The fine line between success and failure: an analysis of open innovation projects

Marco Greco
Department of Civil and Mechanical Engineering, University of Cassino and Southern Lazio, Cassino, Italy
Serena Strazzullo and Livio Cricelli
Department of Industrial Engineering, University of Naples Federico II, Naples, Italy, and
Michele Grimaldi and Benito Mignacca
Department of Civil and Mechanical Engineering, University of Cassino and Southern Lazio, Cassino, Italy

Received 24 December 2021
Revised 31 January 2022
Accepted 9 March 2022

Abstract

Purpose – Despite the multiple calls for research on the dark side of open innovation, very few studies have approached the topic so far. This study aims to analyse successful and unsuccessful open innovation projects.

Design/methodology/approach – This study uses thematic analysis to describe the factors determining their (un)success. The researchers interviewed 27 managers and owners in the manufacturing sector. Then, the respondents were asked to discuss one successful and one unsuccessful open innovation project to explore the differences in triggers and setbacks, focusing on the causes that determined the failures.

Findings – Findings show that many interviewees are reluctant to identify failure cases, which somewhat explains the paucity of studies on the topic, and others do so when the failure is recognised by a third party (such as a public institution not granting funds to the project). This study discussed how this phenomenon is linked with the paradoxical relation between innovation success and failure. It is also found that triggers and setbacks determining the project's (un)success are markedly differently based on the technological intensity of the firm. Implications for scholars and practitioners are also drawn.

Originality/value – This study provides a balanced view between open innovation successes and failures to offer informative recommendations to practitioners. Furthermore, it contributes to filling the scarcity of studies related to risks and failures of open innovation projects. This gap has been addressed by studying the factors that determine the success and unsuccess of an open innovation project.

Keywords Open innovation, Failure, Risk, Costs, Downsides

Paper type Research paper

1. Introduction

Twenty years after the first appearances of the term "open innovation" (Chesbrough, 2003), a vast epistemic community flourished, extensively addressing a wide range of theoretical and practical aspects of the open innovation (OI) paradigm, resulting in more than 184'000 pieces of research [1]. Among these studies, how and how much OI generates beneficial effects

The authors thank Sara Olivieri for her valuable support in the data collection process.

European Journal of Innovation Management
Vol. 25 No. 6, 2022
pp. 687-715
Emerald Publishing Limited
1460-1060
DOI 10.1108/EJIM-12-2021-0620

stands out. For instance, in their literature review, Obradović *et al.* (2021) recently observed that 70% of the studies investigating the manufacturing industry studied the impact of openness on performance. In comparison, the downsides, failures and costs of openness have been quite neglected (Appolloni *et al.*, 2013; Bogers *et al.*, 2017; Chesbrough and Bogers, 2014; Huizingh, 2011; Vos and Achterkamp, 2006), with relatively few exceptions (von Briel and Recker, 2017; Brunswicker and Chesbrough, 2018; Ciesielska, 2018; Dahlander and Gann, 2010; Faems *et al.*, 2010; Greco *et al.*, 2019; Lhuillery and Pfister, 2009; Lokshin *et al.*, 2011). Yet, as Enkel *et al.* (2009) posed, too much openness can harm a firm in the long run, leading to a loss of control and core competencies.

The paucity of studies on the OI downsides is a major gap since it may give the impression that OI is a panacea for all firms' innovation problems. Instead, experience tells us a different story, where failure is not uncommon and unsuccessful stories are often neglected while the attention goes to the successful ones. As Tucci *et al.* (2016) posed, "The failure cases are critical to defining the limits of OI, and to revealing latent conditions that may thwart the effective use of OI in certain situations" (p. 286).

We know little about which factors determine OI failures and how these happen. For instance, even for the not-invented-here syndrome (NIH), which prevents a firm from using other organisations' ideas or technologies, evidence of the impact on failure or underperformance is scarce (Antons and Piller, 2015).

This study aims to offer an exploratory overview of the factors leading to OI failure. Our research question is formulated as follows: "Which factors do determine the success and unsuccess of an OI project?" To seek a response, we interviewed 27 managers and asked them to recall one successful and one unsuccessful OI project in the same period. Such projects are our unit of analysis. This approach mimics what Brunswicker and Chesbrough (2018) did in their exploratory survey.

Hence, we could compare the contextual factors of both projects, verify the key differences and replicate the process for the other interviews, searching for regularities and common patterns. This study also contributes to the recent stream of research targeting OI projects' micro-foundations (Bagherzadeh *et al.*, 2021; Locatelli *et al.*, 2021). Unlike recent studies' quantitative approaches to project-level analysis (Bagherzadeh *et al.*, 2021; Brunswicker and Chesbrough, 2018), we favoured a qualitative methodology for understanding the underlying OI mechanisms that drive success and failure.

2. Theoretical background

A firm's choice to engage in OI activities is grounded in at least two classic managerial theories. On the one hand, transaction cost theory (Williamson, 1979) describes the inherent costs that encompass the interactions between autonomous organisations. Such costs should be compared with an organisation's internal costs to choose whether a "make" decision is more or less desirable than a "buy" one on economic terms. On the other hand, the resource-based view (Penrose, 1959) discusses the importance of resources, which should be rare, valuable, imperfectly imitable and without equivalent substitutes (Barney, 1991). Firms need to combine their own resources with other organisations' complementary ones to achieve sustainable competitive advantage. Such a combination is particularly important when a firm does not own the resources and skills it needs and the risk bore by collaboration is limited (Nieto and Santamaría, 2007). Balancing the benefits deriving from the combination of resources with the cost side of OI is a great challenge for organisations. The remainder of this section will describe the two sides of the OI coin, discussing the nature of its pros and cons (Section 2.1). Finally, Section 2.2 will describe the factors that may hamper OI, impeding it from happening or unbalancing its outcome towards the "cons" side.

2.1 Open innovation pros and cons

A great number of studies have demonstrated the positive impact of various forms of OI on innovation performance (Elmquist *et al.*, 2009). Typical positive consequences of OI include reducing the developmental costs and risks, nurturing the firm's know-how, accelerating time-to-market, accessing new markets and leveraging licensing or technology selling to boost the revenues (Binci *et al.*, 2020; Chesbrough *et al.*, 2006; Enkel *et al.*, 2009; Greco *et al.*, 2019; Helm *et al.*, 2019). From a strategic perspective, OI may lead to durable alliances, which may even allow establishing industry standards generating durable benefits for the firm (Helm *et al.*, 2019). According to Cassiman and Valentini (2016), selling unutilised technologies through inside-out OI can also free up congested innovation funnels and motivate R&D workers. OI also triggers individual-level benefits, including increasing knowledge and skills (Bogers, 2011; Locatelli *et al.*, 2021), interpersonal ties and professional opportunities (Locatelli *et al.*, 2021). Several studies analysed the factors that enable OI adoption, including an appropriate organisation culture (Alassaf *et al.*, 2020; Barham *et al.*, 2020), an OI-oriented incentive system and the employees' active participation in knowledge exchange (Alassaf *et al.*, 2020), the managerial support to OI and OI training for employees (Barham *et al.*, 2020).

The other side of the coin, unsuccess in OI, has been far less investigated, probably due to firms' reluctance to expose their unsuccess stories, challenges and problems (Tucci *et al.*, 2016). According to the market for technology theory, the transfer process is likely to cause significant transaction costs (Dahlander and Gann, 2010; Helm *et al.*, 2019). Such costs are determined by the need to coordinate different organisations in their joint OI effort and the risk of a counterpart's opportunistic behaviour, which implies protecting the organisational intellectual property (IP) (Cricelli *et al.*, 2021). Consistently, Enkel *et al.* (2009) identified several OI risks, including the possible loss of knowledge, higher coordination costs, loss of control and higher complexity. Similarly, Trkman and Desouza (2012) discussed the knowledge risks that emerge from inter-organisational exchanges, depending on the nature of the collaboration and the network, the proximity among partners, the types of action and the range of risk. In their seminal paper, Dahlander and Gann (2010) discussed the main disadvantages of OI outflows, emphasising the risks of revealing key information that competitors could be better equipped to leverage. In the same vein, Helm *et al.* (2019) emphasised that such outflows may cause the loss of competitive advantage and the suboptimal allocation of R&D resources and entail the risk of opportunistic behaviour of partners or acquirers.

OI may also induce firms to develop new practices to enable collaboration with other organisations, which causes costs (Laursen and Salter, 2014). Such costs can be more significant when a firm collaborates with (or sources knowledge from) many different organisations (Dahlander and Gann, 2010), especially if such organisations have specific corporate cultures, goals and business routines (Greco *et al.*, 2020). Indeed, collaboration with specific categories of partners bears peculiar risks. For instance, in the case of customer collaboration, Enkel *et al.* (2005) listed several risks depending on the stage of the collaboration process in which customers are involved. Firms are likely to need new, specific expertise to manage collaborations, which implies hiring new human resources, training the old ones or adopting new business models and introducing new organisational units (Helm *et al.*, 2019). Especially in larger firms, OI may require fixed costs to set up organisational units to oversee the OI initiatives (Barham *et al.*, 2020).

