Managing open innovation projects: an evidence-based framework for SMEs and large companies cooperation

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Abstract

Purpose – How can joint open innovation (OI) projects between small and medium-sized enterprises (SMEs) and large companies (LCs) be effectively managed? This study aims to try to answer this research question with a focus on the critical success factors (CSFs) of such cooperation.

Design/methodology/approach – Based on 40 semi-structured interviews with Italian SMEs and LCs engaged in various industries, 20 open OI projects involving SMEs and LCs are investigated using a reflexive thematic analysis, a methodology involving both deductive and inductive approaches.

Findings – Fifteen CSFs grouped into seven categories emerge from the analysis of joint OI projects between SMEs and LCs. Among them, shared leadership, dynamic decision-making and priority setting emerge as essential elements at the basis of the proposed SMEs–LCs cooperation in joint OI projects that were not sufficiently addressed by prior studies.

Originality/value – To the best of the authors' knowledge, this study is the first to provide an evidence-based framework for managing joint OI projects between SMEs and LCs. Relatedly, this study links the practices and most recurring CSFs that facilitate such cooperation.

Keywords Decision-making, Open innovation, Critical success factors, Small and medium-sized enterprises, Strategic flexibility, Large companies, Knowledge and innovation management, Project management

Paper type Research paper

1. Introduction

Since its conceptualization, open innovation (OI) – i.e. firms' use of external and internal ideas and paths to market to advance their technology – has become an essential model in

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industry practice and a topic of increasing scholarly interest (Chesbrough, 2003). In particular, the effectiveness argument for OI has been the focus of empirical research in different contexts and levels of analysis (Bogers *et al.*, 2017).

The first setting where OI effectiveness was explored is that of large companies (LCs), which is also the context that first saw the emergence of OI practices; only later did the focus of academic research move to the peculiarities of OI in small- and medium-sized enterprises (SMEs) (van de Vrande *et al.*, 2009). As the characteristics of OI in SMEs could scarcely be compared with prior literature and substantially different theoretical frameworks are required to understand and manage OI in SMEs and LCs (Vanhaverbeke, 2017), empirical research was carried out separately in the two contexts for at least a decade. As a result, evidence of the cooperation between SMEs and LCs in OI projects is still limited and sometimes controversial.

Although recent research has suggested that complementarities between SMEs and LCs could be a source of value in OI ecosystems (Radziwon and Bogers, 2019), studies focusing on OI at the firm level specify that unbalanced market power and resource structures in SMEs and LCs influence their relationships, with SMEs already facing substantial challenges in the early stages (Prashantham and Birkinshaw, 2008; Wasiuzzaman, 2019). This is perhaps why only a few contributions, focusing on OI at the project level of analysis, attempted to clarify the complexities of such collaborations (Dezi *et al.*, 2018; Marullo *et al.*, 2020; Albats *et al.*, 2021).

Hence, recent research agendas explicitly call for the development of contextualized knowledge of the relationship between SMEs and LCs in OI projects. In particular, it is asked to deepen the managerial approaches that may facilitate dealing with such a complex relationship (Torchia and Calabrò, 2019; Prashantham and Bhattacharyya, 2020; Zahoor *et al.*, 2020; Ghauri *et al.*, 2021).

This exploratory study deals with the call mentioned above by investigating the following research question:

RQ1. How can joint OI projects between SMEs and LCs be effectively managed?

To answer the above research question, we conducted an exploratory analysis on 20 OI projects involving (at least) one SME and one LC. To this purpose, 40 project managers from Italian business organizations were interviewed, and the transcripts were examined through a reflexive thematic analysis (RTA) (Braun and Clarke, 2019). We focused on critical success factors (CSFs) – the limited number of areas in which "things must go right for a business to flourish" (Rockart, 1979, p. 88) – helping to manage this cooperation.

Emerging codes and themes highlight 15 CSFs, grouped into 7 main categories, which shed light on the research question. Some of them – i.e. shared leadership, dynamic decision-making and priority setting – appear as crucial elements in joint OI projects but were not evidenced by prior research (de Oliveira *et al.*, 2018; Pellizzoni *et al.*, 2019). A broader holistic view of results and their connections with produced literature allowed us to propose an evidence-based framework for managing SMEs–LCs cooperation in joint OI projects. In particular, two practices – i.e. clearly defining formal and informal cooperation processes and adopting Project Management Agile principles (Fetterhoff and Voelkel, 2006; Wallin and von Krogh, 2010; Barrett and Tsekouras, 2022) – are at the basis of the emerging CSFs and their grouping categories, that we provide in this work. Thanks to them, SMEs–LCs cooperation in joint OI projects can be effectively managed. This forms a significant advance concerning prior literature (Martínez Sánchez *et al.*, 2019; Fachrunnisa *et al.*, 2020) and a solid practical implication.

The remainder of the study comprises five sections. The theoretical background is illustrated in the section 2, where the OI management in SMEs and LC s is extensively discussed, pointing at the critical success factors characterizing each innovation model. Section 3 describes the research design and methodology. Then, in Sections 4 and 5 the analysis and the results are presented and discussed respectively. Section 5 reports study's main implications and limitations, representing future research directions.

2. Theoretical background

2.1 Open innovation management in small- and medium-sized enterprises and large companies

The OI paradigm was initially opposed to the prevailing wisdom that most effective innovation processes were based on vertical integration and the creation of entry barriers in an industry. In his first book, Chesbrough (2003) highlighted several cases where LCs (such as IBM, Intel, Philips, Unilever and Procter & Gamble) were launching innovation projects either from internal or external technology sources (e.g. through in-licensing or collaborative research and development [R&D]) and where such projects often went outside the initial target market of the firm (e.g. through out-licensing or spinouts).

