriers. Nevertheless, the open innovation literature has only recently zoomed on the project-level dimension of open innovation (Bogers et al., 2017). Future studies could further contribute to improve our knowledge within this domain. Moreover, due to the nature of pre-competitive R&D projects, some barriers that can be relevant in open innovation such as intellectual property management issues have not emerged from this study. These issues can be relevant in other contexts and they deserve further attention.

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4. The human side of open innovation

4.1 Introduction

Seven years after Chesbrough's first conceptualization of open innovation (Chesbrough, 2003), Gassmann, Enkel, and Chesbrough (2010) assessed the future of open innovation and recognized that most research was still neglecting the human side. A few years later, another influential review of the literature explicitly stated that "we still know little about how individuals who take up the open innovation role draw upon their networks to support them in this role" (West et al., 2014, p. 809). Over the last years, the increasing awareness that much more research is required at the intersection between open innovation and its human side has stimulated several scholars to explore and identify connections between individual personality traits and firm openness. With this purpose, we have witnessed the emergence of competency frameworks (Du Chatenier et al., 2010; Hafkesbrink & Schroll, 2014; Podmetina et al., 2018) and studies investigating how managers' and/or employees' characteristics are linked to firm openness as well as how individuals characteristics aggregate at the organizational level (Ahn et al., 2017; Bogers et al., 2018; Santoro et al., 2020). The literature addressing the human side of openness has just grown recently, and it is expected to continue its growth over the next years. This chapter will provide an overview of the main contributions to this topic.

4.2 Exploring the human side of open innovation: an overview

Despite its recentness, the literature exploring the human side of open innovation has focused on different aspects and has drawn on different theoretical approaches and bodies of knowledge. As for the unit of analysis, some studies have focused on the relationship between openness and managers' characteristics (Ahn et al., 2017; Albats et al., 2020), others have zoomed on employees (Bogers et al., 2018), while still others have combined the two perspectives for a more comprehensive framework (Santoro et al., 2020). For what regards the theoretical approach, most of the studies draw on the notion of microfoundations, combining it with different theories and bodies of knowledge such as human capital, learning, and creativity literature (Albats et al., 2020; Bogers et al., 2018). Other studies do not mention a specific theory (du Chatenier et al., 2010; Santoro et al., 2020), while others have drawn on specific approaches such as the upper echelon theory (Ahn et al., 2017), the combinatorial search (Salter et al., 2015), and attention-based theories (Dahlander et al., 2016). Despite the explorative stage of this field of studies, articles are both qualitative (e.g., Albats et al., 2020; Santoro et al., 2020) and quantitative (e.g., Bogers et al., 2018; Podmetina et al., 2018; Salter et al., 2015).

Chronologically speaking, one of the earliest attempts to investigate the human side of openness is attributable to du Chatenier et al. (2010), who studied the individual competencies that professionals

need to work in open innovation teams. The activities of open innovation professionals are subject to several challenges such as low reciprocal commitment, high diversity and cognitive distances, low social cohesion and unsafe learning climate, and high uncertainty. The authors have clustered these challenges into four tasks: self-management, interpersonal management, project management, and content management. Based on a qualitative study consisting of explorative interviews and focus group discussions, the authors developed a competence model for professionals that extend existing literature and provide suggestions on how to cope with the tasks and challenges of working in open innovation teams. Following the results, the competencies that seem to be the most important for open innovation professionals concern brokering solutions and social competence. Table 4.1 provides the full list of competencies and underlying competencies for dealing with the tasks and challenges.

Table 4.1 Competences and underlying competencies for dealing with the tasks and challenges (c) mentioned in the literature, the interviews (I), and focus groups (F) in frequencies

Competences is able to . . .	**Competencies the open innovation professional therefore . . .**	**References**	**I**	**F**
Cluster 1: Self-Management (basis for other tasks)				
Be committed	Appreciates the learning domain, has the motivation to learn, *has a sense of urgency, and wants to learn from others.*	Bolhuis and Simons, 2001	7	2
Govern oneself (c8)	Has self-confidence, *knows what his/her qualities are, does not take the position of the underdog*.	Bolhuis and Simons, 2001, Schweizer, 2006	1	2
	Is aware of, and regulates, own thinking *and feeling*	Bolhuis and Simons, 2001, Friedman and Antal, 2005 Schweizer, 2006	1	1
	Has perseverance, *keeps on thinking positively, having end-goal in mind*.	Williams, 2002	7	1
	Manages tensions created by multiple accountabilities, *tasks and roles*		1	0
Cluster2: Interpersonal management (main task inter-organizational collaboration)				
Build trust (c2)	Is honest: possesses high levels of integrity, authenticity, sincerity, and genuineness. Can be counted on to represent situations fairly.	Tschannen-Moran and Hoy, 2000, Williams, 2002	2	2
	Is open: shares information freely with others. *Even when he is not sure. With a feeling for boundaries, knowing value of knowledge*.	Tschannen-Moran and Hoy, 2000, Williams, 2002	6	2
	Is competent: able to perform the tasks required by ones position. *Is professional, takes a role in the group, works independently, clear about own role*.	Tschannen-Moran and Hoy, 2000	3	2

	Is benevolent has the best interests at heart for others, protects their interests, *shares successes, allows people to make mistakes. Trusts the other party*.	Tschannen-Moran and Hoy, 2000, Williams, 2002	3	2
	Is reliable: ensures that the others can depend upon him/her to come through for them, acts consistently, follows through.	Tschannen-Moran and Hoy, 2000	5	1
Have social astuteness (c4)	Understands social situations as well as interpersonal interactions. Is sensitive to the roles and responsibilities of all partners, aware of their collaborative motivations and expresses understanding and empathy. *Knows how to play the political game.*	Ferris et al., 2005, Williams, 2002	9	2
Have inter-personal influence (c6,13)	Appropriately adapts, calibrates ones behaviour to each situation in order to elicit particular responses from others. Uses influencing skills (as opposed to instructing): *position, coalition, stimulates, and knows who, when to inform.*	Ferris et al., 2005, Williams, 2002	7	2
	Is assertive, extrovert. *Phrases own perceptions and feelings (in a diplomatic way). Is sometimes straight forward.*	Schweizer, 2006	6	2
Be a social person (c11, 12)	Develops, maintains, uses effective networks. Is approachable, develops friendships easily and strong beneficial alliances and coalitions. *Develops a team spirit.*	Williams, 2002, Ferris et al., 2005, Miller, 2001	8	2
Cluster 3: Project management (main task: overall innovation process)				
Be inventive	Seeks novelties, *experiments*. Is sensitive to environment and market oriented. Manages ambiguous situations, takes risks, *is result oriented, pragmatic.*	Bolhuis and Simons, 2001 Williams, 2002	3	2
	Picks up signals, sees chances, *has intuition for innovation*, creates a vision.	Schweizer, 2006	3	2
	Is pro-active. *Comes up with ideas him/herself and takes initiatives*.	Schweizer, 2006	3	1
Control and coordinate (c5,7,9)	Establishes specific, challenging, accepted team goals. Diagnoses, formulates learning objectives in performance outcomes *not too soon*. Coordinates and synchronizes activities, information, and tasks between team members. Designs a plan of strategies. Carries out the plan systematically and sequentially. *Feels responsible for the team and acts as such*.	Miller, 2001, Knowles, 1990	6	1
		Miller, 2001, Knowles, 1990	6	2
	Identifies human, material, and experiential resources for accomplishing various kinds of learning objectives. *Organizes complementarities*. Identifies situations for participative group problem solving, using	Knowles, 1990, Eoyang, 1997	7	2

	the proper degree of participation, and recognizes obstacles and corrective actions. Monitors, evaluates, and provides feedback on overall team and individual performance. Accepts feedback about his/her performance nondefensively. Collects evidence of accomplishments. *Asks many critical questions.*	Miller, 2001, Knowles, 1990, Eoyang, 1997	6	1
Cope with chaos and un-certainties (c10,3)	Has an overall picture of the project and influencing factors. Understands and manages complexity. Supports many things on his/her mind at the same time.	Williams, 2002, Schweizer, 2006, Eoyang, 1997	1	2
	Balances short and long term goals. Finds problem. *Discerns sub from main issues.*	Eoyang, 1997	2	1
	Deals with unexpected situations, is flexible with plans, deadlines, improvises. Is not too systematic, rigid. *Deals with a flexible team composition.*	Schweizer, 2006, Eoyang, 1997	6	2
Cluster 4: Content management (main task: collaborative knowledge creation process)				
Externalize (c1)	Communicates clearly and understandably. Recognizes open and supportive communication methods	Williams, 2002, Miller, 2001	4	2
Interpret (c1)	Has good reflective skills, and techniques of analysis. *Is critical, but constructive.*	Bolhuis and Simons, 2001, Williams, 2002	4	1
	Possesses basic knowledge and perceptions, of various technical/professional areas *and languages.* Is experienced in partnership working.	Bolhuis and Simons, 2001, Williams, 2002, Schweizer, 2006	3	2
	Listens actively: listen with a view to being influenced, not closed. *Is curious.*	Bolhuis and Simons, 2001, Williams, 2002	8	2
Negotiate (c1)	Openness: treats differences as important opportunities. *Respects, values, appreciates people's ideas.*	Friedman and Antal, 2005, Williams, 2002	2	2
	Is competent in techniques of lateral thinking or divergent thinking.	Williams, 2002, Knowles, 1990	3	2
	Combines high advocacy (egocentrism) with high inquiry. *Is aware that he represents an organization, refuses to accept less.*	Friedman and Antal, 2005, Williams, 2002, Schweizer, 2006	6	2
	Explores assumptions by knowing when and how to interrupt automatic functioning and brings theories of action into awareness.	Friedman and Antal, 2005	0	0
	Recognizes types and sources of conflict, encourages desirable, but discourages undesirable conflict.	Miller, 2001, Williams, 2002	5	1
Combine (c1)	Employs integrative (win–win) negotiation strategies rather than distributive (win–lose) strategies.	Miller, 2001, Williams, 2002, Schweizer, 2006	12	2

	Brokers solutions or outcomes. Thinks in ways that differ from established lines of thought. *Agrees to disagree (lose–lose). Considers common goal as most important. Adapts without violating own ideas.*			

Source: du Chatenier et al. (2010)

Openness has often been addressed from the perspective of ambidexterity literature aiming at investigating how organizations both conduct exploration and exploitation, combining change and stability. Hafkesbrink and Schroll (2014) drew on the theoretical underpinnings of exploration, exploitation, and their simultaneous integration in organizational ambidexterity to outline a comprehensive list of organizational and individual open innovation competencies. Although the main limitation of this framework is the lack of empirical validation, it helps understand the needs of industry and higher educational institutions to nurture the appropriate exploration and exploitation competencies for open innovation, laying the foundations for a research agenda.