Salge *et al.* (2013) discussed the different project-level costs that may affect OI, including identification costs (i.e. costs to detect and access valuable external inputs), assimilation costs (i.e. costs to transfer and absorb external knowledge and contrast the NIH) and utilisation costs (i.e. costs to integrate the external knowledge into internal new product development activities and manage the related IP rights). Greco *et al.* (2019) confirmed many of these costs, including those needed to identify and absorb knowledge, negotiate the terms of the

knowledge transfer, develop desorptive capacity (i.e. the capability to identify opportunities for inside-out technology transfer) and protect IP. In fact, IP protection can be a great cause for OI costs, including maintenance fees (Foege *et al.*, 2019), misappropriation (Stefan *et al.*, 2022) and the costs to prosecute patent infringements (Foege *et al.*, 2019). Such costs may not have a merely economic nature. Indeed, they could also be psychological, induced by the fear of control loss, being treated unfairly (Foege *et al.*, 2019) or having a person's professional identity challenged by the paradigm shift (Lifshitz-Assaf *et al.*, 2018). In a recent study, Stefan *et al.* (2022) unveiled the individual-level negative tensions triggered by the OI paradox. They discussed their possible negative consequences in terms of frustration, health and decision-making.

A few studies explored the extent to which OI costs exceed its benefits. Among them, Faems *et al.* (2010) observed that technology alliance portfolio diversity increases costs and has an overall negative effect on profit margin in the short term, suggesting that the cost-increasing effect exceeded the benefits in terms of revenues. Similarly, Belderbos *et al.* (2010) suggested OI's relational costs and value appropriation disadvantages outweigh the savings and value creation advantages. More recently, Cassiman and Valentini (2016) found that firms resorting to both inside-out and outside-in OI are likely to increase their R&D costs disproportionally more than their sales from new products.

2.2 Open innovation hampering factors

An important stream of the literature explored the contingencies that hamper the OI benefits or impede OI from happening. Oumil and Juiz (2016) distinguished between environmental (legal) barriers, managerial and organisational barriers (referred to IP protection, management, communication, organisational and administrative barriers), individual barriers (attitude, commitment and support) and cultural barriers (NIH). Similarly, Bigliardi and Galati (2016) collected and analysed 17 known hindering factors observed in the extant literature. The authors then classified hindering factors into four classes: knowledge barriers (loss of know-how or imitation by competitors), collaboration barriers (opportunistic behaviour or difficulty in finding the right partner), organisational barriers (lack of managerial skills and resistance to change in the organisation) and financial and strategic barriers (economic aspects and lack of strategic vision). Monteiro *et al.* (2016) remarked that the lack of financial resources and qualified human resources and a secretive orientation negatively moderate the effect of OI on innovation performance.

The NIH, which describes the individual or organisational aversion toward ideas, approaches and technologies developed outside the organisational boundaries (Katz and Allen, 1982), is frequently mentioned as an OI hampering factor. However, despite the strong theoretical arguments favouring this thesis, empirical demonstrations have been rare (Antons and Piller, 2015).

The type of partner and the breadth of a collaboration portfolio may play a role in determining the OI initiative's success. Lhuillery and Pfister (2009) found that firms collaborating with competitors and public research organisations were more likely to abandon innovation projects due to mal-functioning in the collaboration dynamics. In another study, Lokshin *et al.* (2011) found that collaboration with customers or suppliers is less likely to experience issues during R&D technological partnerships. More recently, Greco *et al.* (2020) did not find significant differences between partner categories on the likelihood of abandoning innovation projects. Instead, they found that collaboration breadth is associated with a lower abandonment risk.

In one of the most relevant studies on the success versus failure dichotomy in OI, Brunswicker and Chesbrough (2018) observed that failed OI projects were characterised by comparatively higher use of full control (closed approach) over IP in both the definition and

the development phases. They conclude that a selective sharing approach could be important for a project's success. They also found that successful projects have a higher degree of formalisation of processes and outcome control. IP protection strategies require caution since they can concur with the failure of an OI initiative, as shown in Nokia (Ciesielska, 2018). Indeed, in such a case, fruitful knowledge transfer was impeded by internal conflicting views and unclear IP strategy. Dahlander and Gann (2010) also observed that firms might find it difficult to estimate the potential value of out-licensing – a typical OI practice – possibly renouncing fruitful OI occasions. Enkel *et al.* (2009) mentioned several other barriers, including the difficulty in finding the right partner, the imbalance between OI activities and daily business and insufficient resources for OI. Finally, issues emerging in the communication and interaction process between partners are also likely to hamper OI projects (Braun, 2015; Locatelli *et al.*, 2021; Urbinati *et al.*, 2020).

The remainder of the paper aims to contribute to the state of the art by extending the understanding of OI pros, cons and hampering factors.

3. Methodology

3.1 Dataset

This study focused on a sample of Italian SMEs operating in the manufacturing industry, which is frequently studied in the OI literature (Obradović *et al.*, 2021). We initially contacted 73 firms that did respond to both waves (2016 and 2020) of the survey ("[*Name and reference anonymised for blind-review purposes*]") on OI activities. Such firms were initially drawn from the population of the manufacturing firms in Southern Lazio and Northern Campania, an area densely populated by manufacturing SMEs that compete on national and international scales. Of these, 23 agreed to an in-depth interview. To ensure theoretical saturation (Eisenhardt, 1989) and enhance the robustness of our results, we extended our main sample with an additional convenience sample of manufacturing firms operating in similar sectors to the initial sample and neighbouring geographical areas. Since four additional interviews did not challenge nor extend the findings we had collected in the main sample, we considered the theoretical saturation achieved and interrupted the search for additional interviewees. Interviews were performed from May to July 2021.

The final sample size of 27 interviewees is within the permissible range of 15 samples (Mason, 2010) and in line with previous studies constituting good practices in thematic analysis (TA) (Alaassar *et al.*, 2020; Roberts *et al.*, 2021; Urbinati *et al.*, 2019). Specific features of the companies interviewed are presented in Appendix (Table A1).

3.2 Methods

This study employed a multiple case study design to investigate the subtleties and depth of the phenomena under examination in a natural setting. This strategy aims to establish how phenomena arise in an organisational field (Aberdeen, 2013; Tavoletti *et al.*, 2021). The qualitative case study method is also recognised as the most relevant approach to theory formation through observation of constructs that emerge in real-world applications, especially for new topics (Edmondson and Mcmanus, 2007; Eisenhardt, 1991).

We prepared a semi-structured questionnaire to support the interviewing process, including 14 questions (Appendix). Similarly to Bagherzadeh *et al.* (2021), who requested managers to assess one project of their choice, and to Brunswicker and Chesbrough (2018), we asked respondents to choose one successful and one unsuccessful project. Notably, seven interviewees were unable to identify an unsuccessful project, which brought us to obtain 20 matched pairs of success vs unsuccessful projects, which constitute our units of analysis. We maintained the seven single-sided interviews in our sample to obtain additional insights into their perception of their OI projects' success, risks, triggers and setbacks.

At the beginning of the interview, we asked each participant permission to record the dialogue and proceed with a transcription. Digital platforms were used to conduct the interviews (e.g. Google meet, Zoom, etc.). They lasted from around 30 min to just over 2 h.

To understand OI's main risks and failures, we resorted to TA to systematically find, organise and explain patterns in our dataset (Braun and Clarke, 2006). A theme refers to some key notions related to the research questions that represent a level of structured significance within the data collection. The protocol adopted to conduct the TA is inspired by previous studies (Aberdeen, 2013; Delgosha *et al.*, 2021; Nowell *et al.*, 2017) and consists of the five steps presented in Figure 1.

In the first phase, the data from the interviews were transcribed verbatim and then triangulated among the informants to guarantee their authenticity. The recordings were listened to multiple times to become familiar with the subject. Then the transcripts were open-coded, which involved documenting all relevant codes for the research themes.