Compared to the traditional representation of the innovation process, OI represents a broader approach "systematically encouraging and exploring a wide range of internal and external sources for innovation opportunities, consciously integrating that exploration with firm capabilities and resources, and broadly exploiting those opportunities through multiple channels" (West and Gallagher, 2006, p. 320). From a managerial perspective, models for OI implementation in LCs have extensively been developed. For instance, Fetterhoff and Voelkel (2006) proposed a management process consisting of five stages:

(1) seeking opportunities;
(2) evaluating their market potential and inventiveness;
(3) recruiting potential development partners;
(4) capturing value through commercialization; and
(5) extending the innovation offering.

Yet, focusing on knowledge integration, Wallin and von Krogh (2010) proposed the following management process:

- define the innovation process;
- identify innovation-relevant knowledge;
- select an appropriate integration mechanism;
- create effective governance mechanisms; and
- balance incentives and controls.

At the same time, the emerging field of research on OI in SMEs provided a very different picture of "the creative use of OI that many innovating SMEs around the globe are implementing" (Vanhaverbeke *et al.*, 2012, p. 9). Vanhaverbeke (2017) developed substantial arguments supporting a different framework for OI in SMEs compared to LCs. First, because SMEs are frequently one-project/one-technology companies, OI adoption significantly impacts the firm's business model. At the same time, in LCs, usually managing a portfolio of established innovation projects, OI assumes the connotation of business practice (Spithoven *et al.*, 2013). Second, substantial differences can be observed in *how* OI is

managed in SMEs compared to their larger counterparts. Because OI in small firms is primarily developed by the founder/entrepreneur (and not by dedicated management or OI teams), OI can be considered part of these companies' entrepreneurship. As OI in SMEs frequently takes the shape of innovation networks, personal contacts, trust, fast decision-making and informal communication are the basis of such relationships (Lee *et al.*, 2010).

Because the OI model involves very different practices, motives and sources of benefits in SMEs and LCs, little research has drawn attention to the *complementarities* between the two models and, in particular, to the managerial approaches and CSFs that could enhance cooperation between SMEs and LCs in OI projects (Martínez Sánchez *et al.*, 2019; Pellizzoni *et al.*, 2019; Fachrunnisa *et al.*, 2020).

2.2 Critical success factors) for joint open innovation implementation in small- and medium-sized enterprises and large companies

Established research on OI adoption has observed that, beyond environmental factors, a company's internal culture and organizational characteristics are among the key facilitators of successful OI adoption, as they strongly impact the direction of OI implementation paths (Mortara and Minshall, 2011). In a recent systematic literature review, de Oliveira *et al.* (2018) identified six main categories of success factors for OI projects:

(1) leadership (human and social capital elements);
(2) internal innovation capability (internal structures and resources);
(3) network and relationships (firms' search and networking capabilities);
(4) strategy (alignment between internal resources and strategic objectives);
(5) firms' maturity in technology management; and
(6) firms' organizational culture.

To explore the CSFs facilitating cooperation between SMEs and LCs in OI projects, we build on the theoretical debate about innovation and firm size (Acs and Audretsch, 1987). We draw, in particular, on those contributions clarifying the role of small firms in the emergence of new technologies (Rothwell, 1989) and the relative advantages and disadvantages of small and large firms' innovation models (Vossen, 1998) and management approaches (Stevenson and Jarillo, 1990). Table 1 reviews the main elements provided by relevant literature comparing SMEs and LCs' innovation approaches concerning their strategic orientation, management characteristics, R&D setting, organizational context and the different sources of competitive advantage.

Some elements characterizing SMEs and LCs' innovation approaches may increase the managerial complexity of joint OI projects, acting as barriers to their successful implementation.

The first element concerns asymmetry in resources. Because of resource constraints and underdeveloped internal capabilities, SMEs' innovation approaches have a robust boundary-spanning component (Rothwell, 1989). SMEs, therefore, consider OI projects an opportunity to access external innovation assets and tend to privilege supply chain partners for market-related motives (Rothwell and Dodgson, 1991). On the contrary, OI projects represent for LCs an optimal solution to explore new knowledge and ideas and strategically exploit the most promising technological opportunities without bearing the risks of internal R&D investments (Spithoven *et al.*, 2013). Because LCs largely dispose of resources to exploit technological knowledge into new products and services and complementary

SMEs	vs	LCs	Relevant citations
Strategic orientation			
Pursuit of emerging opportunities	vs	Internal resources planning	Stevenson and Jarillo (1990) Gagnon and Toulouse (1993)
Use of external resources and competencies	vs	Ownership and control	Rothwell (1989) Gagnon and Toulouse (1993)
New (and uncertain) techno-market regimes	vs	Defined technological possibilities and paths to the market	Acs and Audretsch (1987) Rothwell (1989), Thurik (2009)
Management orientation			
Fast decision-making	vs	Structured, stage-gate decision processes	Gagnon and Toulouse (1993) Vossen (1998)
Alignment of R&D and management objectives		Functional expertise and management accounting	Stevenson and Jarillo (1990) Gagnon and Toulouse (1993) Nooteboom (1994), Vossen (1998)
External networking		Monitoring	Hagedoorn (1995), Freel (2003)
R&D setting			
Short learning curves, adaptability of routines		Long learning curves, established routines	Acs and Audretsch (1987); Vossen (1998)
Small R&D operations (problem-solving approach)		Systematic R&D activities	Audretsch and Thurik (2004) Thurik (2009)
Collaborative R&D		Centralized R&D	Freel (2003)
Organizational context			
Integration of tasks in employees; variation and improvisation		Employees specialization	Nooteboom (1994)
Flat managerial structure		Hierarchical managerial structure	Gagnon and Toulouse (1993) Vossen (1998)
Use of external resources and innovation assets		Internalization of relevant ("core") resources and competencies	Freel (2003)
Sources of competitive advantage			
Early stages of product's life cycle		Late stages of product's life cycle	Acs and Audretsch (1987)
Low barriers to entry		Scale advantages, entry barriers	Acs and Audretsch (1987) Rothwell (1989), Vossen (1998)
Tacit, idiosyncratic knowledge		Codified knowledge	Nooteboom (1994)
Knowledge appropriability		Formal IP protection	Rothwell (1989) Nooteboom (1994), Vossen (1998)
Capacity for customization		Economies of scope, diversification	Rothwell (1989) Vossen (1998)