Partially drawing on the frameworks developed by Du Chatenier et al. (2010) and Hafkesbrink and Schroll (2014), Podmetina et al. (2018) further extended research at the intersection between individual competencies and open innovation. To further integrate understandings of individual-level characteristics with macro-level social outcomes, Podmetina et al. (2018) developed an open innovation competency model to understand which individual competencies are essential for open innovation, and how they can be incorporated into a generic model of organizational competency that is applicable across industries. Table 4.2 shows the competency model developed by the authors.

Table 4.2 Open innovation management competency model

Execution/Roles	Open innovation manager Network and partnership manager Knowledge manager Intellectual capital manager R&D manager/chief technology officer Product marketing manager Technology scouting manager
Areas of expertise/processes	Open technology (in and out) sourcing External technologies acquisition Selling unutilised/unused technologies Intellectual property in- and out-licensing Participation in standardisation Open mass innovation Free revealing of ideas and intellectual property to external parties Crowdsourcing Using external networks Idea and start-up competitions Open collaborative innovation

	Collaborative innovation with external partners Subcontracting R&D Customer and consumer co-creation in R&D projects Scanning for external ideas
Professional competencies	OI management distinct competency Cultural awareness Ability to work with different professional communities Ability to share knowledge and ideas internally/within an organisation Ability to share knowledge and ideas externally Ability to work in an interdisciplinary environment Ability to work in internal cross-functional teams Communication skills Networking skills Adaptability and flexibility Managing inter-organisational collaboration processes
Interpersonal competencies	Innovative team work competency Team-working skills Multi-tasking skills Problem-solving skills Inter- and intra-organisational collaboration competency Internal collaboration skills External collaboration skills Innovation process competency IP management skills Negotiation skills Technology and business mindset Project management
Intrapersonal competencies	Creative work competency Creativity New media literacy Risk awareness Failure toilerance Failure toilerance Entrepreneurial leadership competency Entrepreneurial skills Leadership skills Trust skills

Source: Podmetina et al. (2018)

As aforementioned, scholars have investigated the characteristics of both managers and employees. The former perspective has been investigated, for instance, by Ahn and colleagues (2017). The authors drew on the upper echelon theory, which underpins the understanding of the linkages between the most powerful actor and his/her firm's strategic decisions, to explore the relationship between chief executive officers' traits and open innovation. To do so, they framed their study in the context of small- and medium-sized enterprises, where, due to smaller organizational dimensions, chief

executive officers are more frequently involved in the everyday business, and important decisions, such as open innovation adoption, are more influenced by their traits. The authors collected data through a survey using the database of the Korean Small and Medium Business Administration. Results show that positive attitude, entrepreneurial orientation, patience, and education are important characteristics when chief executive officers adopt open innovation. Moreover, the authors further explored the relationship between chief executive officers and open innovation is further explored by the authors by emphasizing how personal traits are differently configured according to the nature of open innovation modes. In this regard, they found that a positive attitude is significant in almost all the open innovation modes, while entrepreneurial orientation is associated with all market and organization-oriented and outbound open innovation. As for patience, this was positively associated with inbound open innovation in R&D collaboration and negatively associated with outbound modes of open innovation. Finally, education in a technology discipline was positively associated with technology-oriented open innovation (R&D collaboration). The authors conclude their study by suggesting that open innovation must be understood as a wide innovation spectrum. To adopt open innovation successfully, chief executive officers are thus called to compensate for characteristics they may lack by recruiting top managers with appropriate complementary characteristics.

Bogers et al. (2018), instead, have studied employee characteristics as predictors of firms' use of external knowledge. The authors combined and analyzed data from different sources, namely a large-scale double respondent survey of Danish firms and the official Danish statistic agency, Statistics Denmark. The statistical analysis supports the hypothesis that employees' educational diversity positively influences firm-level openness. However, no direct association between employees' work history diversity and firm-level openness was found rather. Moreover, as also hypothesized, the authors found a conditional relationship based on educational background according to which diverse work history only has a positive impact at higher levels of educational diversity.

Salter et al. (2015) explored how individuals' openness to external knowledge sources affects their ideation performance. Considering organizations' increasing orientation to encourage scientists and engineers to source knowledge externally, the authors studied how the openness of individuals to external sources of knowledge affects their ability to propose novel and useful innovative ideas, and which factors might moderate this process. To do so, they collected data from 329 R&D scientists and engineers working in a large organization demonstrating that individuals' openness to external sources of knowledge is curvilinearly related to their ideation performance. This means that the benefits of individual-level openness, such as increased alertness and knowledge variety, initially have a positive effect on the individual's ability to develop new, useful innovative ideas for their

organization. However, after a certain threshold, these benefits may be outweighed by a nonlinear increase in integration and approval costs. The authors also examine how the R&D time horizon, ties to senior managers, and the breadth of individual knowledge moderate the costs and benefits of openness to individuals. In this regard, they showed that individuals who work on short-term, near-to-market products, processes, and technologies gain less from openness than those who focus on long-term efforts and experience more rapidly occurring negative effects of openness. Moreover, results do not support the prediction that ties to senior managers alleviate integration and approval costs, while knowledge breadth is associated with more benefits and lower costs of openness.

Individual openness is also at the core of Dahlander and colleagues' study (2016). Assuming that the discovery of novel ideas is not exclusively a firm-level process but is the cumulative result of an innovative search conducted by individuals, they investigated search behaviors of elite boundary spanners at IBM to shed light on how individuals' search breadth affects innovation outcomes and how individuals' allocation of attention affect the efficacy of search breadth. To do so, they statistically elaborated survey data matched with complete patent records. Their results surprisingly reveal that individuals who allocated attention to people inside the firm were more innovative. These results identified limits to the "variance hypothesis", according to which greater exposure to diverse information sources provides a variety of ideas and knowledge needed for innovative outcomes. The authors found that individuals with high external search breadth were more innovative only when they allocated more attention to those sources, pointing out the relevance of understanding how boundary spanners' allocation of attention, a finite resource, affects the benefits that can be extracted from external search.

Research addressing the human side of open innovation has also benefitted from qualitative approaches. Albats et al. (2020), for instance, explored the specific context of university-industry collaboration, analyzing the case studies of ten firms to study how human capital fosters corporate collaborative innovation with universities. The authors propose a two-dimensional framework that intersects the companies' human capital characteristics (i.e, skills and abilities, knowledge, education, experience, and personal characteristics) and the managerial roles (i.e., attitudinal, relational, and cognitive) required for university partnerships. When human capital characteristics intersect the attitudinal role, for instance, relevant characteristics are the ability to sense the needs of stakeholders and the willingness to engage with people and knowledge. With regards to the relational dimension, ability in negotiation, building trust, and connecting two entities by balancing the very diverse expectations on business and academic sides are important; this also means being a patient mediator, able to manage relations across disciplines, organizational functions, and contexts. Finally, favorable

prerequisites for the cognitive dimension of organizational roles are education in multi-stakeholder project management, intellectual property management, and business law, but also the ability to combine scientific/technical knowledge with knowledge of the industry, the university structure, and the market as well as experience of working in both the R&D and business environments. The findings here reported are not fully comprehensive of the list that Albats and colleagues have reported. They only report some examples from the complex framework developed by the authors to assist managers and recruiters in better understanding the role of human capital in their university-industry collaboration.

Another relevant work investigating how personal characteristics influence firm openness characteristics have been conducted by Santoro et al. (2020). The authors developed a qualitative multi-level analysis to individuate the factors explaining firm openness at entrepreneur-, employee-, and firm-levels. Their results identified, as explaining factors at the entrepreneur-level, the propensity toward delegating and level of trust on external partners and internal employees, the number and strength of individual ties with partners, and the propensity toward taking risks. At the employee-level, instead, the main essential elements are the overall employees' work satisfaction, the number and strength of individual ties with partners, the financial rewards given to employees in case of good performances, the ability to perform activities related to open innovation, and the willingness to engage in risky open innovation. The authors integrated the study with a firm-level analysis that has brought to light further factors such as number of years since founding, number of employees and turnover, expenses in internal R&D, and number of innovation projects developed (see Table 4.3 for a detailed picture of results).