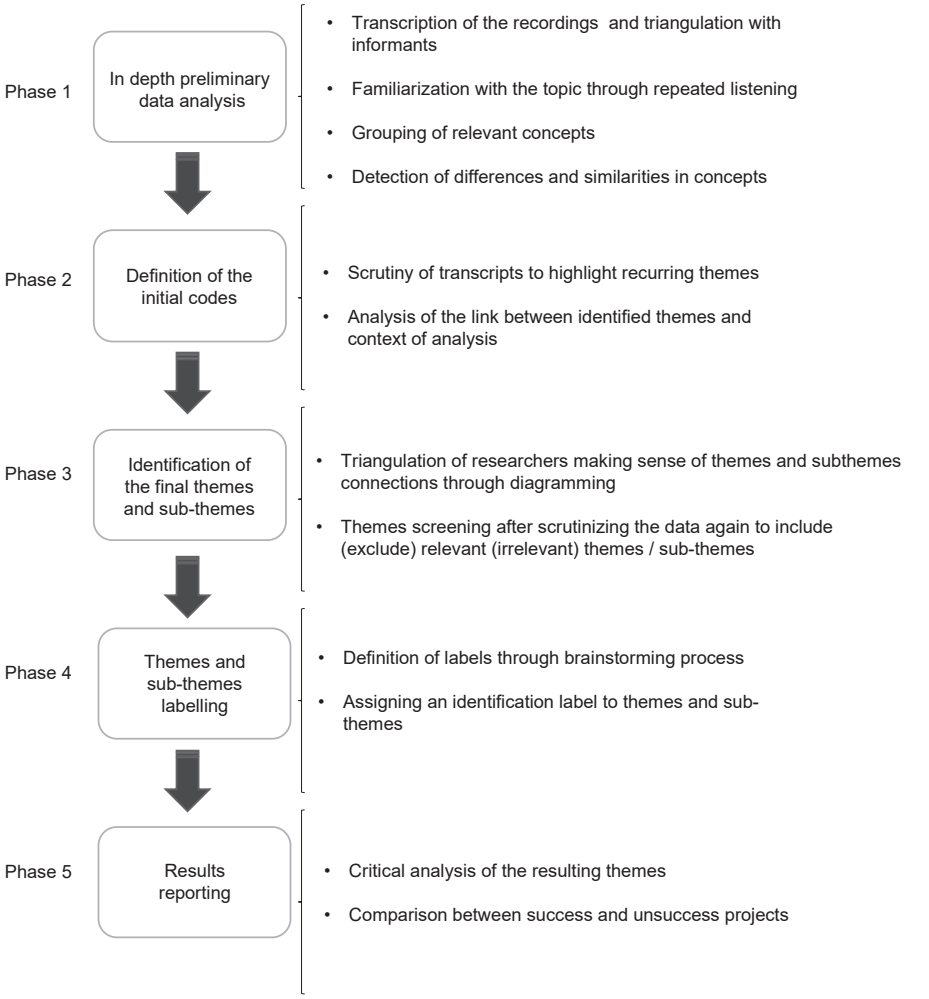


Figure 1.
Thematic analysis protocol

The significant similarities and contrasts between the macro-concepts revealed were highlighted as a result of this procedure. In the second phase, we reviewed the transcripts and established tentative codes for the recurring themes. In the third phase, a triangulation process involving three researchers was performed based on the primary codes detected. Two researchers identified themes and the sub-themes associated with each transcript. These themes and sub-themes were then subjected to a third researcher's analysis to determine the final themes and sub-themes. Furthermore, to ensure the coherence of the themes and sub-themes, we then went back on the transcripts of the interviews to exclude (include) irrelevant (relevant) themes mistakenly included (excluded) due to the subjectivity of the researchers' perspectives. In the fourth phase, we assigned each identified theme and sub-theme an explanatory label defined by brainstorming involving the three researchers. Finally, the fifth phase entailed critically analysing the resulting themes and comparing successful and unsuccessful projects.

4. Results

4.1 Descriptive results

We analysed both cases of successful and unsuccessful OI to distil key differences and similarities. Table 1 presents an overview of the five main themes, sub-themes and dimensions we identified. We categorised the projects according to the degree of technological intensity of the interviewed firms, based on Eurostat's classification of manufacturing NACE sections (Eurostat, 2017). We found common pathways related to the companies' risks and failures in OI projects, depending on the technological level, type of partners and financing source.

More than 50% of the projects were funded internally; high-tech and medium-high-tech companies almost always relied on public funding, while less technologically intense projects tended to be funded privately. However, the comparison between successful and failed projects, classified according to firms' technology intensity, does not show apparent differences (Figure 2).

Regarding the type of partners, more than 60% of the companies collaborated with customers and partner companies, 30% with suppliers and universities and research centres, 11% with external consultants and 7% with public organisations. Collaboration with universities and research centres has been more frequent for higher technology intensity levels (high tech and medium high tech). Figure 3 compares the type of partners chosen for successful and failed projects according to the firms' technological levels. Interestingly, successful cases have greater partners' heterogeneity.

The remainder of the results section discusses the collected evidence more in-depth according to the five themes.

4.2 Success vs failure

We allowed the interviewees to choose their success and failure cases freely. Therefore, we could identify how such a distinction can be quite subjective. Table 2 summarises the results according to four sub-themes, using dots and heat-diagram combined to better visualise the information. It is apparent how the relevance of enhanced know-how as a success factor grows with firms' technology intensity. In contrast, customer satisfaction is considered comparatively more important in lower-tech firms. Furthermore, short-term economic success has been discussed much more frequently in low-tech firms than in high-tech ones. The results are discussed more in-depth in the remainder of the section.

4.2.1 Successful projects. Success cases can be associated with developing a prototype, regardless of its commercial success, due to personal gratification and the development of new knowledge and competencies. One interviewee emphasised these aspects effectively *"This innovative product fascinated everyone; it also made us win an award in England. [. . .] It*

Themes	Subthemes	Items
Success of an OI project	Economic	Increase in turnover
		Increase in margins
		Cost reduction
		Increase in sales
	Business	Victory of public tender
		Expansion of the network of relationships
		Profitable use of human resources
		Entry into a new market segment
		Ensuring work for employees
		Increased market share
		Expansion of the product catalogue
	Customer	Customer loyalty
		Customer satisfaction
		Customers' Problems solving
		Acquisition of new customers
	Know-how	Know-how expansion
		Generation of technological fallout/innovative solutions
		Patent filing
Risks of OI	Technical issues	Failure from a technical point of view
		Unavailability of own resources
		Inability to find a suitable partner for the project
		Loss of IP
		Loss of competitive advantage
		Inability to complete the project
		Inadequate technological level
		Communication needs
		Data acquisition and control needs
		Emulation of the idea
		Sustainability of the innovative idea in the future
		Decrease in reputation
		Blurring charm of the initial idea
	Internal coordination	Difficulty in adapting the business model to the rules of collaborative innovation
		Poor control of internal resources
		Employee overload
		Understand the attitude of employees to innovation and collaboration
		Difficulty/slowness in adapting employees to the OI paradigm
		Real possibility of giving and receiving a contribution also in terms of knowledge
		Human resource inexperience in a new market segment
		Lack of internal organisational perspective
		Lack of employee involvement/commitment
	External coordination	Difficulty of coordination in collaborative innovation activities
		Difficulty in managing relationships with partners
		Partners with a low level of experience
		Interests in conflict with partners
		Interests in conflict with partners
		Dependence on partners
		Lack of trust in partners
		Poor knowledge of partners

Table 1.
Themes and sub-themes

(*continued*)

Themes	Subthemes	Items
	Economic and market	Loss of part or all the capital
		Dynamism of the market
		Overall economic impact
		Timing of payments concerning cash outflows
		Business
		Financial
		No need in the market
		High project coordination costs
		High transaction costs
Triggers of an OI project	Strategy oriented	Expand the network of collaborations
		Lack of internal know-how
		Share the risk (S)
		Internalise a process carried out in outsourcing (F)
		Receive public funding
	Market-oriented	Expand the market share
		Anticipate possible future trends
		Increase visibility (S)
		Entering a new market segment
		Intercepting new business opportunities
	Customer-oriented	Consolidation of the relationship with the customer (S)
		Increase social awareness (S)
		Promote new customer models
		Respond to customer needs
	R&D and technology-oriented	Development of new patents
		Charm of the idea (F)
		Research new technological/sustainable trends
		Develop novel know-how
		Develop innovative products
		Valuing IP (S)
	Productivity oriented	Improve product quality (F)
		Reduction of product realisation times (S)
Setbacks in OI projects	Inadequate competences	Poor partners' relational skills
		Poor partners' technical skills
	Lack of organisation	Settlement phase to acquire the logic of the new market in which the company has entered (S)
		Absence of coordination
		Poor supply chain management
		Lack of leadership (F)
		Difficulties in the transition to an open approach (F)
		Absence of coordination
		Timetable for participation in tenders
		Delays in the completion of projects (S)
		Non-compliance fixed deadlines
		Difficulties in choosing the right partner
		Lack of investment to support the project (F)
	Lack of interaction	Disappointing interaction with partners (S)
		Different working methods of the partners (S)
		Poor communication
		Poor definition in the specification phase
		Lack of motivation to carry out the project (F)

(*continued*)

Table 1.