Table 1. SMEs and LCs' differences in innovation approaches

innovation assets, they may exert a powerful attraction on SMEs as potential partners (Jang *et al.*, 2017). Such unbalanced resource profiles might be the source of coordination problems (Prashantham and Birkinshaw, 2008). For instance, differences between the organizational context of LCs, leveraging separation of roles and employees' specialization to gain efficiency compared to SMEs, owing their advantages to the integration of tasks and

flexibility, may create communication problems during the initializing and processing stages of OI projects (Marullo *et al.*, 2020).

The second element of complexity can be related to differences in the R&D setting of SMEs compared to LCs. As SMEs operate with low or no formalization of R&D processes, they experience shorter organizational distance between the R&D and general management objectives than their larger counterparts, typically adopting an R&D portfolio perspective. Such an entrepreneurial approach to OI, based on agility and risk-taking, leads to behavioral advantages of SMEs in innovation, which represent critical elements for successfully exploiting new markets (Stevenson and Jarillo, 1990). On the opposite, the "material" advantages of LCs' innovation models arise as technological possibilities and paths to the market are defined, and the benefits of scale and resource planning prevail (Rothwell, 1989; Gagnon and Toulouse, 1993). Notwithstanding the complementarity of the two approaches, such marked differences between SMEs and LCs may lead to different time horizons in resource planning, driving ambiguities in the priority setting of joint OI projects.

A third element concerns incentives for knowledge exchange, representing the "core" of OI projects. Well-established literature comparing OI in the two contexts of SMEs and LCs (Spithoven *et al.*, 2013) has underlined that OI in SMEs represents, at the same time, an opportunity and a threat, as SMEs deal with greater levels of appropriability risks than LCs. Faced with these points of difference, a close collaboration among SMEs and LCs can lead to the rise of cultural, managerial, and legislative obstacles (Brouthers *et al.*, 2015), which are even strengthened in OI contexts (Vanhaverbeke, 2017). In this vein, Marullo *et al.* (2018, 2020) disclosed that the rise of unexpected risks associated with free revealing, the failure to set adequate R&D priorities, and the emergence of communication costs represent the main challenges that prevent the success of OI projects between SMEs and LCs.

To diminish the issues above, Barrett and Tsekouras (2022), who investigated the microfoundations at the individual level of OI partnerships between young innovative companies and multinational enterprises, underlined how the need of young companies' founders to "do their homework in advance" for better managing the interaction; thus, be prepared for meetings, understand roles and objectives and get familiarity with the formal processes of the counterpart.

Yet, Marullo *et al.* (2020) have suggested that managers, especially the ones of LCs, should embrace adequate project management approaches to capture the value-creation opportunities and anticipate the emerging challenges in different stages of execution of joint OI projects. Managers could rely on Agile project management methods (Fernandez and Fernandez, 2008), typically characterized by incremental and iterative approaches that can be synthesized in short development iterations (known as *sprints)*, working closely with project stakeholders, reprioritizing work regularly and addressing changes in scope quickly and flexibly. In this regard, Agile project management (e.g. Scrum, Kanban, Lean) supports resource planning and decision-making in hyperdynamic and complex contexts such as those featured by joint OI projects. Furthermore, the peculiarities of Agile project management methods (i.e. cutting big projects into smaller ones, defining bite-sized processes, prioritizing and executing functions) make it an extraordinarily flexible approach that can be easily embraced in various business contexts (Gustavsson, 2016). In sum, it is suggested that LCs embracing these methods to reach flexibility within the joint OI project.

3. Methodology

3.1 Research design

Knowledge of managerial approaches facilitating the cooperation between SMEs and LCs in OI still suffers from a paucity of scientific literature (Prashantham and Bhattacharyya, 2020;

Zahoor *et al.*, 2020; Ghauri *et al.*, 2021), and only the first tentative work in this direction has been produced to date (Pellizzoni *et al.*, 2019).

To answer the main research question:

RQ2. What are the CSFs facilitating cooperation between SMEs and LCs in joint OI projects?

We adopted a fitting qualitative research design (Edmondson and McManus, 2007) to explore this developing research area. In particular, we conducted semi-structured interviews with 40 Italian project managers – 20 from SMEs and 20 from LCs – engaged in 20 joint OI projects.

In this study, we adopted the OI project as the unit of analysis. Indeed, research on OI has increasingly moved from the firm level toward the project level of analysis to understand better the CSFs and the most relevant challenges characterizing the dynamics of inter-firm collaborations (Pellizzoni *et al.*, 2019; Marullo *et al.*, 2020). An analysis of OI projects appears particularly relevant in this context because the boundaries of managerial actions are not only constrained to the single decision to open up (or not) the internal innovation process but are also extended throughout the projects' evolution (Bahemia and Squire, 2010).

The initial sample consisted of 53 SMEs who started joint OI projects with LCs by 2019. The involved SMEs were clients of an international consulting firm where one of the authors worked during the research period. SMEs' project managers were contacted personally and asked for:

- their availability to take part in the research; and
- the possibility of being put in contact with their larger counterparts.

A total of 31 OI projects were identified as potential candidates for investigation. Data analysis reached saturation (Fusch and Ness, 2015) when 40 interviews concerning 20 OI projects were analyzed (see Appendix online for details).