Table 4.3 Factors explaining firm level openness

Themes	**Explanation**	**Category**
Delegation	The propensity toward delegating	Entrepreneur level
Trust	Level of trust on external partners and internal employees	
Entrepreneur's individual ties	Number and strength of individual ties with partners	
Risk taking approach	The propensity toward taking risk	

Work satisfaction Employees' individual ties Financial rewards Technical and Relational Skills Willing to take responsibility	Overall employees' work satisfaction Number and strength of individual ties with partners Financial rewards given to employees in case of good performances Ability to perform activities related to open innovation Willingness to engage in risky open innovation activities	Employees level
Firm age Firm size Internal R&D Innovativeness	Number of years since founding Number of employees and turnover Expenses in internal R&D Number of innovation projects developed	Firm level

Source: Santoro et al. (2020)

4.3 Concluding remarks and research agenda

Although research on the human side of open innovation is only at the dawn, the works that we have overviewed provide a variety of insights that improve the theoretical understanding of this topic and provide managerial insights for practitioners. We have seen as several studies have focused on the development of competency frameworks. Du Chatenier et al. (2010), for instance, have developed a framework for professionals who work in open innovation teams while Hafkesbrink and Schroll (2014) have drawn on the theoretical underpinnings of organizational ambidexterity to elaborate a comprehensive catalog of organizational and individual open innovation competencies. These studies are however not free from limitations. The former, for instance, fails to distinguish analytically between open innovation skills and abilities as well as it lacks clarity by conflating the concepts of competence and competency, while the latter is not empirically validated. More recently, Podmetina et al. (2018) tried to overcome these limitations by developing a competence framework combining deductive identification of competency clusters through a literature review and inductive model development based on a large-scale structured industrial survey. Other studies have investigated how individuals' characteristics influence openness as in the case of Ahn et al. (2017), who studied the relationship between chief executive officers' traits and open innovation, and Santoro et al. (2020), who explored how entrepreneur- and employee-level characteristics influence SME openness. Bogers et al. (2018) verified whether knowledge diversity of employees is positively associated with firms' use of external knowledge in their pursuit of innovation. Other authors, such as Dahlander et al.

(2016) partially contrasted previous research, highlighting the limitations of the "variance hypothesis", according to which greater exposure to diverse information sources provides a variety of ideas and knowledge needed for innovative outcomes. Their results show in fact that individuals with high external search breadth are more innovative only when they allocate more attention to those sources, revealing how boundary spanners' allocation of attention, a finite resource, affects the benefits that can be extracted from external search. Salter et al. (2015), instead, suggested that individual-level openness, such as increased alertness and knowledge variety, is curvilinearly related to their ability to propose novel and useful innovative ideas, suggesting that, after a certain threshold, integration and approval costs may overweigh benefits. Finally, Albats et al. (2020) have shed light on the human side of university-industry collaboration by intersecting human capital components and managerial roles to provide a complex framework for assisting managers and recruiters in better understanding the role of human capital in their collaborations with universities.

The human side of open innovation is an emerging stream of studies that provides a breeding ground for further theorizing. Based on this, I have individuated issues, methods, and theories that could help research on this topic moving forward. First of all, most of the studies that I have presented in the overview reflect on the outside-in perspective of open innovation, also called inbound open innovation, exploring the link between individual characteristics and the ability to seek for and absorb external knowledge. Further studies could integrate this perspective by exploring the outbound perspective and coupled mode of open innovation. Moreover, although research on the human side of open innovation is strictly related to the subject of human resource management, current studies have overlooked how researching the human side of open innovation provides implications for training and recruiting processes. Moreover, we have also seen how existing research relies on traditional qualitative and quantitative approaches. In this regard, future research is called to analyze the phenomenon from different angles, moving beyond traditional qualitative and quantitative studies and adopting mixed methods and configurational approaches. Finally, there is a need to explore the human side of open innovation from approaches rooted in organization studies such as the neo-institutional theory and the paradox theory. In line with these reflections, I conclude this chapter by summarizing in Table 4.4 some avenues for future research that may contribute to this debate.

Table 4.4 Research agenda for further exploring the human side of open innovation

Theme	**Exemplary research questions**
Open innovation modes *Outbound open innovation* *Coupled open innovation*	How do individual characteristics influence outbound open innovation?

	What are the skills and individual traits required to conduct simultaneosuly inbound and outbound open innovation (i.e., the so-called coupled mode)?
Human resource management *Training* *Recruiting*	What pedagogical tools can be used to help managers and employees develop open innovation skills and competencies? How to measure open innovation skills and competencies in professionals for evaluating human resources in phase of recruiting?
Methods *Configurational approaches* *Mixed methods*	How personal traits are differently configured according to the nature of open innovation practices (e.g., venturing, employee involvement, customer involvement, outward IP licensing, knolwedge exploitation, knowledge provision)? Which configurations of individual characteristics are more needed for specific types of collaboration (e.g., market-based vs scientific-based, formal vs informal). How can qualitative methods shed light on quantitative insights that contraddict previous theory? How can quantitative inquiries integrate exploratory qualitative analysis to provide a more comprehensive understanding of the human side of open innovation?
Theoretical approaches *Exploring and integrating theories* *Investigating the human side of open innovation through different theoretical approaches*	Which theories can be combined with a microfoundational approach to explore how individual features aggregate to explain organizational-level outcomes? Institutional work: What are the individual features of institutional entrepreneurs who are contributing to transform R&D models from closed to open? Paradox theory: How can paradoxical mindset help professionals deal with tensions emerging in open innovation activities (e.g., knowledge sharing vs knowledge protection, change vs stability, exploration vs exploitation)?

Source: Author's own elaboration

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5. Microfoundations of open innovation: individual determinants of relational capabilities for coupled open innovation.

5.1 Introduction

I have concluded the previous chapter by providing avenues for future studies to address unsolved theoretical and managerial issues. This chapter has the purpose to fill one of the gaps that I have identified by exploring the skills required to conduct simultaneously inbound and outbound open innovation (i.e., the so-called coupled mode). Before introducing the empirical study, I will first develop a theoretical reflection on the notion of microfoundations to organization studies. This approach, useful for understanding how individuals and their interactions influence organization-level outcomes (Felin et al., 2015), will be then used to provide empirical insights on how individual skills influence organizational capabilities for performing the coupled mode of open innovation.

5.2 Microfoundations and open innovation

Greater attention to micro-level elements in organization studies is required to capture the complexity of organizational performance (Felin et al., 2015). Not surprisingly, macro-management theories in their origins have investigated micro-level phenomena. For example, Barnard (1938, p. 139) argued in strikingly strong terms that "the individual is always the basic strategic factor of organization". Similarly, Simon's early work on administrative behavior was explicitly linked with individual-level foundations (Simon, 1955), concerned for example with questions addressing individual decision-making, motivation, and organizational performance (for a review, see Felin & Foss, 2009). However, this emphasis was gradually lost over time and, as Gavetti and colleagues have noted in their review of behavioral theories in macro-management, "organizational research has been considerably less focused on linking individuals' interests and cognitions to organizations' actions and decisions" (2007, p. 524). The subsequent trajectory of organization studies as well as strategic management was heavily focused on macro factors, at the expense of the micro (Felin & Hesterly, 2007), with a focus on organizational environments in the form of theories such as institutional theory (DiMaggio & Powell, 1991; Meyer & Rowan, 1977) and resource dependence theory (Pfeffer & Salancik, 1978). By emphasizing a focus on homogeneity rather than heterogeneity, these theories have often overlooked the role of individuals. Organization studies can help understand open innovation from different levels, however, the microfoundations of open innovation and related capabilities are called to assume relevance in the years to come.

Since its original conceptualization, open innovation has been studied from different facets and particular attention has been paid to its antecedents. However, most of these studies reside at the organizational-level (Burcharth, Knudsen, & Søndergaard, 2014; Herzog & Leker, 2010; Kratzer, Meissner, & Roud, 2017; Laursen & Salter, 2006, Leiponen & Helfat, 2010), while a multi-level

perspective would be indeed crucial for a) extending the open innovation body of knowledge by breaking concepts into multiple component elements, b) tracing links among them at different levels of analysis, and therefore grasping the nature of this complex phenomenon (Bogers et al., 2017). In this regard, the notion of microfoundations represent a useful theoretical basis to understand how the organizational context to which individuals are exposed and their actions and interactions influence organizational capabilities (Abell et al., 2008; Barney & Felin, 2013; Felin et al., 2015; Foss, 2011; Felin, Foss, Heimeriks, & Madsen, 2012). Therefore, exploring the microfoundations reveals its usefulness in assessing the under-investigated topic of the human side of open innovation (Albats et al., 2020; Bogers et al., 2018 *b*; Gassmann et al., 2010). Moreover, it helps in connecting the individual level to the organizational formation of open innovation-related capabilities that are often used as theoretical concepts to explain heterogeneity in firms' open innovation-related outcomes (Bogers et al., 2018 *a*; Enkel et al., 2020).