Themes	Subthemes	Items
		Distrust of the real applicability and remuneration of the project (F)
		Excessive number of partners involved (F)
	Technical difficulties	Bureaucracy
		Wrong technical design
		Timing in obtaining payments
		Bureaucracy
		Regulatory gaps (F)
		Obtaining certifications (S)
		Obtaining scientific validations (S)
		Technical ineffectiveness of the solution provided (F)
		Blockages due to unforeseen events (Covid) (S)
		Deviation of the project towards unwanted technology/ product
Causes of failure/ abandonment (F)	Linked to skills	Inexperience in the sector
		Lack of leadership ability
		Inexperience in public tenders
		Lack of experience/knowledge of OI methods and tools
	Linked to partnerships	Opportunistic behaviour of partners
		Bankruptcy of the partner company
		Difficulty in finding an adequate partner for idea development
		Inadequate chosen partner
		Splitting of the collaboration
		Misunderstandings with the partner
		Partners' distrust of the idea
		Low skills partner company
		Ineffective collaboration
		Poor commitment/involvement of the partner
	Linked to project management	Loss of public tender
		Failure to obtain funds
		Failure to submit the project within the set deadlines
		Ineffective risk analysis
		Time dilation
		Lack of feedback and project monitoring systems
	Linked to economic issues	Economic feasibility/sustainability of the product or technology
		Failure to market
		Ineffective cost/benefit analysis
		Loss of competitive advantage
		Ineffective market analysis
		Lack of investment
		Incorrect investment analysis
		Ineffective market analysis
		Incorrect budget analysis
		Cost increase
		Low sales
		Poor appeal of products in the area
		Scarcity of economic resources

Note(s): Items related only to failed/abandoned projects are labelled with (F); items related only to successful projects are labelled with (S)

Table 1.

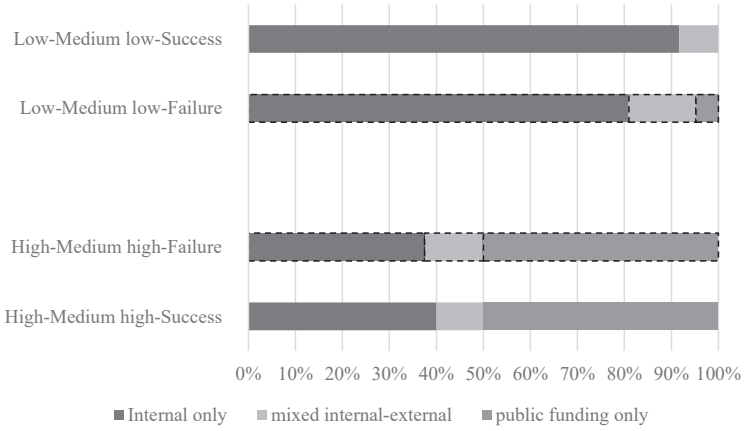
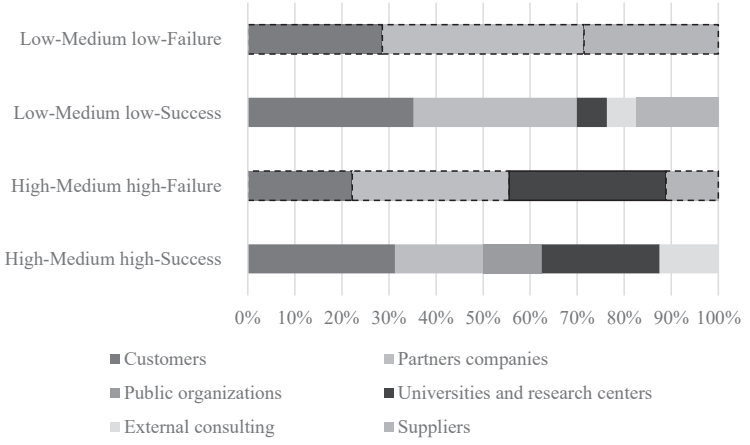


Figure 2.
Type of financing in failure/success OI projects



Note(s): The bars describing failure projects are emphasized through dashed outlines

Figure 3.
Type of partners in failure/success OI projects

Subthemes	Companies' degree of innovativeness Low-tech	Medium-low tech	Medium-high tech	High-tech
Business	••	•	•••	•
Customer satisfaction	••	••	•	•
Know-how	•		••	•••
Economic	•••	••	••	•

Note(s): •, low level, less than 33% of the interviewees of the technological sector refer to the sub-theme; ••, medium level, 34–66% of the interviewees refer to the sub-theme; •••, high level, more than 66% of the interviewees refer to a specific sub-theme

Table 2.
Theme: success of an OI project

is a product that everyone likes but nobody buys. For this, I have learned to measure success based on the approach to find a solution to new problems. [. . .] Our satisfaction, on the other hand, comes from calls from customers who have to solve problems but do not know how to do it, and we help them develop products that allow them to start a job" (Owner, Company 19). Other interviewees insisted on the development of know-how: *"My perception of success includes that the funds are obtained, that there is a development of know-how and innovative products or solutions that are also useful for the future. There are many projects in which economic success is achieved, but then, in fact, the technical result is zero or almost zero"* (Manager, Company 22). *"To understand the extent of the success of an OI project, I look at the human resources employed to carry out the project over time. An important project requires the use of skilled and additional resources compared to those usually present in the company staff, and I proceed in this way for all demanding and technologically advanced projects"* (Manager, Company 20).

However, in other cases, interviewees remarked on the importance of an increase in turnover to consider a project a success: *"I measure success based on the increase in turnover for sure. "*(Manager, Company 14). Another interviewee emphasised the importance of accessing new markets, regardless of the short-term revenues: *"If I wanted to evaluate the success of the development of the new software based on the turnover, I would say that it was a failure, but it is also true that at the time I was already expecting it and I decided to implement it following other types of evaluations. I aimed for revenue in the years to come when I would have used that software for other customers. So, the dimension I was looking at was opening up to new customers"* (Owner, Company 23).

Another group of interviewees considered those projects that obtained public funding as successful. On the one hand, these projects represent a challenge due to the complexity and number of partners. On the other hand, they are an opportunity to expand the network, the know-how and the profitable use of internal resources. One interviewee effectively described this position: *"First of all, if the project goes through, if it reports well if the financing is obtained and the tender is won . . . these are already elements of success. Then even if you manage to file a patent, because this attributes value to the company that is recognised from the outside so that marketing can take a targeted action of recognition of the results achieved"* (Owner, Company 27). Another interviewee emphasised the good outcome of their project: *"It was a highly successful project because we were led by the international team and even finished before the time of the research project with Mise. We also obtained the requested funds, which were almost sufficient to pay the costs"* (Manager, Company 22).

Finally, many managers saw customer satisfaction as the key to success, which allows for loyalty and an improvement in the company's reputation. *"Surely the degree of customer satisfaction and loyalty is the priority dimension for measuring success. Very often we find ourselves confronted with competitors bigger than us, but as I said before our strengths are the strong customisation offered to customers, competitive prices, and quality"* (Manager, Company 8). *"Today, value is more important for a company than profit because value is key to a company's survival in the medium-long term. We must try to establish a good relationship with customers, we must retain them, try to satisfy their needs, and the same is also true with suppliers. We try to establish a good relationship so that if there are any problems, we can discuss them"*. (Manager, Company 12).

4.2.2 Unsuccessful projects. Many of the failure cases were OI projects that have been ultimately abandoned before completion. For example, *"I have always found myself faced with companies that claimed that the project was interesting, but that still wanted to be paid for carrying out the activities, so they were not willing to co-invest, they were acting as suppliers and not as partners. And this was a major limitation that led to the abandonment of the project"* (Owner, Company 24).

However, some managers were not satisfied with the mere development of a prototype and considered the project a failure when it did not have commercial success. *"We made*

prototypes, and these have allowed us to develop scientific research. However, they have not yet resulted in concrete applications for specific customers, so this in some way is a failure because in any case, it has not led to the realisation of commercial opportunities" (Owner, Company 1). "*We expected that such an innovative and efficient product would have had great success. Instead, it was a success in terms of the idea but not in terms of sales"* (Owner, Company 27).

We observed some reluctance when dealing with failures. Seven interviewees declared that they had no unsuccessful OI projects to discuss: "*[. . .] I could not say that we experienced failures. There are activities that we carry out somewhat slower because others prevail"* (Owner, Company1). Other interviewees struggled to consider the project as a failure, emphasising the temporary nature of its stand-by: *"This is a project that was not a failure but was short-lived. Indeed, it was interesting, it was liked, but it did not grow. It was born on our initiative of the partners, we found some partner companies, we developed it in just four months, but then the application on the market was unsuccessful" (Owner, Company 24).*

Several interviewees considered unsuccessful those projects that did not obtain public funding, as in this case: "*Unfortunately, however, there was the problem of non-submission of the project within the established deadlines, which are very strict terms from the point of view of time, of characteristics that in my opinion should be changed, because they do not assess the merits of the project*" (Owner, Company 10).

4.3 Risks of open innovation

Risks have been distinguished in four subthemes: technical issues, internal coordination, external coordination, economics and market (Table 3). During the interview, respondents could share their views on OI risks without necessarily linking them to the specific success and failure cases. Hence, this section is not bipartite as the others.

We found that high-tech firms perceive technical issues and external coordination as more worrying risks in OI, whereas low-tech firms are more worried by internal coordination difficulties. Finally, medium-low-tech firms frequently mentioned risks associated with economics and the market.