RTA, an empirical procedure extensively used to explore the distribution of information regarding a definite array of arguments (King and Brooks, 2018), was used to analyze the content of the semi-structured interviews. In Sections 3.2 and 3.3, we report additional data collection and analysis details.

3.2 Data collection

We collected secondary information from companies' websites, newspaper articles, blog posts and the OI projects' documentation in the first stage. The analysis of secondary data, in some cases provided by the interviewees, allowed us to have an initial description of the joint OI projects and the companies involved and, consequently, to develop the research subquestions for the interview protocol, consciously designed to follow the respondents' flows (Yin, 2013).

The interview protocol consisted of three main parts. The first structured part was designed to understand the evolution of the OI project (including a general description of the project and paying particular attention to the initial triggers, strategic goals and motivations behind the adoption of OI). A second unstructured part aimed at reaching an in-depth view of the factors enhancing/challenging OI project management in different stages and their direct/indirect link with the peculiarities of OI management in SMEs and LCs. The unstructured part of the interview was regularly updated to embody relevant insights and information emerging from the previous interviews – a third closing section aimed at eliciting possible future scenarios based on the collected evidence. Informant biases were

mitigated through triangulation activities between the data gathered in the first two stages of the collection process and the reference theory. In case of inconsistencies, doubts and/or missing information, the interviewees were called back, and further details were collected.

Interviews were carried out between March 2021 and January 2022 and required an average of 105 min each. After the interviews, recordings were examined and transcribed; this activity required an average of 5 h per interview.

3.3 Data analysis

As in similar works, interview transcripts were examined through RTA (Cristofaro, 2017; Cristofaro *et al.*, 2019; Braun and Clarke, 2019). When correctly carried out using codes and themes, the RTA methodology unambiguously displays data and information supporting scholars in developing theoretical frameworks by defining the concepts, the mechanisms and the relationships behind the topic under investigation (Boyatzis, 1998). RTA is often used to acquire a nuanced understanding of spontaneous and sophisticated processes by envisioning "new constructs with few formal measures in an open-ended inquiry" (Edmondson and McManus, 2007, p. 1160). Hence, RTA approaches thematic analysis as a "reflection" of the researcher's interpretive role (Braun and Clarke, 2019). In this regard, RTA requires deductive approaches (by which communication messages are thematized according to an initial codebook) and inductive approaches (by which new themes emerge). In our analysis, we followed the procedure suggested by Braun and Clarke (2019) and consisting of six steps:

(1) familiarizing ourselves with the data
(2) generating initial latent codes as features of the data;
(3) searching for themes;
(4) reviewing themes;
(5) defining and naming themes; and
(6) producing reports [1].

Each author analyzed the transcripts individually, and their inter-rater reliability was high (Cronbach's alpha = 0.89); however, when disagreeing, they deepened the analysis to reach a shared vision of the sentence meaning and related theme. The RTA procedure concluded when the qualitative information provided by the interviewees reached saturation. From the analysis, 15 codes were identified (Table 2), and 7 themes were defined by analyzing 20 OI projects.

The definition of themes out of the 15 latent codes was performed in a deductive manner, using an initial codebook composed of the six main categories of CSFs – i.e. leadership, internal innovation capability, network and relationships, strategy, technology management and culture – proposed by de Oliveira *et al.* (2018). Following the inductive–deductive procedure within RTA (Braun and Clarke, 2019), other themes not included within the initial codebook were inductively detected and categorized.

Codes and themes – respectively quantified in terms of the number of appearances in each transcript and related attachments, and according to the sum of codes' frequencies pointing to them – allowed the construction of a thematic map (Figure 1) (Braun and Clarke, 2019).

The information gathered from the semi-structured interviews was analyzed separately and then combined to highlight similarities and dissimilarities among the opinions expressed by the SMEs' and LCs' project managers interviewed. This allowed the creation of

Code(s)	Definition(s)
Learning through experimentation	The learning mechanisms, accomplished by organizations, consist of trying out new ideas, methods or activities and implementing them within the business process
Trusting relationships	One organization's expectation that another organization will not take advantage of the trusting organization's vulnerabilities
Knowledge transfer	The movement of knowledge between larger entities within organizations, such as between departments or divisions, and between organizations themselves
Result-oriented approach	A culture that emphasizes outcomes rather than inputs or processes
Strategic resources complementarity	A unique and symmetric strategic combination of firm roles, goals, readiness for the implementation and use of resources across partnering firms and the extended supply chain
Technical competence	Internal and external promotion and development of innovation-related technical skills – complementary to each other – that are used to enhance the realization of either product or service innovations
Conflict/relationship management	Either formal or informal processes by the means of which two or more parties find a peaceful solution to their misalignments or set rules to handle their relationship over time
Sharing of responsibilities	The process through which peers squeeze out the problems they face by distributing duties and sharing possible solutions
Knowledge complementarities	The characteristic of the knowledge that may determine its value as a tradable commodity. It is the effect resulting from combining two distinct bodies of knowledge whose agglomeration is super-additive – i.e., the combined knowledge set has more embedded knowledge than the simple additive values of the parts
Incentives management	The use of internal promotion systems that focus on employee merit and other forms of incentives intended to align the interests of employees with those of shareholders
Key performance indicators	Indicators used by management to measure, report and improve performance against the predetermined strategic objectives
Adaptive problem-solving	The ability to generate ways to develop better solutions for immediate high efficiency
Temporal dynamism	The degree to which organizational emphasis is placed before, during, and after a process occurs
Innovation strategy	Clearly define innovation-related strategic positioning (e.g., objectives in terms of radical/incremental and product/process innovation), which may vitally determine the success, or the failure, of a project or even of the firm itself
Objectives' alignment	The crucial integration – between business plan and sustainable strategies – needed to delineate the strategic goals to be achieved in the medium and long-term

Table 2.
Definition of codes

a basis upon which it has been possible to explore the validity of the information stated in the theoretical background and, consequently, to derive implications for theory and practice.