Also, most of the open innovation studies leveraging the capabilities perspective have explained the effectiveness of open innovation bringing up the concept of dynamic capabilities (Lichtenthaler & Lichtenthaler, 2009; Bogers et al., 2019; Enkel et al., 2020). However, dynamic capabilities include a wide set of different capabilities that are expected to influence differently the three types of open innovation, namely inbound, outbound, and coupled. To understand inbound open innovation, for instance, the literature has principally analyzed absorptive capacity (Spithoven et al., 2010), intended as "the ability of a firm to recognise the value of new, external information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990, p. 128). On this basis, several studies have drawn on the concept of microfundations to explore absorptive capacity (e.g., Distel, 2019; Lewin et al., 2011). Although these studies do not frame explicitly their study in the open innovation literature, implications are strongly linked to this stream of research and to the inbound perspective of open innovation for the reasons aforementioned. The outbound and coupled modes of open innovation are instead less investigated by the literature (Radziwon & Bogers, 2019; West & Bogers, 2014) and there is not yet an established set of dynamic capabilities that have been linked to them. This study takes this challenge by focusing on coupled open innovation, a term introduced by Enkel et al., (2009) to describe a two-way interaction that implies co-creation processes combining inbound and outbound knowledge flows. With this purpose, I investigate the concept of relational capabilities as a key dynamic capability for coupled open innovation, here defined, based on previous studies (e.g., Capaldo, 2007; Ngugi et al., 2010), as the ability of a firm to enter into and to manage relationships across boundaries to obtain access and develop resources that are complementary to the firm's activity and exchange resources required by other organizations. I thus provide empirical evidence on the

microfoundations of relational capabilities in open innovation contexts by studying the case of five Italian firms. In fact, despite the importance attributed to relational capabilities in inter-organizational relationships (Capaldo & Petruzzelli, 2011; Dyer & Singh, 1998; Ungureanu et al., 2020), there is still little evidence on the microfoundations of relational capabilities in open innovation contexts. Hence, this paper seeks to assess the multi-level nature of open innovation and to explore the role of human resources in bringing about relational capabilities for effective coupled innovation, positing the following specific research question: "What are the skills and abilities of professionals involved in inter-organizational collaboration that influence relational capabilities for coupled open innovation?".

5.3 Methodology

To address the research question of this study I have developed a multiple embedded case study on five firms operating in a Northern Italian Region with firms as a unit of analysis and individuals as sub-unit. I only considered those companies that in the last three years had developed both inbound and outbound open innovation (the so-called coupled mode) as the result of participation in inter-organizational projects. Data were collected through interviews with both managers and employees directly involved in open innovation activities. A total of 9 formal interviews has been conducted between 2018 and 2020. 7 interviews were conducted face-to-face and 2 interviews online. The number of interviews was determined following the principle of theoretical saturation until the information gathered was considered sufficient and no further relevant information could have been added by additional interviews (Strauss & Corbin, 1990). Interviews were conducted in Italian, transcribed, and analyzed in the same language to ensure greater rigor. Data analysis was based on both within- and cross-case analyses (Eisenhardt, 1989). Within-case analysis was done to explore the specific events and processes taking place within each case, while cross-case analysis was carried out to identify similarities and differences between the studied cases and to theorize the results. Data from interviews have been triangulated with informal interviews conducted during the field-level investigation.

5.4 Findings

"Collaboration is a matter of social interactions between individuals. I can say, based on my experience, that whenever I have collaborated with individuals who exclusively pursued their perspective, the collaboration has never turned out in the desired results, to the detriment of both".

This excerpt of interview highlights the importance of adopting alternative points of view when engaging in collaboration with other individuals and/or organizations. This ability is expected to play a pivotal role in inter-organizational collaboration, as directed at firm-external actors belonging to the firm's supply chain such as customers and suppliers, or other stakeholders such as universities, government, and citizens (Grant & Berry, 2011; Distel, 2019). Despite the ability to consider how someone else may think about something is strictly related to personal traits, we also found that working daily in environments that stimulate confrontation can increase individuals' propensity to look beyond their point of view. For instance, during an informal interview, I was informed about how one organization was pushing the members who are in charge of following open innovation projects to map their partners for enabling more effective knowledge of them and thus improving strategic collaboration.

"Part of our R&D efforts take place jointly with universities and research centers. Following my organization, I map the partners to know in advance which professor is an expert for instance of sensory analysis or microbiology or whatever. The objective is to understand what to expect from them and what they can expect from us. Early knowledge of the characteristics and expectations of our future partners facilitates both the project proposal and the collaboration along with the project".

However, this ability can only be partially induced by the context of reference. During field observations, I realized how some individuals were more likely to adopt the perspective of others. Usually, this propensity was associated with distinctive traits such as high curiosity and creativity. Moreover, considering the perspectives of others can also stimulate the production of new and useful ideas, combining, building on, and experimenting with different viewpoints (Perry-Smith & Shalley, 2003). But also, seeing problems from others' perspectives can stimulate the tendency to ask new questions, identify nonobvious linkages, and apply interpretations to unusual domains (Distel, 2019), with a positive effect on individuals' divergent thinking abilities (Ford, 1996) fostering individual, and thus organizational propensity towards sensing and discovering new business opportunities.

Drawing on previous studies, I have conceptualized this social competence as perspective-taking, following Galinsky et al., (2008, p. 378) that define perspective taking as "the cognitive capacity to consider the world from other viewpoints".

A second skill relevant for inter-organizational collaborative innovation is the ability to balance potentially conflicting demands. The art of balancing can assume different meanings in practice. As put forward in previous studies, individuals' ability to handle contradictory forces such as, for instance, between competition and collaboration is essential in inter-organizational contexts (Bouncken & Fredrich, 2016; Walley, 2007). This dimension is also linked with the dimension of

perspective-taking, previously introduced, since the ability to balance formal and informal opportunities for meeting is essential for increasing group cohesion and facilitating in turn perspective-taking. The chief executive officer of one of the firms under analysis evidenced his strategy to take advantage of steering committee meetings in open innovation projects as a way of both discovering new opportunities and negotiate new collaborations.

"Any partner has its specific characteristics. With some of them it is easier to communicate during the formal work tables, with other ones, maybe the less experienced, you have to change your tune, avoid technicalities and bureaucratic language and immerse in their reality. In these cases, coffee breaks allow you to be informal and to break down barriers".

A relevant problem also emerges when disruptive ideas need to be integrated into the business strategy. This requires the ability to balance competing demands such as change and stability and external and internal ideas. This often happens when a specific team collaborates with external organizations in open innovation projects. In this case, the team can develop potential new products or services across organizational boundaries but it can experience resistance to change (Röth & Spieth, 2019; Santoro et al., 2019; Van de Vrande et al., 2009) when the innovative ideas need to be implemented in the organization (e.g., the top management does not recognize it as strategic or the employees feel uncomfortable). Some firms have solved this problem by directly involving in the project the chief executive officer as supervisor. However, when this is not possible, especially in larger companies, we found to be relevant the relationship between firm executives and the (open) innovation manager, or whoever in charge of leading the project. As evidenced by the innovation manager of one medium-size firm:

"I am daily in contact with the CEO regarding the projects we are carrying out with other organizations. The main goal of course is to follow the organization's targets, but it is also true that projects often take a different turn and sometimes we identify, with my team and our partners, unexpected solutions. In recent years, I have worked to build a relationship of trust with the CEO so that there is a continuous and transparent dialogue. So we can understand together to what extent the ideas from the project can be integrated into our strategies".

This ability to balance potentially conflicting demands, for which I have provided some examples, has been conceptualized under the label balancing skills, in line with previous studies (Ritala et al., 2009).

Another individual ability that emerged as relevant in this study is the ability to reach a compromise with partners. This dimension is strictly related to perspective-taking and balancing skills since

looking at others' perspectives and balancing conflicting demands is essential to reach a compromise with other parties. We have conceptualized this ability as a negotiation skill, an element that can become a key resource for maturing relational capabilities. When coupled open innovation is at stake, negotiation is a continuum process in which individuals are engaged in different activities. In the case of participation in an inter-organizational project, for instance, it will be important initially to contribute shaping the project proposal to ensure that every partner of the network is in condition to co-create value. This implies different rounds of review of the project initiation documentation in which negotiation plays a fundamental role. Moreover, negotiation is also important during the execution of the project, and it can also be stimulated by some organizational solutions at the project-level. For instance, a chief executive officer referred to as the collaboration during the steering committee meetings was

"facilitated by the presence of different tables in which companies can confront with the leaders of the various work packages. The presentations are all open. So, everyone can see what the companies are doing and get to know each other [...]. We specifically do not know what all the other partners are doing, but we get a general idea that allows us to develop relationships during the project with organizations with which we have elements in common".

Negotiation skills are also essential to build new relationships but also to re-negotiate goals over time. During field investigations I also had the opportunity to discuss with a professor who was collaborating with one of the SMEs that I had selected as a case of study:

"*Our partner had clear ideas about the project but unfortunately we realized over time how difficult was to achieve the original objectives. However, they were very skilled, in concert with us, to reformulate the plans and promptly communicate to the project manager the new, more realistic, objectives we were setting*".