In OI projects in the high and medium high-tech sector, the risk of loss of IP is not contemplated, and typically the risk of dependence on partners is also well managed. The greatest risks are linked to coordination among partners and to the technical problems that may emerge in public tenders: *"Beyond the financial risks, there are risks associated with the specifics of the system which constitute a series of particularities that are not simple. The problems could be many because there is communication and data acquisition, while the need to control the companies with which we collaborate is often not evaluated in the planning phase"* (Owner, Company 1). "*Among the main risks, the project will fail if the external contribution does not support you in the right way. A little synergy between the external study and the company is necessary, but often what occurs is not being able to find this valuable help from the outside*" (Manager, Company 15). While high-tech firms displayed no fear regarding IP,

	Companies' degree of innovativeness			
Subthemes	Low-tech	Medium-low tech	Medium-high tech	High-tech
Technical issues	•	•	•••	•••
Internal coordination	••	••	•	•
External coordination	•	••	•••	•••
Economics and the market	••	•••	••	••

Note(s): •, low level, less than 33% of the interviewees of the technological sector refer to the sub-theme; ••, medium level, 34–66% of the interviewees refer to the sub-theme; •••, high level, more than 66% of the interviewees refer to a specific sub-theme

Table 3.
Theme: risks of OI

thanks to their systematic use of IP protection mechanisms (including contracts and non-disclosure agreements), low-tech firms did not even mention IP.

Other relevant risks pertain to the economic and market area: financial planning is not easy and exogenous variables can block the expected resources. Therefore, evaluating the economic impact of the OI project well in advance is an essential prerequisite as highlighted as follows: *"The main risk is the economic risk, therefore making an investment that may not give the desired and expected results. Secondly, it is necessary to understand if the project can be completed or not. Indeed, if you implement a project and then, halfway through it, you realise that it cannot be completed, there is a waste of resources, money, and time. It is always more advisable to carry out a thorough investigation initially [. . .]. So, I think the preliminary study phase is the most important one"* (Owner, Company 9).

For those companies producing consumer goods – whose margins are low – the main risk is not being able to launch the new product or service resulting from the OI project. Companies experience higher failure rates when transforming their business models. Furthermore, especially in a turbulent environment, OI partners may back out from the project, bearing the risk of compromising it. A set of the main risks is effectively summarised as follows: *"Some events cannot be foreseen and involve lengthening of the times, and this is the risk that occurs most frequently; secondly, other risks are the failure to achieve the desired results and the lack of communication. Finally, there is a reputational risk: if you declare that you will achieve results which then fail, you risk compromising the image of the company and therefore losing credibility"* (Manager, Company 18).

4.4 Triggers of an open innovation project

The main levers that push firms to implement an OI project pertain to five sub-themes: strategy-oriented, market-oriented, customer-oriented, R&D and technology-oriented and productivity-oriented. Successful projects seem more frequently triggered by R&D and technology-oriented motivations (for high-tech companies) and by customer-oriented motivations (for low-tech companies) (Table 4).

		Companies' degree of innovativeness			
	Subthemes	Low-tech	Medium-low tech	Medium-high tech	High-tech
Successful OI projects	Customers-oriented	●●●	●●●		●
	Market-oriented	●	●	●●	●
	Productivity-oriented	●			
	R&D and technology-oriented	●	●	●●●	●●●
	Strategy-oriented	●			●●
Unsuccessful OI projects	Customers-oriented	●		●●	
	Market-oriented	●●			●●
	Productivity-oriented	●	●		
	R&D and technology-oriented	●●	●	●●	●●
	Strategy-oriented	●	●		

Note(s): ●, low level, less than 33% of the interviewees of the technological sector refer to the sub-theme; ●●, medium level, 34–66% of the interviewees refer to the sub-theme; ●●●, high level, more than 66% of the interviewees refer to a specific sub-theme. A cell with no dots indicates that no interviewee mentioned the subtheme

Table 4.
Theme: triggers of an OI project

4.4.1 Successful projects. Successful projects entailed motivations including strategy and technological development aimed at creating radical innovations. One interviewee emphasised the technological trigger of their project in the high-tech sector: *"[. . .] the will to respond to technological requests, because we had the international team that wanted to carry out this very ambitious and innovative project, as high-risk as possible."* (Manager, Company 22). Another interviewee insisted on the driving force of technology in triggering the OI project: *"The lever of this project is the creation of a prototype of an innovative re-entry capsule from space"* (Manager, Company 10).

In the same vein, OI projects in medium-high-tech firms aimed to develop new technologies and anticipate possible future trends while keeping an eye on increasing market share and entering new market segments, as can be seen from the following quotations. *"The main reason is to be ready on the market for what will be the new technologies and new trends of the future, especially in such advanced areas as aerospace, where the future is already in our office"* (Manager, Company 20).

A different trend can be seen for successful OI projects implemented by low-tech and medium-low-tech companies. These projects have a strong customer orientation linked to better understanding the customers' needs and solving their problems, as the following quotations exemplify. *"Knowing this problem, this customer asked for a solution, and we developed it*" (Owner, Company 19). *"We were the ones who went to new customers, stating that we were aware of their problem and that we could solve it"* (Owner, Company 4). In the same vein, consolidating the supplier–customer relationships is also very important: *"It is clear that when an explosive new innovative product can be developed between customer and supplier, a much more intense relationship is created for the future as well"* (Owner, Company 3).

4.4.2 Unsuccessful projects. Unsuccessful projects in the high-tech sector also often aimed to develop new technologies while having a significant market orientation. *"The project was born from an internal idea [. . .] when the electric began to have its space as electric mobility. We wanted to enter this channel [. . .], but we wanted to create our own patent that we could manage independently to ensure that the small user could access a non-consumer product. Unfortunately, we were inexperienced in competitions and did not get the funding"* (Manager, Company, 13).

The failed projects of the medium high-tech sector also had a technological characterisation but were strongly linked to the satisfaction of the customers' requests. "*We decided to undertake this project to meet the request of a customer. It was a nice project for a car park of a hotel that we did not realise because we were not competitive with the price*" (Manager, Company 15).

In contrast, we observed a more heterogeneous focus on productivity, market, technological development and strategy change factors in low-tech and medium-low-tech failed projects.

4.5 Setbacks in open innovation projects

Table 5 describes how the setbacks occurred in successful and unsuccessful OI projects.

While the situation is more difficult to read than in previous synoptic views, a few results stand out. Among them, high-tech firms frequently experienced interaction difficulties in their OI projects, but this issue was resolved and did not impede success. Differently, the lack of organisation in high-tech projects – matched with technical difficulties – challenged many projects. Interestingly, medium-low-tech firms also often experienced interaction difficulties, albeit, in their case, the issue appeared in unsuccessful OI projects.

4.5.1 Successful projects. In the high-tech sector, referring to projects involving international teams, the interviewees described a good interaction with the partners, but not without difficulties. The main critical issues are related to interaction difficulties with the partners. On this topic, one interviewee affirmed: *"Just think of having to organise meetings between Canadians and Chinese, who have 16 h of the time difference, and us. Another practical problem*

was transport, which implied sending items to countries with duties and tariffs. Another problem was having to talk to people who have different habits." (Manager, Company 22) *"Specifically, in collaborations with partners, most of the time there are risks related to communication problems. The customers very often do not know what they want when they make a request. Therefore, there's the risk to define product specifications that do not precisely cover the customers' needs"* (Manager, Company 8). Consistently, another interviewee highlighted collaboration problems with international partners caused by differences of views, mentality and approaches to work. Referring to the collaboration with an Israeli company, he said: "*They have a different way of perceiving work, just think that they close on Fridays and work on Sundays. Furthermore, they are very direct, and there is no diplomacy, neither between managers nor between employees*" (Owner, Company 10).

The medium-high tech companies have shown slight problems linked to organisational aspects. In particular: *"We did not encounter particular problems except from the point of view of the timing necessary to obtain the authorisations"* (Manager, Company 15). Successful projects of medium-low-tech companies, on the other hand, highlighted interaction problems with partners: "*The most difficult thing is to communicate to the customer that there are limits that cannot be exceeded, that is, technological or at least economic limits. Obviously, everything is possible, but everything has a cost, and often this is not recognised because there is ignorance about the technology that you are addressing*" (Owner, Company 19).

As for the successful projects performed by low-tech companies, these problems are often related to technical difficulties and concern the planning and prioritisation of activities to meet certain requests and urgencies. In this regard, one interviewee said: "Urgencies from multiple customers imply that different urgencies need to be managed simultaneously. Carrying out a production plan and managing urgencies is not easy. If we have already started a production process and need to manage urgencies, it must be interrupted, which entails slowdowns. After all, it is necessary to change the format of the piece, the setting of the machine, the specialised operator, etc." (Manager, Company 25).

4.5.2 Unsuccessful projects. The main problems that occurred in unsuccessful OI projects in the high-tech field are technical and organisational. Medium-high-tech companies' projects experienced organisational problems, while issues in the interaction with partners challenged medium-low-tech ones. Finally, for the failed projects of low-tech companies, the issues are heterogeneous, linked to interaction, technical problems and scarce skills. Since these setbacks often triggered the failure of the OI project, we discuss them in the next section, which describes what the interviewees perceived as the failure causes.