4. Findings

Fifteen CSFs characterizing SMEs and LCs' collaboration in OI projects emerged from the analysis of the semi-structured interviews. Those with the higher frequency rate are, namely, "knowledge transfer" ($N = 193$, % = 14.94), "innovation strategy" ($N = 185$, % = 14.31), and

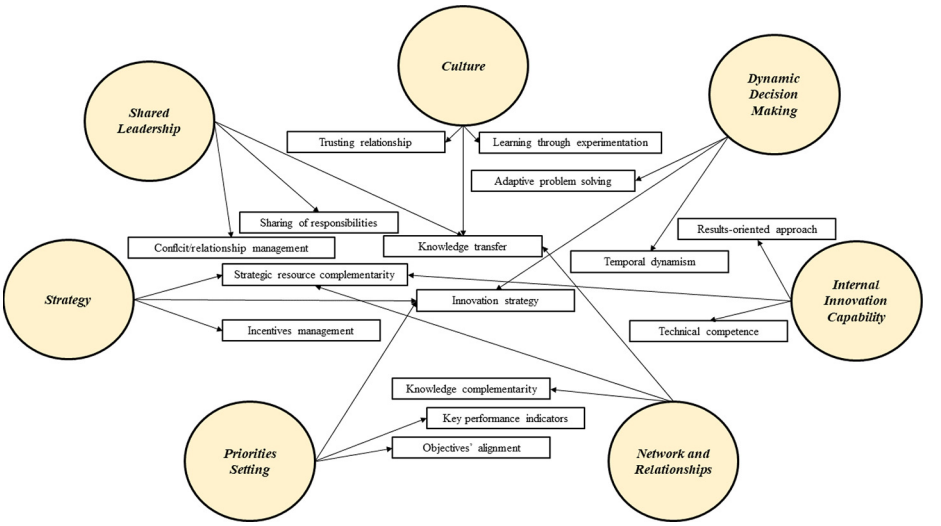

Figure 1.
Thematic map

"strategic resource complementarity" ($N = 182$, % = 14.09). Based on Vaismoradi *et al.* (2016), the CSFs were grouped into seven main categories (Table 3).

Four categories, namely, *culture*, *internal innovation capability*, *network and relationships*, and *strategy*, were listed in the initial codebook (de Oliveira *et al.*, 2018), while three categories – *shared leadership*, *dynamic decision-making* and *priorities setting* – emerged from the inductive part of the analysis [2]. In what follows, we provide a detailed description and a discussion of the findings for each identified category of CSFs.

4.1 Culture

This category gathers the different perspectives according to which companies' internal culture – i.e. a set of norms and values widely shared and strongly held throughout the organization – represents an effective enabler of OI performance. Prior research (Mortara and Minshall, 2011; Pellizzoni *et al.*, 2019) has shown that an appropriate organizational culture is necessary to promote experimentation, risk tolerance, motivation and reward mechanisms, encouraging OI effectiveness. In this vein, three project managers declared:

> Thanks to the fact that our firm has in its DNA the predisposition towards collaborating with other firms, we have not encountered many difficulties in developing a highly automated solution for the assembly line of agricultural vehicles with Firm "17b". Precisely, this has been possible thanks to shared managerial policies, which allowed the creation of a solid and collaborative team. [Project #17 – SME respondent]

> Our values support the contamination of knowledge with other realities. For us, this represents a silver bullet since it enables us to build new products as well as to share knowledge with our partners. [Project #9 – LC respondent]

4.2 Internal innovation capability

One of the primary reasons organizations engage in OI projects is their need to preserve the internal knowledge base while building new capabilities through external knowledge

Theme(s)	Code(s)	SMEs		LCs		TOTAL	
		N	%	*N*	%	*N*	%
Culture	Learning through experimentation	25	64	14	36	39	100
	Trusting relationships	28	44	36	56	64	100
	Knowledge transfer	31	53	27	47	58	100
Internal innovation capability	Result-oriented approach	40	58	29	42	69	100
	Strategic resource complementarity	19	36	34	64	53	100
	Technical competence	21	45	26	55	47	100
Shared leadership	Sharing of responsibilities	31	45	38	55	69	100
	Conflict/relationship management	35	49	37	51	72	100
	Knowledge transfer	41	60	27	40	68	100
Network and relationships	Knowledge complementarities	22	42	30	58	52	100
	Knowledge transfer	40	60	27	40	67	100
	Strategic resource complementarity	24	51	23	49	47	100
Strategy	Incentives management	43	55	35	45	78	100
	Innovation strategy	12	29	29	71	41	100
	Strategic resource complementarity	47	57	35	43	82	100
Dynamic decision-making	Adaptive problem-solving	30	53	27	47	57	100
	Temporal dynamism	39	56	31	44	70	100
	Innovation strategy	42	55	35	45	77	100
Priorities setting	Innovation strategy	35	52	32	48	67	100
	Key performance indicators	21	34	40	66	61	100
	Objectives' alignment	28	52	26	48	54	100
TOTAL		*654*	*51*	*638*	*49*	*1,292*	*100*

Table 3. Number and frequency of the codes and themes extrapolated from the semi-structured interviews

exploration. This takes the name of "Internal innovation capability: the ability to continuously transform knowledge and ideas into new products, processes, and systems for the benefit of the firm and its stakeholders. Notably, organizations involved in OI projects might need to find the right balance between teams characterized by diverse skills and competencies (e.g. technical background) by leveraging on partners" complementary skills (Mowery *et al.*, 1996), advanced problem-solving approaches as well as networking and communication intelligence (Mortara and Minshall, 2011). In this respect, some respondents declared:

> The decision to join a project based on OI has been enhanced by the need to answer the new market demand. By combining our complementary knowledge and skills in innovation with "Firm 14a," it has been possible to make a cutting-edge medical appliance based on AI and 5G technologies. [Project #14 – LC respondent]

> To develop a new command and control solution for the European Space Operations Centre [. . .] we have established a successful collaboration with Firm "19a". Thanks to the common results-driven mindset and, of course, the [innovation] complementarities [. . .] our companies started a beneficial exchange of knowledge. [Project #19 – LC respondent]

4.3 Shared leadership

OI success requires a close interaction among partner companies to share, assimilate and mutually integrate knowledge upon common strategic visions and values. In this vein, individuals, teams and organizations embracing the shared leadership practice – distribution of leadership influence across multiple team members (Carson *et al.*, 2007) – show a lower probability of internal conflicts as well as consensus, trust and cohesion in

participative decision-making, compared to those teams that, on the contrary, have not put into action such policies (Choi *et al.*, 2017). In our analysis, shared leadership played a role as CSF in supporting OI projects:

> I had to share many activities and responsibilities with the project manager of the LC. In this regard, flexible and frequent meetings have facilitated both our relationship and, in turn, conflict management as well as the share of knowledge among our partner and us. [Project #9 – SME respondent]

> By implementing policies that facilitate relationship management and conflict resolution – through the sharing of responsibilities – we are fruitfully collaborating with Firm "6b" to develop a new blockchain-based solution. [Project #6 – SME respondent]

4.4 Network and relationships

The network of external partners, particularly the variety, intensity and levels of trust characterizing external linkages, are among the CSFs of OI in SMEs (Lee *et al.*, 2010). Concerning LCs, Somech and Drach-Zahavy (2013) underlined the creation of *ad hoc* heterogeneous networks within the firm (e.g. interorganizational teams) to build a portfolio of different, complementary skills. In the context of joint OI projects between SMEs and LCs, some respondents affirmed:

> Thanks to our well-diversified network, we have been able to meet the representatives of Firm "8a" with whom we established a successful joint OI project aimed to develop a cutting-edge, highly interactive medical device for the measurement of insulin levels. [Project #8 – LC respondent]

> Thanks to our network of partner firms and advanced OI projects, we have been able to enter a new market and explore new business opportunities allowing us to successfully develop a series of smart subway locomotives. [Project #12 – LC respondent]

4.5 Strategy

Companies should initiate an OI project by aligning business growth objectives with the ambition to take advantage of external knowledge flows (Chiaroni *et al.*, 2010), thus adapting their strategy. Particularly, to successfully exploit OI opportunities, organizations should systematically engage in the external exploration of a broad spectrum of information sources, purposively select the relevant knowledge to be combined with internal resources (and capabilities), and, overall, exploit the most promising opportunities through multiple channels (West and Gallagher, 2006; Cristofaro and Lovallo, 2022). To the point, managers claimed:

> The OI project with Firm "18a" led to better cost management. Rather than acquire IPs as we usually do, we combined their knowledge about mobility with our financial resources and electronic engineering capacities. This moved our focus from a full exploration to an equally shared exploration-exploitation strategic approach. [Project #18 – LC respondent]

> To develop a hi-tech solution based on AI, we are collaborating with Firm "5b" because of our knowledge complementary [. . .] in particular, to keep both the development and sales strategies aligned, we have implemented key performance indicators that are linked to the achievement and maintenance of the settled short-term goals and medium/long term objectives. [Project #5 – SME respondent]

4.6 Dynamic decision-making

Dynamic decision-making characterizes managerial approaches dealing with complex environments (e.g. caused by the emergence of new technological patterns or changes in industry regulation) – that call for quick decision-making processes (Rudolph *et al.*, 2009). By using dynamic decision-making, managers may effortlessly and rapidly adapt their original decisions – as well as the corporate culture and strategy – to changes in the external environment and coevolve to preserve competitive advantage over time (Cristofaro, 2016). Considering the characteristics of OI projects –requiring the purposive management of internal and external knowledge as well as the setting up of appropriation mechanisms, respondents declared:

> To develop a new model of smart subway locomotives [. . .], it has been necessary to continuously carry out adaptive problem-solving activities fed by the new information coming out once the safety tests were started. We benefited from the presence of KPIs to promptly adjust both the product and the strategy. [Project #12 – SME respondent]

> The development of the overall [OI] project has required the precise combination of our technical competencies. Therefore, we had to implement adaptive problem-solving procedures that have been taken during the weekly meetings [which] have been very useful to speed up the development phase. [Project #10 – LC respondent]

4.7 Priorities setting

Defining the range of action alternatives related to innovation inputs, activities and outputs and putting them in order (Chenhall, 2005). This practice is even more relevant in OI projects where managers must carefully and routinely assess how the cooperation with the third parties is developing to adjust their short-term objectives accordingly. In this vein, respondents declared:

> We had to use a wide array of KPIs to evaluate the development of such an OI project. Specifically, these measures facilitated the identification of resources needed to follow the joint strategy. [Project #3 – SME respondent]

> To develop a new line of apparel, we have asked Firm "15a" to combine skills and resources [. . .] We established joint R&D teams that adopt shared KPIs and goals to assess whether the development of the project is in line with the settled strategy. [Project #15 – LC respondent]

5. Discussion

The results of this study and the related thematic map underlined 15 CSFs, grouped into seven categories, enhancing SMEs–LCs collaboration in OI projects. From a holistic reading, which considers recent scientific literature on the topic, it is possible to derive a framework for managing SMEs and LCs cooperation in joint OI projects.