The propensity to (re)negotiate represents a key ability to secure new opportunities, acquire external knowledge, and transfer internally this knowledge to the organization. Excellent negotiation skills prove to be fundamental not only regarding to inter-organizational relationships but also regarding to intra-organizational relationships. As a manager revealed:

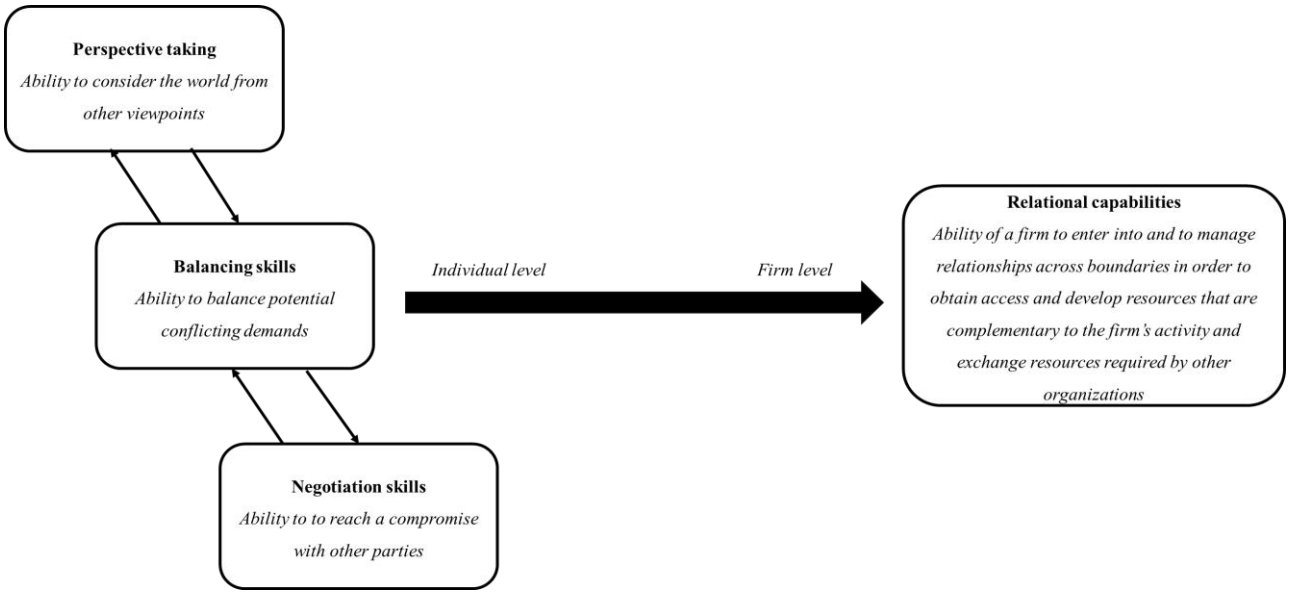
"The negotiations that must then take place within the firm to communicate the benefits of certain innovations to managers and employees that are not directly involved in the project are often more exhausting than those that take place with external organizations".

The adoption of open innovation practices requires negotiation processes with or between managers to implement at the organizational level what is going to be developed at the project-level. Put in other words, negotiation is essential for absorbing knowledge from external sources.

5.5 Summary of results and conclusions

To summarize results, I found three skills to be particularly relevant for firms to nurture relational capabilities when they engage in coupled open innovation. These skills have been conceptualized following existing categories in previous literature and they are perspective-taking, balancing skills, and negotiation skills. These three skills are dynamically interrelated since the ability to look beyond their point of view and considering others' perspectives is an essential step to consider both poles of potential conflicting elements (formal and informal knowledge sharing, internal and external sources of knowledge, stability and change, competition and collaboration, etc.) while balancing skills, in turn, are of the utmost importance for negotiating with partners. Successful negotiating outcomes can then stimulate perspective-taking since actors recognize the importance of looking at others' perspectives (for a visual representation of findings, see Figure 5.1).

Figure 5.1 Microfoundations of relational capabilities in coupled open innovation



Source: Author's own elaboration

The results of this study thus contribute investigating the human side of open innovation by exploring the microfoundations of open innovation. More specifically, I have investigated how specific skills and individual abilities may aggregate at the organizational-level in higher relational capabilities, a dynamic capability essential in coupled open innovation. Focusing on coupled open innovation as a

context of analysis I have shed light on the human side of this open innovation model, extending previous research on microfoundations that had mainly prioritized the inbound mode of open innovation and related concepts such as absorptive capacity (e.g., Salter et al., 2015, Distel, 2019). More generically, this study responds to calls for the microfoundations of organizational capabilities (Felin & Foss, 2005; Felin et al., 2012; Felin et al., 2015; Foss, 2011). Indeed, as numerous studies have already proved the positive effect of organizational capabilities on open innovation performance, there is still a paucity of studies regarding the microfoundations of capability development in the open innovation domain (Bogers et al., 2018*b*).

The findings of this study have also implications for policymakers, especially in government-funded open innovation projects. A good outcome of open innovation projects depends in part on the ability to stimulate organizational capabilities and individual social cognition and behaviors. In this regard, it would be important, as already suggested by Distel (2019), to leverage human-centered innovation methods such as design thinking to nurture perspective-taking, balancing, and negotiation skills.

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6. Organizing open innovation for grand challenges

6.1 Introduction

We live in a world that is increasingly characterized by complex problems with far-reaching societal implications, conceptualized in the literature as "wicked problems" (Dorado & Ventresca, 2013; Head, 2008) and, more recently, "grand challenges" (George et al., 2016; Kunisch et al., 2020). Organizations are thus called to deal with a wide range of issues such as climate change, energy and water supply, digital workforce, labor exploitation, gender inequality, poverty, natural disaster, and pandemics (Grodal & O'Mahony, 2017; Tarba, et al., 2020; Venugopal & Viswanathan, 2019). Grand challenges transcend the interests or influence of individual organizations or local communities and require collective, coordinated, and sustained efforts from multiple different actors (Bertello et al., 2021; George et al., 2016). Organizations are thus called to rethink their practices and to develop participatory and network-based models that enhance collaboration between consumers and producers, technicians and citizens, and public and private organizations (Ferraro et al., 2015; Moggi et al., 2018; Schmidthuber, et al., 2019). While research on new organizational forms for tackling emerging societal challenges is burgeoning, much remains to be understood about the implications of organizing for complex, uncertain, and evaluative challenges. Grand challenges may therefore be both great stimulants of innovation and opportunities for organizational learning (Chesbrough, 2020; Bertello et al., 2021). In this regard, the open innovation community has the huge opportunity to offer possible new solutions to grand challenges on the one side, while taking lessons on how to move forward the concept of open innovation on the other side. Taking COVID-19 as a grand challenge we have noticed as several developments throughout the pandemic have already highlighted the crucial role of innovation, openness, and knowledge flows in dealing with the crisis (e.g., Chesbrough, 2020; Wenzel et al., 2020). Scientists around the world have mobilized to collaborate on possible vaccines. Researchers have shared more openly data for their publications to accelerate the management of the COVID-19 crisis. Firms have been looking for new ways to innovate and collaborate by developing new products and business models to provide essential infrastructure and products, such as masks and ventilators. These examples provide new insights into our understanding of the value of open innovation in the face of grand challenges and call for further research that investigates the underlying processes of organizing open innovation for the common good.

Based on these assumptions, this chapter is conceptual in nature, reflecting on the organizational dynamics characterizing novel forms of organizing in the face of grand challenges. In particular, I have identified four interrelated factors (i.e., moving beyond traditional forms of cross-boundary collaboration, inclusiveness, systems thinking, and paradoxical mindset), laying the groundwork for further exploration of how to organize open innovation to meet societal needs.

6.2 Moving beyond traditional forms of cross-boundary collaboration

Cross-boundary collaboration requires working with individuals and organizations outside one's immediate work area or span of control. Moreover, previous literature, especially R&D research has shown that there is not only one way to innovate across boundaries (Bertello et al., 2021). For instance, cross-boundary collaboration can take place at the intra-organizational level when innovation happens thorugh leveraging cross-functional teams or by occasionally engaging employees with suggestion boxes. At the inter-organizational level, instead, innovation can happen through traditional R&D alliances that involve actors from the supply chain, competitors, or universities and governments (Bogers, 2011; Park et al., 2015; Sandulli et al., 2017). Furthermore, the emergence of the COVID-19 pandemic has shown how open innovation can help speed up innovation processes in the face of urgent crises, through collaboration across boundaries between businesses and consumers. As highlighted by Chesbrough (2020) open innovation has contributed in several ways to address the COVID-19 issue. The US Office of Science and Technology Policy, for instance, has shared all relevant research in machine-readable format, as an example of outside-in open innovation with B2B collaboration. Outside-in open innovation has also been characterized by B2C collaboration, with users sharing designs for masks, hand sanitizer, and how to support 2 patients on one ventilator. One example of inside out B2B open innovation comes from the medical device company Medtronic that opened up its ventilator design and IP, while inside out B2C took place for instance with firms converting from making perfume or alcohol products to hand sanitizer manufacturing.

Moreover, when grand challenges are at stake, cross-boundary collaboration is not only mobilizing organizations to collaborate but also looking for novel forms of organizing. In the open innovation domain, examples of novel models are for instance crowdsourcing programs and hackathons (Vermicelli et al., 2021). Crowdsourcing has been broadly defined as the act of broadcasting tasks to a 'crowd' rather than to a designated 'agent', through an open, flexible call (Afuah & Tucci, 2012; Brunswicker et al., 2017; Tucci et al., 2018), while hackathons can be intended as 'accelerated innovation processes that bring together individuals to voluntarily […] solve specific and ambitious challenges in an extremely limited and ad hoc time frame' (Lifshitz-Assaf et al., 2020, p. 1). These forms of organizing can be particularly valuable since they often make use of unknown resources (Majchrzak & Malhotra, 2020). Grand challenges are in fact complex and unknown problems, that cut across fields of expertise and jurisdiction as put forward by Ferraro et al. (2015). This means that there is not always a best way to proceed, problems are unexpectedly nested and interwoven (George et al., 2016), and it is not possible to understand whoever owns domain-relevant knowledge

(Majchrzak & Malhotra, 2020). In this regard, as highlighted by Bertello et al. (2021) in their study of the EUvsVirus hackathon, a pan-European initiative to fight COVID-19, purpose-driven crowdsourcing can enable solution providers with different and multifaceted knowledge backgrounds to give life to a process of collective problem solving which is difficult to replicate when organizational members from different areas and backgrounds work together, among organizations of the same nature, or among organizations. However, to fully exploit the potential of the crowd, it is also important to pay attention to the challenge that the contest aims to solve. Organizers must consider that grand challenges cannot be easily decomposed into neat narrow modularizable components. Moreover, a too narrow definition of the challenge can reduce the creativity that can stem from the diversity that characterizes participants in crowdsourcing initiatives. On the other side, a too wide definition can reduce the effectiveness of potential solutions. These programs must thus be able to ensure effectiveness while allowing participants to capture the complexity of the problems through cross-boundary collaboration among individuals and organizations.