Table 5.
Theme: setbacks in OI projects

		Companies' degree of innovativeness			
	Sub-themes	Low-tech	Medium-low tech	Medium-high tech	High-tech
Successful OI projects	Interaction difficulties	•	•	•	•••
	Inadequate competences			•	
	Lack of organisation	•	•	••	••
	Technical difficulties	••			•
Unsuccessful OI projects	Interaction difficulties	•	•••		•
	Inadequate competences	•			
	Lack of organisation			••	•••
	Technical difficulties	•	•		••

4.6 Causes triggering the failure/abandonment of open innovation projects

We asked interviewees the causes that determined the outcome of their unsuccessful OI projects. Table 6 summarises the main results. The causes of abandonment/failure of OI projects have been categorised into four different areas: related to skills, partnerships, project management and economic aspects. Economic issues emerge as a foremost failure cause in most cases (for low, medium-low and medium-high tech firms). In contrast, partnership and project management issues hampered the OI projects of higher technology companies particularly.

Companies in the high-tech sector experienced unsuccessful OI projects due to poor project management or lack of organisation. We observed several cases where firms went out of business and had to quit the project. This phenomenon signals a lack of caution in the initial phases of the OI project during the selection of partners. The exclusion of a partner from a project generates numerous problems, including the need to change the project itself, which usually takes more time and, in the worst cases, leads to the abandonment/failure of the project. Two interviewees described different issues related to bad project management: "*After the first year, one of the companies involved had financial issues [. . .] then that project stopped for two years, during which we had to contact the Ministry to re-modulate the proposal, we took the activities of the other company and now we are waiting to be able to restart*" (Manager, Company 13) *"[. . .] We also had a phase of collaboration with the National Research Centre on this abandoned project because we participated in a call for a contribution. Still, we could not obtain the funding due to a bureaucratic issue determined by incorrect project management. Therefore, the project remained in a pre-competitive stage."* (Owner, Company 10). *"It was a fairly innovative project, also related to the specific moment of the covid and the sensitivity of the operators. But then, after a short time, this sensitivity subsided. So, we thought it best to put it on stand-by. It would have been necessary to carry out a more in-depth market analysis which would have avoided the negative outcome"* (Manager, Company 8).

Companies in the medium high-tech sector are more likely to experience failure due to poor project management and inadequate market analyses focused on the short term only. Not carrying out effective planning and not having an adequate scale plan caused several OI projects to fail. As two interviewees posed: *"I believe that if a more in-depth market analysis had been made, the project could have had a different outcome"* (Manager, Company 15). "*Probably the preliminary risk analysis phase was bypassed by the charm of the idea. When you fall in love with your ideas, you make mistakes, and you learn that by making mistakes. In fact, there was no risk planning. Especially what was lacking was the analysis of the market because there was the enthusiasm for a first-time product, a product that we expected to work better*" (Owner, Company 27).

The main causes of failure of OI projects in medium-low tech companies are related to inadequate skills and economic issues. Often, companies are not adequately prepared from a

	Companies' degree of innovativeness			
Subthemes	Low-tech	Medium-low tech	Medium-high tech	High-tech
Linked to skills	•	•••		•
Linked to economic issues	•••	•••	•••	•
Linked to the partnership	••	••	••	•••
Linked to project management		•	•••	••

Note(s): •, low level, less than 33% of the interviewees of the technological sector refer to the sub-theme; ••, medium level, 34–66% of the interviewees refer to the sub-theme; •••, high level, more than 66% of the interviewees refer to a specific sub-theme. A cell with no dots indicates that no interviewee mentioned the subtheme

Table 6. Summary of causes triggering the failure of an OI project

technical point of view or are inexperienced. These factors, matched with a poor economic/market analysis, led OI projects to fail. Quoting an interviewee: "*The main problem was not having a combination of skills suited to making the right decisions. The project started from the dream of some friends, but that's not how you do business. There were too many people not experienced in the sector*" (Manager, Company 21).

In OI projects in the low-tech sector, the cause that most frequently generated the failure/abandonment was the poor market analysis. *"Technically, the project was finished, the product was created, and it is pleasant, the problem was the high cost, which had a significant impact [. . .]. The project was successful, from the point of view of functionality, we made prototypes and tests, but then in the implementation, we realised that we had to abandon"* (Manager, Company 16).

5. Discussions

This study adopted an inductive approach to defining themes and sub-themes independently from the extant literature to limit the confirming bias as much as possible and increase the chances of identifying new, valuable insights about OI and failure. This section seeks to harmonise our findings with previous research, emphasising the confirmed and surprising results.

5.1 The fine line between success and failure

When we conceived the title of this article, we had in mind the nuances that could determine the success or failure of an OI project. However, soon after the initial interviews, we realised that exists an even finer line: it separates the perception of success from failure. Previous econometric studies often approached innovation failure as a discontinued or suspended innovation project (e.g. D'Este *et al.*, 2016; Leoncini, 2016; Tranekjer, 2017). However, our results showed that such a view is too narrow since even a successfully developed prototype may or may not be a "success". Indeed, we observed that some interviewees marked a prototype with little commercial value as a success – due to the development of new skills and technologies that could be useful in the future – while others deemed the commercial unsuccess as a cause to consider the OI project a failure. The interest towards the (possibly future) knowledge externalities generated by a failure is consistent with the literature discussing how the setbacks occurring during the innovation activities can be very valuable to learning (Baum and Dahlin, 2007; Cannon and Edmondson, 2005; D'Este *et al.*, 2012; Madsen and Desai, 2010; Miner *et al.*, 1996). Interestingly, we observed that nurturing the firm's know-how is an important part of a project's success for high-tech firms. This result can be justified considering the knowledge-intensive nature of high-tech firms.

Perhaps the paradoxical relationship between failure and future success and the fine line separating one from another can justify many interviewees' reluctance to identify failure OI projects at all. Such reluctance was also mentioned by Tucci *et al.* (2016). Cognitive biases may also play a role, especially on discontinued projects that the interviewees considered temporarily suspended. Among such biases, escalation of commitment (Behrens and Ernst, 2014) – which describes the decision-makers' propensity to insist on an innovation project despite the negative signals – certainly stands out. In this context, we also observed that – among those that recognised a failure – many did so thanks to a third party's unfavourable judgement (e.g. in the case of projects submitted to public calls that were not awarded the funding). This suggests that, in many cases, a perceived failure could be summarised as follows: it is not a failure unless they tell you so.

5.2 Hampering factors

Even though risk-taking is unavoidable when running a firm, risk assessment may induce renouncing possible business opportunities, including OI projects. Our interviewees reported

different perspectives on the OI risks, most likely depending on their different technological intensity.

Indeed, on the one hand, we observed that high-tech firms perceive technical issues and external coordination as more worrying risks in OI. Such an approach is consistent with the probable higher complexity of their projects, which involve radical innovation and a wider number of partners in the project team and are more likely to fail than others (D'Este *et al.*, 2016; Kristiansen and Ritala, 2018). This result is also consistent with Bigliardi and Galati (2016), who discussed that the knowledge-intensive firms in their sample were particularly worried about the knowledge barriers (including the risk of loss of know-how, the availability of relevant knowledge and the imitation risk).

On the other hand, low-tech firms perceive internal coordination difficulties as more pressing risks. This is consistent with a likely lower absorptive capacity, which is more developed in firms that invest in R&D more (Lane *et al.*, 2006) and have experience in OI (Vanhaverbeke *et al.*, 2008). This result is also in-line with Bigliardi and Galati's (2016) findings. Indeed, they discussed that less innovative firms recognised the collaboration and organisational barriers more.

The interviewees did not seem particularly worried by IP issues. While high-tech firms mentioned the possible risk but emphasised that their use of contracts such as non-disclosure agreements made them feel safe, the issue was not on the radar at all for low-tech ones. The use of IP protection mechanisms discussed in the former case confirms their importance to enable OI (Hagedoorn and Zobel, 2015; Veer *et al.*, 2016). The lack of attention to IP risks is consistent with the literature, as knowledge barriers (which encompass the loss of know-how and imitation) were also neglected in low-tech firms in Bigliardi and Galati's (2016) study.

5.3 What does determine the success and unsuccess of an open innovation project?

Being off to a good start is desirable for any project. Our results showed that some OI projects' motivations are more frequently associated with a successful outcome than others. Such evidence depends on firms' degree of innovativeness. Indeed, while R&D and technology-oriented motivations triggered high-tech successful projects more frequently, customer-oriented motivations are associated with low-tech firms' successful projects. The latter result could be read as a willingness to obtain short-term revenues in response to customers' solicitations. Consistently, Dziruski and Sopińska (2020) found that the OI activities of non-high-tech firms were significantly more driven than high-tech firms by the opportunity to increase revenues from innovation. The result also echoes van de Vrande *et al.* (2009), who discussed how market-related motives (including meeting customer demand) are prominent OI driver in SMEs, and Galati *et al.* (2016), who emphasised the paramount role of consumers in a low-tech industry's OI activities.