Following Figure 2, to effectively manage joint OI projects, involved actors should adopt some useful practices. On the one hand, SMEs should clearly define the *formal or informal processes* regarding conflict resolution, internal promotion systems, innovation-related strategic positioning, distribution of duties and how to combine resources from the beginning of the joint OI project. This will allow them to gain familiarity with the rigid mindset of LCs (Barrett and Tsekouras, 2022) and broaden their effort – usually toward adopting an experimental attitude and making fast and adaptive decisions (Rothwell, 1989). On the other hand, LCs should embrace *Agile project management principles* to allow strong strategic flexibility and a result-oriented attitude, which is typical of SMEs (Gustavsson, 2016; Marullo *et al.*, 2020). This would soften LCs looking, for joint OI projects, to long-term objectives in line with their established learning curves, grounding their internal innovation

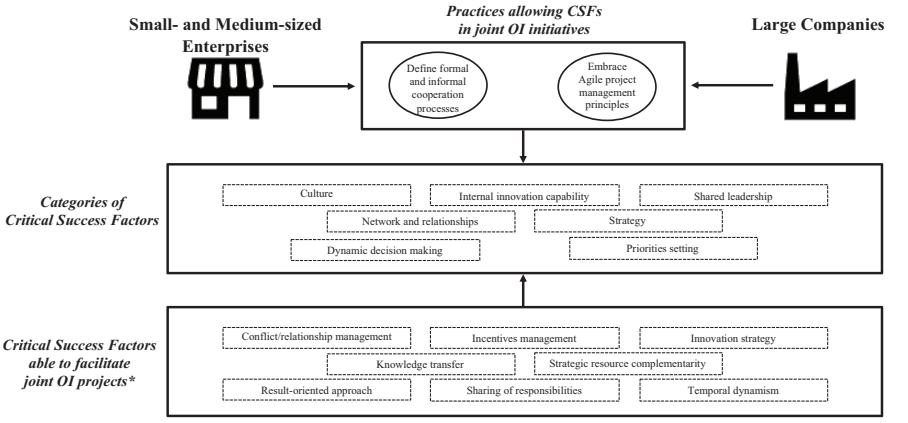

Figure 2.
Managing SMEs–LCs joint OI projects

Note: *Listed critical success factors are those belonging to the third and fourth quartiles

capabilities on their technical competencies and employees' specialization and adopting stage-gate decision processes (Acs and Audretsch, 1987; Vossen, 1998).

These two-leading normative suggestions represent the starting point upon which the management of OI collaborations are inaugurated and help shape the observed differences. These practices emphasize the need for an initial coordinating phase that precedes established OI steps (Fetterhoff and Voelkel, 2006; Wallin and von Krogh, 2010), aiming to reach a high degree of alignment among SMEs' and LCs' managers regarding the methodologies and practices for executing joint OI projects, thus forming a solid field for the flourishment of CSFs (Spithoven *et al.*, 2013; Pellizzoni *et al.*, 2019; Fachrunnisa *et al.*, 2020; Ragazou *et al.*, 2022).

For what concerns the emerging success factors, two considerations are relevant. First, beyond "culture," "internal innovation capability," "network and relationships" and "strategy" – already known as CSFs in interorganizational relationships (de Oliveira *et al.*, 2018), three additional categories – namely, "shared leadership," "dynamic decision-making" and "priorities setting" – emerged from the inductive analysis and were not considered by prior research (de Oliveira *et al.*, 2018; Pellizzoni *et al.*, 2019). Further, while "technology management" was not detected as a relevant factor by our thematic analysis of joint OI projects, "shared leadership" emerged as a critical factor characterizing SMEs–LCs collaborations. This emerging category suggests that OI projects not only require a close interaction between companies to enable mutual learning mechanisms and trust building but also the setting up of common strategic visions and values from the initializing stage. In this vein, the study supports the assumptions of previous scholars (Choi *et al.*, 2017), suggesting that shared leadership principles assist decision-makers in preventing conflict management.

Furthermore, from the interviews, it also emerged that shared leadership principles positively influence the formation of consensus, trust and cohesion through dynamic and participative decision-making. Such an approach has relevant managerial implications in the context of OI projects. It may effortlessly and rapidly allow priority settings and resource planning to adapt and coevolve with the OI project.

Second, single CSFs presented in this study are partially different from those highlighted by previous investigations (de Oliveira *et al.*, 2018; Pellizzoni *et al.*, 2019). For instance, in

addition to confirming those (e.g. intellectual property management, and trusting relationships) advanced by the studies above. Also new CSFs (e.g. temporal dynamism, conflict resolution and incentives management) have been proposed, which should be perceived as complementary to those suggested by de Oliveira *et al.* (2018). Consequently, this addition enlarges the understanding of CSFs influencing the implementation of OI projects among SMEs and LCs – given that they have repeatedly appeared in the statements made by the involved firms' representatives.

From a managerial perspective, this study raises the importance of CSFs allowing SMEs and LCs to respond to OI challenges emerging quickly and efficiently during the execution of joint OI projects (Huang *et al.*, 2013).

6. Conclusions and implications

Although in the last decades, the quantity of scientific contributions regarding OI has grown tremendously, most scholars have separately investigated how SMEs and LCs approach OI projects (Spithoven *et al.*, 2013; Fachrunnisa *et al.*, 2020). To fill the gap on how SMEs can effectively manage cooperation in OI with LCs (de Oliveira *et al.*, 2018; Torchia and Calabrò, 2019; Wasiuzzaman, 2019; Prashantham and Bhattacharyya, 2020; Zahoor *et al.*, 2020; Ghauri *et al.*, 2021), 40 project managers (20 for SMEs and 20 for LCs) cooperating in 20 joint projects have been interviewed, and transcripts have been investigated according to the RTA approach.