The COVID-19 emergency has also further highlighted the importance of the principles of open science as put forward by Vicente-Sáez and Martínez-Fuentes (2018). The authors identified three main pillars: accessibility (e.g. open access to publications and research data), transparency (e.g. reproducibility of results, open peer review), and inclusiveness (e.g. citizen science). While the first two pillars of open science focus on existing scientific outputs and processes, the third envisions opening up the knowledge production process itself. This concept can be discussed in the next section as a relevant factor when organizing open innovation for grand challenges.

6.3 Inclusiveness

Grand challenges require pursuing bold ideas and adopting less conventional approaches through collective, coordinated and sustained efforts from numerous and different actors (George et al., 2016). Several streams of research, from responsible management to innovation management, have highlighted the importance of organizing for inclusiveness in the face of grand challenges (Ahn et al., 2019; Nonet et al., 2016). Inclusiveness assumes increasingly relevance in open innovation processes when the objective of the collaboration is not exclusively oriented to increase the competitive advantage of a single organization, but more widely it aims to meet societal needs. So, inclusiveness is particularly relevant in the contexts of open social innovation (Chesbrough & Di Minin, 2014; Santoro, Feraris, & Vrontis, 2018), sustainable open innovation (Bogers, et al., 2020), or, more generally, open innovation for grand challenges (Bertello, et al., 2021; McGahan, et al., 2020).

Inclusiveness can assume a twofold meaning, depending on whether one considers the input or the outcome of open innovation: in the first case, inclusiveness refers to those who will take part in the

open innovation practices, while in the second case, the term refers to who will benefit from the open innovation activity. As for the former, open innovation literature has only recently highlighted the importance of involving citizens in open innovation processes. Some studies, for instance, have focused on citizen participation in public administration. Schmidthuber et al. (2019) have explored the issue of open government for social innovation, by examining citizen involvement in an ideation platform initiated by a local government, and the motivations that affect participation intensity. Forliano et al. (2020), instead, have argued that inclusive dialogue and deliberation based on democratic and constitutional values and a greater centrality of citizens and their needs are at the core of public value co-creation processes, while Randhawa, Wilden, and West (2019) examined the organizational and project-level choices of government agencies that crowdsource from citizens to drive open social innovation, and thus develop new ways to address societal problems, a process sometimes termed 'citizensourcing' (Lukensmeyer & Torres, 2008; Hilgers & Ihl, 2010). Citizen participation assumes also relevance in open science practices, as mentioned in the previous paragraph, and crowdsourcing models such as hackathons. Bertello and colleagues (2021), for instance, have shown, how combining the knowledge of skilled experts with that of atypical resources, such as retired experts, graduate students, and the general public (Ahn et al., 2019; Chesbrough, 2017; Wang et al., 2012), can lead to unexpected innovative solutions for facing complex, uncertain, and evaluative challenges (Ferraro et al., 2015) such as the COVID-19 pandemic. They also highlighted how citizens could benefit from the inclusiveness of purpose-driven crowdsourcing initiatives in several ways. For instance, they can enhance their individual absorptive capacity, as well as an open science and innovation mentality (Ahn et al., 2019; Sauermann et al., 2020). Moreover, they argued that an effective governance model for responsible innovation should balance the contribution of experts and citizens. This would minimize the risk of an excessive focus on technocratic rationality on the one side, thus jeopardizing the common good, or on public concerns on the other side, thus reducing the scientific relevance. Within this context, governments and institutions are called to orchestrate a wide innovation ecosystem that is ready for combining a broad set of knowledge, resources, capabilities, and perspectives, following a more inclusive model of responsible innovation in which citizens have the opportunity to play a relevant role in mobilizing research and development for innovative solutions.

Moreover, inclusiveness should also be considered in respect of open innovation outcomes. Open innovation, for instance, could be adopted not only for a specific firm competitive advantage but also to alleviate poverty, to deal with the disasters that climate change is causing in some communities, to support digital transformation in traditional firms, and so on. Considering the impact of open

innovation beyond a firm-centric perspective requires systems thinking, as I will explain in the next paragraph.

6.4 Systems thinking

Bogers and colleagues (2020) have recently developed a study to investigate the case of Carlsberg, a Danish beer company that developed the Green Fiber Bottle as part of its sustainability program through a collaboration with complementary partners. In this study, Bogers and colleagues have introduced the concept of sustainable open innovation as "a distributed innovation process which is based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model, thereby contributing to development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (2020, p. 1507). This definition integrates the previous one on open innovation (see Chesbrough & Bogers, 2014 *a*) with the definition of sustainable development developed by the World Commission for Environment and Development report for the United Nations (WCED, 1987). Linking open innovation to the "needs of present generations without compromising the ability of future generations to meet their own needs" highlights the interconnected and recursive nature of environmental, economic, and social systems (Bansal et al., 2021) opening the doors for a more systemic perspective on open innovation. Addressing grand challenges, in fact, requires a systems view of organizations and the environments in which they are embedded. Collective and interconnected resources need to be mobilized to tackle complex challenges, giving life to a complex systemic puzzle (Slawinski & Bansal, 2015).

Although most of the literature on open innovation intersects with literature on ecosystems and innovation systems, we have still limited evidence of the use of systems thinking in open innovation studies. In this regard, a methodological approach that could be particularly suitable to extend the perspective of open innovation to social and environmental impacts through a dynamic analysis of open innovation practices is system dynamics modeling. For instance, Forliano and colleagues (2020) used this method to investigate the credit collection process of a municipally-owned company. In this way, they were able to move beyond the traditional logic of linearity for capturing systemic, unintended, and delayed implications of decision-making activities related to the provision of public services, considering citizens as active stakeholders in the process of public value co-creation.

Ass for inclusiveness, systems thinking must be adopted for both what regards the input of open innovation activities (e.g., ideas, people, technologies, etc.) but also for what regards the outcome of open innovation (e.g., next generations, unemployed people, fringe stakeholders, etc.). Open

innovation in the face of grand challenges should thus be able to consider open innovation as a system that regenerates resources on both these sides.

6.5 Paradoxical mindset

According to Ferraro and colleagues' definition (2015), grand challenges have three main analytic facets. First, they are complex, entailing many interactions and associations, and non-linear dynamics. Second, they are uncertain, since their evolution is difficult to forecast for the actors who cannot properly define the possible future states of the world. And third, they are evaluative, cutting across jurisdictional boundaries, implicating multiple criteria of worth, and revealing new concerns even as they are being tackled. Paradox theory can provide interesting insights on how to deal with grand challenges. This because paradox theory embraces complex thinking beyond linear dynamics, it does not aim to solve tensions but to navigate them, and, moreover, it stresses the interrelatedness of contradictions and opposing demands (Pradies et al., 2021; Schad et al., 2016). While, on the one hand, paradox theories can support theoretically and practically the management of and the organizing for grand challenges, they can also benefit from this emerging context of analysis. Given their complexity, grand challenges may generate multiple tensions simultaneously. These tensions can be located at multiple levels and across multiple sources. This would stimulate paradox theory to increase its complexity to deal with increasing complex issues, responding to recent calls for pushing forward paradox research by tracking tensions across multiple levels and sources, investigating how tensions are interrelated and interwoven, and how sparking tension at one level or in one source may spark new tensions at another (Putnam et al., 2016). On the other hand, open innovation is rife with tensions (knowledge sharing and knwoledge protection, change and stability, exploration and exploitation) that will increasingly capture the attention of scholars since research on open innovation is both going in the direction of investigating open innovation across levels, both regarding antecedents, and outcomes (Bogers et al., 2017). At the same time, as we have seen in Chapters 3 and 4, open innovation is increasingly calling for studies exploring the role of individuals. Focusing on the micro-level, individuals undertaking the endeavor of collaborating for tackling grand challenges will thus be increasingly subject to tensions. These tensions may vary from belonging tensions between self and others, performing tensions between different roles to be performed as well as higher-level tensions that will affect individuals' activities. Miron-Spektor et al. (2018) have recently demonstrated that a paradox mindset, understood as the extent to which one is accepting of and energized by tensions, can help individuals leverage them to improve innovation. Their results thus suggest paradoxical mindset as a key to unlocking the potential of tensions. Research on

microfoundations in open innovation studies should therefore dedicate more attention to how individuals deal with competing demands in the face of grand challenges requiring collective efforts from a variety of actors.

6.6 Conclusion

Grand challenges constitute complex, uncertain, and evaluative problems (Ferraro et al., 2015) requiring the coordinated efforts from different actors, knowledge, and technologies (George et al., 2016). Open innovation has gained momentum as an innovation management tool for dealing with such broadscale problems, raising the interest of both practitioners and academics (Bertello, et al., 2021; McGahan et al., 2020). This chapter has reflected on the organizational dynamics characterizing novel forms of organizing in the face of grand challenges. More specifically, I have highlighted how open innovation for grand challenges requires going beyond traditional forms of cross-boundary collaboration, leveraging concepts such as inclusiveness, systems thinking, and paradoxical mindset.

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7. Informing open innovation through organization studies: theoretical insights.