Our results also suggest that high-tech firms' OI projects should not be led by customer orientation primarily. This result is not unprecedented. Indeed, Knudsen (2007) found that customer involvement harmed innovation performance, suggesting that customers may not be able to trigger radical innovations that go beyond the realm of their experience. Hence, high-tech firms' innovativeness could be constrained by too much reliance on customers' views.

Economic issues emerged as a foremost failure cause in most cases (for low, medium-low and medium-high tech firms). Such a broad theme includes multiple sub-themes such as the economic feasibility of the product, mistakes in the cost/benefit analysis, incorrect budget forecasts, failure to market the products and the funds' unavailability. Instead, partnership and project management issues hampered the OI projects of higher technology companies particularly.

Interaction difficulties are a typical OI setback, which was frequently discussed by high-tech and medium-low tech companies. While the former could deal with such difficulties and ultimately achieve project success, the latter often mentioned the issue as a driver of projects' failure. Some of this difference could be explained by the fact that high-tech companies often participated in publicly funded projects, whose structure brings partners to commit to the project more since otherwise the public funds can be lost. Such a conjecture is supported by recent evidence on how public subsidies can improve OI efficiency, helping companies obtain better innovation outputs starting from similar inputs (Greco *et al.*, 2017). Consistently, several high-tech failure cases are more related to project management issues that compromised such public funding.

Interestingly, when one or more partners opted out from a project or demonstrated a lack of competence, our interviewees blamed the inaccurate due diligence that allowed involving unreliable partners in the early stages of the project. This points to the importance of partner selection, an important but still under-researched topic in the OI literature (Guertler and Sick, 2021; Slowinski and Sagal, 2010). Related to this is the importance of trust among the partners, which contrasts opportunistic behaviour (Bunduchi, 2013; Kale and Singh, 2009) and is nurtured when partners collaborated on previous occasions (Messeni Petruzzelli, 2011).

6. Conclusions

This study analysed the risks, triggers, setbacks and failure cases of OI projects, adding to a growing number of studies approaching the "dark side of OI" to identify OI's costs and the causes for the failure of innovation projects. This article contributes to such an emerging stream of the literature in multiple ways, offering implications for scholars and practitioners.

6.1 Implications for scholars

First, this article emphasised the somewhat narrow and subjective interpretation of success and failure when dealing with innovation management. Hence, it sets the ground for future research in several directions. Future empirical studies could explore how OI activities and business models affect different degrees of failure (e.g. a discontinued project without learning, discontinued project with learning, completed a project without market success, completed project with market success, etc.). Furthermore, future research could explicitly address what makes an OI project a success and which nuances exist.

Second, our research supported and extended previous studies on OI's barriers and drivers. The marked differences we observed depending on firms' innovativeness unveiled a significant gap in the literature: how OI motivations and barriers change with firms' technological intensity?

Third, in several unsuccessful cases, partners' withdrawal or inertia emerged as critical issues. According to the interviewees, a better planning and partner selection phase would have avoided much damage in many cases. This result encourages further research analysing partner selection and, more in general, project management in OI.

Fourth, we found new evidence on how engaging customers in OI activities may not always be fruitful. Indeed, our exploratory results suggest that customer-oriented triggers are often important for success projects in low-tech firms, but very rarely in high-tech ones. A comparison of customer involvement in OI activities depending on technological intensity could be a very promising area for future research.

Fifth, academics could explore in more detail the causes of risk and failure of OI projects in the context of large companies and compare the results with those obtained in SMEs.

6.2 Implications for practitioners

Taking some risks, which is the essence of entrepreneurship, implies that the occasional company's initiative may be a legitimate unsuccess. However, despite the calls from scholars to "learn to fail" (Cannon and Edmondson, 2005) and the considerable evidence of the positive externalities that failure may bring, we realised that failure still is covered with discredit. Indeed, many of the interviewees did not find any unsuccessful story to share. Yet, you cannot learn from a failure you do not recognise, which leaves you just with a failure without any of the positive aspects discussed in the literature. Hence, one key implication for practitioners is embracing failure, building an organisational culture tolerant towards it and learning from mistakes.

This article contributed to collecting some of these mistakes. We found a marked difference between high-tech and low-tech companies, remarking how OI projects can follow entirely different paths according to the sector. Economic problems, such as the failure of a partner or the loss of public subsidies, are sometimes outside the managers' control. However, several of our interviewees emphasised the importance of an appropriate project and risk management to contain the probability of these events. Choosing the partners to involve accurately can be a burden in the early stages but having the wrong ones on board can cause very hard times and even failure. Similarly, the lack of rigour while defining the roles and requirements can cause fundamental unbalances in the effort, which can, in turn, harm the relationships. Another undesirable consequence of the lack of rigour is the proliferation of mistakes that can have major negative consequences, especially in the case of publicly subsidised projects. Finally, managers might use the results of the TA for forecasting purposes. In this way, when working on an OI project, they can review the risks that have been discovered and assess the application of potential risk-avoidance methods.

6.3 Limitations

This study is limited since it resorted to a relatively small sample of SMEs from a specific geographic zone and industrial sector. Hence, the findings discussed in this study may not be considered valid in general. Furthermore, unlike Braun (2015), who could compare one success case with one failure case involving the same two organisations, our approach allowed different organisations to be involved in the success/failure cases chosen by each interviewee. Hence, the role of different partners involved in different projects could have affected the success/unsuccess of the initiative in an unobservable way. We also cannot exclude some selection bias, since the interviewees had already demonstrated willingness to disclose information on their innovation activities by participating in two waves of an innovation management survey. The fact that even among them, several did not disclose failure cases, raises the challenge of how to engage reluctant managers to share their unsuccessful experiences.

Note

1. Based on a query on "open innovation" searched on Google Scholar in October 2021

References

Aberdeen, T. (2013), "Yin, R. K. (2009). Case study research: design and methods (4th ed.). Thousand Oaks, CA: Sage", *The Canadian Journal of Action Research*, Vol. 14 No. 1, pp. 69-71.

Alaassar, A., Mention, A.-L. and Aas, T.H. (2020), "Exploring how social interactions influence regulators and innovators: the case of regulatory sandboxes", *Technological Forecasting and Social Change*, Vol. 160, p. 120257.

Alassaf, D., Dabić, M., Shifrer, D. and Daim, T. (2020), "The impact of open-border organization culture and employees' knowledge, attitudes, and rewards with regards to open innovation: an empirical study", *Journal of Knowledge Management*, Vol. 24 No. 9, pp. 2273-2297.

Antons, D. and Piller, F.T. (2015), "Opening the black box of 'not invented here': attitudes, decision biases, and behavioral consequences", *Academy of Management Perspectives*, Vol. 29 No. 2, pp. 193-217.

Appolloni, A., Mavisu, M. and Tarangapade, S.K. (2013), "Service innovation in Indian knowledge-intensive business services: the Wipro case", *International Journal of Learning and Intellectual Capital*, Vol. 10 Nos 3-4, pp. 276-293.

Bagherzadeh, M., Markovic, S. and Bogers, M. (2021), "Managing open innovation: a project-level perspective", *IEEE Transactions on Engineering Management*, Vol. 68 No. 1, pp. 301-316.

Barham, H., Dabic, M., Daim, T. and Shifrer, D. (2020), "The role of management support for the implementation of open innovation practices in firms", *Technology in Society*, Vol. 63, p. 101282.

Barney, J. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99-120.

Baum, J.A.C. and Dahlin, K.B. (2007), "Aspiration performance and railroads' patterns of learning from train wrecks and crashes", *Organization Science*, Vol. 18 No. 3, pp. 368-385.

Behrens, J. and Ernst, H. (2014), "What keeps managers away from a losing course of action? Go/stop decisions in new product development", *Journal of Product Innovation Management*, Vol. 31 No. 2, pp. 361-374.

Belderbos, R., Faems, D., Leten, B., Van Looy, B. and Looy, B. Van. (2010), "Technological activities and their impact on the financial performance of the firm: exploitation and exploration within and between firms", *Journal of Product Innovation Management*, Vol. 27 No. 6, pp. 869-882.

Bigliardi, B. and Galati, F. (2016), "Which factors hinder the adoption of open innovation in SMEs?", *Technology Analysis and Strategic Management*, Vol. 28 No. 8, pp. 869-885.

Binci, D., Belisari, S. and Appolloni, A. (2020), "BPM and change management: an ambidextrous perspective", *Business Process Management Journal*, Emerald Group Holdings, Vol. 26 No. 1, pp. 1-23.

Bogers, M. (2011), "The open innovation paradox: knowledge sharing and protection in R&D collaborations", *European Journal of Innovation Management*, Vol. 14 No. 1, pp. 93-117.

Bogers, M., Zobel, A.-K., Afuah, A., Almirall, E., Brunswicker, S., Dahlander, L., Frederiksen, L., Gawer, A., Gruber, M., Haefliger, S., Hagedoorn, J., Hilgers, D., Laursen, K., Magnusson, M.G., Majchrzak, A., McCarthy, I.P., Moeslein, K.M., Nambisan, S., Piller, F.T., Radziwon, A., Rossi-Lamastra, C., Sims, J. and Ter Wal, A.L.J. (2017), "The open innovation research landscape: established perspectives and emerging themes across different levels of analysis", *Industry and Innovation*, Vol. 24 No. 1, pp. 8-40.