The main theoretical implication of this work is to provide an evidence-based framework for managing joint OI projects between SMEs and LCs. Relatedly, we link the practices and most recurring CSFs that facilitate such cooperation. In this last regard, we identify seven main groups of CSFs and recognize 15 CSFs that permit the fruitful management of OI projects between LCs and SMEs. All of them are theoretical advancements with regard to prior literature (Dezi *et al.*, 2018; Martínez Sánchez *et al.*, 2019; Fachrunnisa *et al.*, 2020; Marullo *et al.*, 2020; Albats *et al.*, 2021). In particular, this study enhances the understanding of such a complex phenomenon by extending the view from CSFs that are essential to OI adoption (e.g. "culture," "internal innovation capability," "network and relationships" and "strategy") (de Oliveira *et al.*, 2018; Martínez Sánchez *et al.*, 2019; Fachrunnisa *et al.*, 2020) to CSFs characterizing the successful management of OI projects ("shared leadership," "dynamic decision-making" and "priorities setting"). Further, it has been possible to reinforce the point made by Pellizzoni *et al.* (2019) regarding the need for future research exploring Agile principles in implementing OI projects.

Among the many practical implications of this study, the main one lies in providing a guiding framework for the cooperation between SMEs and LCs in joint OI projects and underlining the most important CSFs. In this respect, managers should put into action a series of initiatives, such as:

- purposively forming OI project teams with the most fitting composition in terms of skills, personalities and shared vision;
- establishing routines for sharing information across teams' members to facilitate their integration and alignment on common objectives;
- introducing active policies for promoting and spreading the adoption of tools and situational guidelines that allow dealing with obstacles and challenges emerging during the execution of OI projects; and
- creating *ad hoc* organizational protocols (e.g. defined roles and responsibilities) supporting compliance.

Indeed, implementing these actions in a later stage of execution of the OI project is neither easy nor quick, given the different characteristics of SMEs and LCs' innovation models. Hiring experts may be needed to lead the transition from a closed innovation to an OI attitude, as well as to assist managers in evaluating the ongoing practices for ameliorating the adoption of the Agile mindset and, in turn, the strategic flexibility to reflect better-performing cooperation between SMEs and LCs.

This study is not exempt from limitations. The first limitation concerns the sample population reflecting OI management in SMEs and LCs operating in specific industries (e.g. fashion design, food, information technology, manufacturing and robotics). Thus, different dynamics may characterize OI implementation in other sectors (Marullo *et al.*, 2020). A second limitation is that this study has not profoundly investigated the (direct or indirect) potential links among CSFs. These limitations represent, however, a promising avenue for future research.

Notes

1. Identification of latent codes and themes is based on identifying or examining the underlying ideas, assumptions, and conceptualizations (Braun and Clarke, 2019). So, the development of the themes involved interpretative work, and the analysis produced is not just a description but is already theorized – following a constructionist paradigm.
2. It is worth noting that although "leadership" was a category included in the initial codebook, in the context of OI projects, it was relabeled as a new theme ("shared leadership") based on the declarations of 40 interviewees. Yet, from the analysis of transcripts, the "technology management" theme – present in prior literature (de Oliveira *et al.*, 2018; Pellizzoni *et al.*, 2019) – did not emerge as a CSF in the context of OI projects.

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Appendix

Table A1. Key elements of the OI projects

ID	Objectives of the OI project	OI approach	Business sector(s)
#1	Creation of a new line of IT products based on fee-sharing rather than subscription	Collaboration agreements with users and developers	Information Technology
#2	Development of a robot for warehouse logistic purposes	R&D alliance with partners and research institutions	Robotics
#3	Exploitation of 3D printers to make a speedboat	Collaboration agreements with industrial partners and external stakeholders	Manufacturing Nautical Engineering
#4	R&D in the fashion design industry (recycled plastic as a textile)	Collaborative product design and development	Fashion Industry
#5	Codevelopment of a human–machine interface for the foodservice industry (automatic cash desk based on AI)	Collaboration agreements with users and developers	Information Technology
#6	Creation of a cloud platform based on blockchain technology for the Italian public administration	Collaboration with business partners and public institutions	Information Technology
#7	Development of home appliances made by fully recycled materials	Collaborative product design and development	Manufacturing
#8	Commercialization of a new highly interactive medical device to assess insulin levels	Collaboration with partners and consumers	Information Technology Medical Supplies
#9	Collaborative R&D in the field of solar panels and energy accumulators	R&D alliance with research institutions and business partner	Manufacturing Electrical Engineering
#10	Development of a new IT solution able to predict the risk of default of banks' debtors by using machine learning	IP licensing	Information Technology Financial Services
#11	Technology codevelopment of new microchips (to lower the use of semiconductors)	Collaborative product design and development	Manufacturing Electrical Engineering
#12	Codevelopment of smart subway locomotives	R&D alliance with partners and research institutions	Manufacturing Railway Engineering
#13	Collaborative R&D in the food industry (a new line of frozen food)	Collaboration with partners and consumers	Food Industry
#14	Commercialization of a robot that allows remote surgical operations	IP licensing	Robotics Medical supplies
#15	Development of apparel that requires less water during the whole production process	Collaborative product design and development	Textile Industry
#16	Exploitation of AI to develop a virtual assistant for air traffic controllers	R&D alliance with research institutions and business partner	Information Technology Aerospace

(*continued*)

ID	Objectives of the OI project	OI approach	Business sector(s)
#17	Codevelopment of new cutting-edge industrial types of machinery	Collaboration agreements with industrial partners and external stakeholders	Mechatronics Engineering
#18	Commercialization of a new segment of electric vehicles	IP licensing	Mobility Electrical Engineering
#19	Collaborative R&D in the space industry (instrumentation for satellite control)	R&D alliances with partner, industries, and stakeholders	Information Technology Aerospace
#20	Development of a new electromagnetic solution to optimize a train's energy efficiency	Collaborative product design and development	Mechatronics Engineering Electrical Engineering

Table A1.

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