7.1 Introduction

The concept of open innovation has been primarily developed by observing changing innovation management practices in companies (Chesbrough, 2003, 2006), thus following a practice-based approach that explains to some extent why research on open innovation has not been grounded systematically in prior management research. To develop a better theoretical grounding of open innovation, Vanhaverbeke & Cloodt (2014) have highlighted the need to link open innovation to strategy literature and to different theories of the firm, such as resource-based view, relational view, transaction cost economics, resource dependence theory, and real options theory. Moreover, they argued that existing management theories should be combined as none of them can fully explain how companies benefit from open innovation. Seven years after that article open innovation has not yet solid theoretical foundations. Indeed, scholars are increasingly highlighting the need for a more comprehensive understanding of open innovation by calling for approaches that draw on other literature streams, thus advancing theoretical concepts that might improve the success rates of open innovation collaborations (Randhawa et al., 2016; Stanko et al., 2017). In this chapter, I will introduce some theories particularly used in organization studies that might advance knowledge on open innovation-related phenomena.

7.2 Neo-institutional theory

Prior research on open innovation has traditionally adopted a technology-centered view or a rational view of open innovation (Bocquet & Dubouloz, 2020), according to which opening the innovation process to inflows and outflows of knowledge is invariably a rational or an efficient choice based on a deliberative action (Bogers et al., 2017; Damanpour et al., 2018). In line with this perspective, the firm-centric aspects of open innovation have been the core of the reflection of many scholars (for a review, see Randhawa et al., 2016), while only recently this research stream has broadened its perspective to capture the complexity and the relevance of this phenomenon at inter-organizational, extra-organizational, as well as industry and society-level (Bogers et al., 2017). However, we still know little about how external forces (e.g., opinion leaders, governments, competitors) can influence the adoption of open innovation. Radnejad, et al. (2017), for instance, have shown that institutional forces, such as social and environmental pressures, were among the primary drivers for open innovation adoption in the Canadian oil industry. Oguguo et al. (2020), instead, have developed multilevel analyses of data on 601 European firms to analyze how a specific collaboration logic in national institutional contexts influence firms' ability to benefit from R&D collaboration, while Torres de Oliveira et al. (2020) have explored the connection between open innovation and national innovation systems and their institutions comparing data from different market economies. The core

postulate of these studies is that organizational actors always pursue their interests within certain institutional constraints. This perspective can therefore balance the rational view of open innovation and provide an explanatory tool for investigating the process of open innovation institutionalization.

In fact, after gaining momentum in large firms and high-tech start-ups, this model has spread across several industries and sectors, attracting the attention of governments and policymakers. For instance, In Horizon Europe, the 9th EU Framework Program, the European Commission allocated € 13.5 billions on the open innovation pillar (De Marco et al. 2020). Recently, the attention of open innovation scholars has thus shifted to investigate how policies and the institutional context influence open innovation (Oguguo et al., 2020; Torres de Oliveira et al., 2020). The intention of public authorities to increasingly finance open innovation lays in the fact that innovativeness is at the basis not only of the wealth of firms but also of the communities that benefit from such firms' positive externalities (Almus & Czarnitzki, 2003; Messeni Petruzzelli et al., 2009). However, since policies require resources that are subtracted from alternative uses that could benefit the communities, it is important to further investigate how these policies are translated into action and to what extent they actually enable open innovation across organizations. We have seen in Chapter 1 and Chapter 2, for instance, that governments are launching an increasing number of initiatives to stimulate open innovation in SMEs. However, we have also seen how difficult it is sometimes to implement open innovation. The increasing efforts of governments to align their policies with the imperative of open innovation may give life to institutional pressures that can affect organizations' behavior, leading them to join open innovation projects not for seeking efficiency but for legitimacy (Bocquet & Dubouloz, 2020), as would suggest the neo-institutional theory.

One of the master propositions of neo-institutional theory has traditionally been the concept of isomorphism (Meyer & Rowan 1977; DiMaggio & Powell 1983; Scott 2008). According to this concept, organizations tend to progressively cohere on specific sets of shared rules and beliefs to gain legitimacy and survive (Meyer & Rowan 1977). More specifically, DiMaggio and Powell (1983) have individuated three forms of institutional pressures that cause organizations to conform: coercive (often conveyed through laws, regulations, and accreditation processes), mimetic (mimicking behaviors as a result of organizational response to uncertainty), and normative (associated with professional values). If we apply this assumption to innovation management, the increasing attention that governments and policymakers are giving to the promotion of open innovation, and the increasing number of successful cases of open innovation in the managerial world could lead organizations to gradually adopt open innovation as a result of coercive, mimetic, and/or normative pressures. However, despite open innovation is spreading rapidly across a broad spectrum of domains and

sectors, there is still evidence that open innovation does not always work in practice (Bertello et al., 2020).

The exposure to coercive pressures, triggered by the government subsidies, and to mimetic pressures, as the result of the interaction with virtuous examples of organizations that adopt open innovation does not often provide the results that the government is expecting. This means that the government efforts to institutionalize open innovation on a large scale may also result in inter-organizational frictions and opportunist behaviors, and in what the literature has called decoupling. This can be increasingly relevant in specific innovation schemes such as government-funded R&D projects since the presence of monetary incentives can further attract organizations and stimulate opportunistic or fraudulent behaviors (Catozzella & Vivarelli, 2016; Wang et al., 2020).

In the face of the increasing adoption of open innovation across several sectors and organizations, studies may investigate if seeking legitimacy rather than efficiency could lead organizations to abide by institutional pressures only superficially through the adoption of new structures without necessarily implementing the related practices (i.e., symbolic decoupling, Pressey & Ashton, 2009; Pressey & Vanharanta, 2016; Pressey et al., 2014). Alongside this traditional form of decoupling, organizational literature has recently introduced the so-called means-ends decoupling. This form of decoupling takes place when an organization adopts and implements practices and/or policies but fails to achieve the intended goals (Bromley & Powell, 2012). Further research could investigate antecedents, contingencies, and consequences of these two forms of decoupling in the face of the attempts to institutionalize open innovation.

Neo-institutional theory could also inform open innovation research by leveraging other research streams that have been emerged more recently. The line of reasoning of early neo-institutional scholars was criticized for being characterized by a rather deterministic view of institutionalized action (Seyfried et al., 2019). Concepts such as institutional entrepreneurship (Hardy & Maguire, 2008) and institutional work (Lawrence et al. 2013) have thus emerged to bring agency back into institutionalism for explaining institutional change. Exploring institutional work, as "the purposive action of individuals and organizations aimed at creating, maintaining and disrupting institutions" (Lawrence & Suddaby, 2006, p. 217), would help analyze how individuals might react to the institutionalization of open innovation practices by juxtaposing agency to the stasis induced by institutional pressures.

Another lens that could be relevant in open innovation contexts is the institutional logic approach. This theoretical lens has been introduced to enrich the perspective of early neo-institutionalism by proposing a novel view of the society as made up of inter-institutional systems, wherein multiple

institutional orders coexist simultaneously, and each of these institutional orders may influence in different ways individuals and organizations' behaviors (Friedland & Alford 1991). This theoretical shift, therefore, resulted in the development of the concept of institutional logics, defined by Thornton and Ocasio (1999, p. 804) as "the socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence, organise time and space, and provide meaning to their social reality". Consider, for example, university-industry-government collaboration in innovation projects. It is supposed that these three actors bring into the partnership different institutional logics. Academics' belief systems are rooted in norms of science that strongly encourage the open dissemination of knowledge, whereas firms are principally driven by incentives to appropriate knowledge for competitive advantage (Oguguo et al., 2020). Governments, on their side, follow a bureaucratic logic according to which procedural correctness prevails over performance and results (Meyer & Hammerschmid, 2006). This third point may generate an institutional complexity at the project-level that has overlooked academic literature so far. Exploring institutional complexity in open innovation and how to manage it would increase the opportunity to improve the success rates of open innovation collaborations

7.3 Paradox theory

Competing demands and contradictions are at the heart of organizational life. Traditionally, scholars approached such tensions as dilemmas that can be solved through rational and linear models based on trade-offs. Notwithstanding, organizational scholars have recently shifted from traditional either/or approaches towards reframing contradictions and tensions as both/and opportunities (Ashforth & Reingen, 2014, van Hille et al., 2019). The paradox lens invites organizations and individuals facing increasingly contradictory goals, multiple stakeholder expectations, and pluralistic missions to depict such competing demands as interdependent and persistent (Clegg et al., 2002; Lewis, 2000; Schad et al., 2019).

Combining previous definitions, Schad and colleagues concisely delineated paradoxes as "a persistent contradiction between interdependent elements" (2016, p. 6). This definition clearly outlines three key features of paradoxes in management and organization studies (De Keyser et al., 2019). First, paradoxes indicate a contradiction between oppositional elements (Poole & Van de Ven 1989; Smith & Lewis 2011). Second, this contradiction occurs between interdependent elements that can be defined as "ontologically inseparable" (Schad et al. 2016, p. 7). Third, this contradiction between interdependent requires persistence over time rather than resolution (Putnam et al. 2016). These three features differentiate paradox from related terms such as duality, dilemmas, dialectics, and tension (Putnam et al. 2016; Schad et al. 2016).

The accumulating knowledge in the field of organizational paradoxes has advanced research on multiple tensions, such as exploration-exploitation (Andriopoulos & Lewis, 2009; Smith & Tushman, 2005), control-collaboration (Sundaramurthy & Lewis, 2003), and social-financial mission (Hahn et al., 2014; Jay, 2013).

Conflicting demands between control and collaboration are at the core of open innovation since organizations and individuals who collaborate for innovation are called to protect their technological competencies on the one hand while collaborating with other organizations on the other hand. This paradox has also been conceptualized as knowledge sharing-knowledge protection (Bogers, 2011) and control-openness paradox (Lauritzen & Karafyllia, 2018). Although most open innovation studies have applied a dilemmatic either/or approach to these this tension, recent studies (e.g., Dahlander & Gann, 2010; Faraj et al., 2011; Jarvenpaa & Lang, 2011) have begun to recognize that both demands of control and openness are vital for innovation to flourish (Lauritzen & Karafyllia, 2018).

Paradox theory can contribute in several ways to deal with the complexity of open innovation practices, both in terms of identifying new sets of conflicting demands and suggesting how to manage them. Organizations, in fact, are not exclusively called to deal with the control-openness paradox that implies finding a balance between knowledge sharing and protecting. Indeed, new tensions might emerge due to the gradual openness to open innovation as a tool to tackle grand challenges. While engaging in open innovation, organizations could face several tensions arising from divergences in economic, social, and environmental goals, short- vs long-term objectives, and efficiency vs resilience (see, for instance, Bansal et al., 2021 and Van der Byl & Slawinsky, 2015).

The paradox perspective could also be used to integrate other theoretical perspectives. The open innovation literature, for instance, has traditionally used the stakeholder theory to extend the reflection from the firm- to the society-level. However, as put forward by Pinto (2019), while the stakeholder theory provides guidance on the ‘what’ (i.e. simultaneously address multiple, often conflicting interests), paradox theory could integrate this perspective by guiding on the ‘how’ (i.e. how to manage competing objectives simultaneously). This would help, for instance, avoid unintended negative outcomes in the effort of pursuing innovation in collaboration with other actors.

Furthermore, drawing on Smith and Tracey (2016), we could argue that research on institutional complexity (see the previous paragraph) and paradox theory can be integrated to critically contribute to debates on how open innovation can tackle grand challenges. Taken together, in fact, these two theories can investigate both the exogenous and endogenous factors that surface competing demands, and explore organizational and individual approaches for accommodating competing demands simultaneously.

Moreover, a paradox perspective could also stimulate a systemic view of open innovation. In this regard, another theory that could provide theoretical support for further understanding open innovation is the theory of the commons as I will describe in the next section.

7.4 Theory of the commons

Although recent research streams such as the literature on social innovation (Murray et al., 2010) and robust action (Ferraro et al., 2015) have proposed interesting theoretical approaches to explain collaborative innovation for grand challenges, little is known about how to govern and organize a network of actors in a systemic perspective that goes beyond innovators' competitive advantage as the key performance indicator of innovation processes. In other words, there is an increasing need to understand what makes individuals and/or organizations capable to cooperate so that innovation extends its benefits from the innovators to the collectivity (Zollo et al., 2013). In this sense, one theory that might help to explore open innovation behind the traditional theories of the firm is the theory of the commons in its recent developments proposed by organization scholars (see, for instance, Cantino et al., 2017 and Ricciardi et al., 2020)

A systemic view of the theory of the commons is a promising theoretical lens to investigate open innovation in the face of grand challenges in that the systemic perspective itself has started to emerge in sustainability discourse and it is increasingly becoming central to understanding the implications of grand challenges in management studies (e.g. Bansal et al., 2021; Linnenluecke & Griffiths, 2010; Williams et al., 2019). Consistently with the studies on the adaptive co-management of social-ecological systems (Ostrom, 2009), a commons can be conceptualized as a system, rather than a resource. More precisely, it can be defined as a system that (may) (re)generate resources and/or make them available for a certain community's collective benefit, but is vulnerable to the misbehaviors of the beneficiaries themselves (Ricciardi et al., 2018). These possible misbehaviors include not only misappropriation (e.g., over-exploitation), like in traditional common-pool resources studies, but also social loafing (e.g. neglect, lethargy, carelessness). Based on this, the theory of the commons, could provide, for instance, organizational insights through the perspective of the tragedy of the commons to explore how the collective responsibility of all the stakeholders do not result in opportunistic behaviors, thus integrating a stakeholder theory view of open innovation.

As this systemic view recognizes the nestedness of systems, and consequently, the relationship between the local and the global, business actions and societal outcomes, and short- and long-term (Bansal et al., 2021; Slawinski & Bansal, 2015), the theory of the commons also fits with paradox theory to explore grand challenges by understanding tensions between local and global, business and

society, short- and long-term, and others as "contradictory yet interrelated elements that exist simultaneously and persist over time" (Smith & Lewis 2011, p. 382).

7.5 Conclusion

To summarize what argued above, the strong practice-oriented nature of open innovation research has led to an under-theorization of this paradigm, with most studies that have been principally oriented to illustrate successful case studies to individuate actionable design principles (Brunswicker et al., 2017; Dodgson et al., 2006; Rayna & Striukova, 2019) rather than explain this phenomenon from a theoretical lens. Following Vanhaverbeke & Cloodt (2014), I argue that existing management theories should be combined as none of them can fully explain how companies benefit from open innovation. Moreover, I suggest some theories from organization studies that could help understand better the organizing principles of open innovation. In particular, I have reflected on the institutionalization of open innovation as an innovation management practice, suggesting that firms might engage in open innovation for legitimacy and not only for efficiency reasons. This perspective raises new implications on exploring (1) how organizations balance deliberate actions and institutional pressures (Bocquet & Dubouloz, 2020), and (2) how organizations might engage in symbolic and/or means-ends decoupling as possible outcomes linked to institutional pressures to open innovation. Subsequently, I have suggested how neo-institutional theory could provide insights to investigate how individuals enact institutional pressures towards open innovation (i.e., institutional work, see Lawrence et al., 2009), and how different organizations with different system's beliefs can interact to create and capture value effectively (institutional logics perspective, see Gümüsay et al., 2020). Moreover, I have suggested how paradox theory and the theory of the commons could inform open innovation. The first approach could help to explore paradoxical tensions in open innovation (i.e., control-openness, efficiency-resilience, exploration-exploitation) while the second one could provide a wider perspective on open innovation that goes beyond the firm-centric perspective. All these theoretical approaches can provide a breeding ground for capturing the complexity and non-linearity underlying open innovation in the face of the emerging issues addressed in this dissertation.

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Chapter 8: Conclusion

The paradigm of open innovation is gaining increasing attention across both academics and practitioners. The open innovation model has spread over the years from large companies and high-tech sectors (Mortara, & Minshall, 2011; Parida et al., 2012), to a wide set of areas and domains. New perspectives about the dark sides and the human side of open innovation (Bogers et al., 2017; Stanko et al., 2017), as well as its role in the face of grand challenges (Bertello et al., 2021; McGahan et al., 2020), have emerged and attracted scholars' attention.

Most of the theorization on open innovation comes from strategy and management scholars (Vanhaverbeke & Cloodt, 2014), while organization studies still play a marginal role in explaining open innovation practices. However, this dissertation argues that the development of organization theories and their use in the framing process of the organizing processes of open innovation would stimulate a more comprehensive understanding of open innovation. The decision to focus on specific topics such as the dark sides of open innovation, the human side of open innovation, and open innovation in the face of grand challenges is not only theoretical driven. Indeed, it also reflects my intention to explore open innovation based on my personal attitude and preferences, which I believe to be an essential point for a researcher.

The focus on the dark sides comes from my interest in what is still unexplored as well as what does not work properly as it should. Although recently scholars have called for studies addressing the dark sides of open innovation (Stanko et al., 2017), the community is still strongly focused on the positive and the working aspects. I remember that when I had presented in a seminar my work on the barriers to open innovation in SMEs someone from the audience mentioned that what I was referring to was not open innovation. Although the critics helped me improve the frame of the study, they also made me reflect: "How can be possible that what works is open innovation while what cannot work is something else?". Based on these assumptions, I focused my efforts in Chapter 2 in outlining an overview of barriers to open innovation in SMEs, introducing in Chapter 3 the empirical results of a qualitative study investigating the challenges that low- and medium-low tech SMEs experience in collaborative projects based on pre-competitive R&D. This second chapter will also propose organizational solutions for the management of these projects.

This dissertation also addresses the human side of open innovation. The emerging literature on the microfoundations of open innovation (Ahn et al., 2017; Albats et al., 2020; Bogers et al., 2018) combines well with my natural curiosity for human elements and human relations. In chapter 4, I have thus presented an overview of the major studies exploring the human side of open innovation.

Then, considered the trajectory of organization studies as well as strategic management, heavily focused on macro factors, at the expense of the micro (Felin & Hesterly, 2007), in Chapter 5 I have brought individuals back at the core of the reflection as a strategic factor of organization. This allowed me to link individuals' interests and cognitions to organizations' capabilities (Felin et al., 2015), unveiling the microfoundations of relational capabilities when organizations approach the coupled mode of open innovation.

Finally, I have shed light on the role that open innovation can play in the face of grand challenges. Grand challenges potentially affect all of our lives. However, our perceptions often lag behind real problems. The long-term effects of challenges such as climate change are difficult to be perceived, causing greater damages if we do not act properly in the short time. Recently, the COVID-19 pandemic has shown how grand challenges are complex, uncertain, and they cut across different disciplines (Bertello et al., 2021; Gümüsay & Haak, 2020). At the same time, they require collective and coordinated efforts (George et al., 2016). Grand challenges have thus attracted my attention for their relevance in practice as well as their complexity that calls for theoretical advancement in management and organization studies. Open innovation has the huge opportunity to offer possible new solutions on how to address grand challenges on the one side, while taking lessons on how to move forward the concept of open innovation on the other side. For this reason, in Chapter 6, I have identified some key elements for moving research on open innovation forward in the face of grand challenges.

This dissertation concludes with Chapter 6 reflecting on the theoretical implications of organizing open innovation, taking inspiration from what was discussed in the previous chapters. Further research is in fact needed to extend research on open innovation beyond the traditional theories of the firm, and neo-institutional theory, paradox theory, and theory of the commons can represent relevant theoretical lenses.

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