Braun, A. (2015), "Linking business model and open innovation - success and failure of collaborations", *International Journal of Entrepreneurship and Innovation Management*, Vol. 19 Nos 1/2, pp. 59-76.

Braun, V. and Clarke, V. (2006), "Using thematic analysis in psychology", *Qualitative Research in Psychology*, Vol. 3 No. 2, pp. 77-101.

Brunswicker, S. and Chesbrough, H. (2018), "The adoption of open innovation in large firms", *Research-Technology Management*, Vol. 61 No. 1, pp. 35-45.

Bunduchi, R. (2013), "Trust, partner selection and innovation outcome in collaborative new product development", *Production Planning and Control*, Vol. 24 Nos 2-3, pp. 145-157.

Cannon, M.D. and Edmondson, A.C. (2005), "Failing to learn and learning to fail (intelligently): how great organizations put failure to work to innovate and improve", *Long Range Planning*, Vol. 38 No. 3, pp. 299-319.

Cassiman, B. and Valentini, G. (2016), "Open innovation: are inbound and outbound knowledge flows really complementary?", *Strategic Management Journal*, Vol. 37 No. 6, pp. 1034-1046.

Chesbrough, H.W. (2003), *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business School, Boston, MA.

Chesbrough, H.W. and Bogers, M. (2014), "Explicating open innovation: clarifying an emerging paradigm for understanding innovation keywords", in Chesbrough, H.W., Vanhaverbeke, W. and West, J. (Eds), *New Frontiers in Open Innovation*, Oxford University Press, Oxford, pp. 3-28.

Chesbrough, H.W., West, J. and Vanhaverbeke, W. (2006), *Open Innovation: Researching a New Paradigm*, Oxford University Press, Oxford.

Ciesielska, M. (2018), "Nokia on the slope", *The International Journal of Entrepreneurship and Innovation*, Vol. 19 No. 3, pp. 218-225.

Cricelli, L., Grimaldi, M., Rogo, F. and Strazzullo, S. (2021), "Patent ranking indicators: a framework for the evaluation of a patent portfolio", *International Journal of Intellectual Property Management*, Inderscience Publishers, Vol. 11 No. 2, pp. 185-218.

Dahlander, L. and Gann, D.M. (2010), "How open is innovation?", *Research Policy*, Elsevier B.V., Vol. 39 No. 6, pp. 699-709.

Delgosha, M.S., Hajiheydari, N. and Talafidaryani, M. (2021), "Discovering IoT implications in business and management: a computational thematic analysis", *Technovation*, Elsevier, No. September 2019, p. 102236.

Dziurski, P. and Sopińska, A. (2020), "Does industry matter? Drivers and barriers for open innovation in high-tech and non-high-tech industries—evidence from Poland", *International Journal of Management and Economics*, Vol. 56 No. 4, pp. 307-323.

D'Este, P., Iammarino, S., Savona, M. and von Tunzelmann, N. (2012), "What hampers innovation? Revealed barriers versus deterring barriers", *Research Policy*, Vol. 41 No. 2, pp. 482-488.

D'Este, P., Amara, N. and Olmos-Peñuela, J. (2016), "Fostering novelty while reducing failure: balancing the twin challenges of product innovation", *Technological Forecasting and Social Change*, Elsevier, Vol. 113, pp. 280-292.

Edmondson, A.C. and Mcmanus, S.E. (2007), "Methodological fit in management field research", *Academy of Management Review*, Academy of Management, Vol. 32 No. 4, pp. 1155-1179.

Eisenhardt, K.M. (1989), "Building theories from case study research", *The Academy of Management Review*, Vol. 14 No. 4, pp. 532-550.

Eisenhardt, K.M. (1991), "Better stories and better constructs: the case for rigor and comparative logic", *The Academy of Management ReviewThe Academy of Management*, Vol. 16 No. 3, p. 620.

Elmquist, M., Fredberg, T. and Ollila, S. (2009), "Exploring the field of open innovation", *European Journal of Innovation Management*, Vol. 12 No. 3, pp. 326-345.

Enkel, E., Kausch, C. and Gassmann, O. (2005), "Managing the risk of customer integration", *European Management Journal*, Vol. 23 No. 2, pp. 203-213.

Enkel, E., Gassmann, O. and Chesbrough, H.W. (2009), "Open R&D and open innovation: exploring the phenomenon", *R&D Management*, Vol. 39 No. 4, pp. 311-316.

Eurostat (2017), *Glossary: High-Tech Classification of Manufacturing Industries*.

Faems, D., De Visser, M., Andries, P. and Van Looy, B. (2010), "Technology alliance portfolios and financial performance: value-enhancing and cost-increasing effects of open innovation", *Journal of Product Innovation Management*, Vol. 27 No. 6, pp. 785-796.

Foege, J.N., Lauritzen, G.D., Tietze, F. and Salge, T.O. (2019), "Reconceptualizing the paradox of openness: how solvers navigate sharing-protecting tensions in crowdsourcing", *Research Policy*, Vol. 48 No. 6, pp. 1323-1339.

Galati, F., Bigliardi, B. and Petroni, A. (2016), "Open innovation in food firms: implementation strategies, drivers and enabling factors", *International Journal of Innovation Management*, Vol. 20 No. 3, pp. 1-24.

Greco, M., Grimaldi, M. and Cricelli, L. (2017), "Hitting the nail on the head: exploring the relationship between public subsidies and open innovation efficiency", *Technological Forecasting and Social Change*, Vol. 118, pp. 213-225.

Greco, M., Grimaldi, M. and Cricelli, L. (2019), "Benefits and costs of open innovation: the BeCO framework", *Technology Analysis and Strategic Management*, Vol. 31 No. 1, pp. 53-66.

Greco, M., Grimaldi, M. and Cricelli, L. (2020), "Interorganizational collaboration strategies and innovation abandonment: the more the merrier?", *Industrial Marketing Management*, Vol. 90, pp. 679-692.

Guertler, M.R. and Sick, N. (2021), "Exploring the enabling effects of project management for SMEs in adopting open innovation – a framework for partner search and selection in open innovation projects", *International Journal of Project Management*, Vol. 39 No. 2, pp. 102-114.

Hagedoorn, J. and Zobel, A.-K.K. (2015), "The role of contracts and intellectual property rights in open innovation", *Technology Analysis and Strategic Management*, Vol. 27 No. 9, pp. 1050-1067.

Helm, R., Endres, H. and Hüsig, S. (2019), "When and how often to externally commercialize technologies? a critical review of outbound open innovation", *Review of Managerial Science*, Vol. 13 No. 2, pp. 327-345.

Huizingh, E.K.R.E. (2011), "Open innovation: state of the art and future perspectives", *Technovation*, Elsevier, Vol. 31 No. 1, pp. 2-9.

Kale, P. and Singh, H. (2009), "Managing strategic alliances: what do we know now, and where do we go from here?", *Academy of Management Perspectives*, Vol. 23 No. 3, pp. 45-62.

Katz, R. and Allen, T.J. (1982), "Investigating the Not Invented Here (NIH) syndrome: a look at the performance, tenure, and communication patterns of 50 R&D Project Groups", *R&D Management*, Vol. 12 No. 1, pp. 7-20.

Knudsen, M.P. (2007), "The relative importance of interfirm relationships and knowledge transfer for new product development success", *Journal of Product Innovation Management*, Vol. 24 No. 2, pp. 117-138.

Kristiansen, J.N. and Ritala, P. (2018), "Measuring radical innovation project success: typical metrics don't work", *Journal of Business Strategy*, Vol. 39 No. 4, pp. 34-41.

Lane, P.J., Koka, B.R. and Pathak, S. (2006), "The reification of absorptive capacity: a critical review and rejuvenation of the construct", *Academy of Management Review*, Vol. 31 No. 4, pp. 833-863.

Laursen, K. and Salter, A.J. (2014), "The paradox of openness: appropriability, external search and collaboration", *Research Policy*, Vol. 43 No. 5, pp. 867-878.

Leoncini, R. (2016), "Learning-by-failing. An empirical exercise on CIS data", *Research Policy*, Vol. 45 No. 2, pp. 376-386.

Lhuillery, S. and Pfister, E. (2009), "R&D cooperation and failures in innovation projects: empirical evidence from French CIS data", *Research Policy*, Vol. 38 No. 1, pp. 45-57.

Lifshitz-Assaf, H., Tushman, M.L. and Lakhani, K.R. (2018), "A study of NASA scientists shows how to overcome barriers to open innovation", *Harvard Business Review*, available at: https://hbr.org/2018/05/a-study-of-nasa-scientists-shows-how-to-overcome-barriers-to-open-innovation.

Locatelli, G., Greco, M., Invernizzi, D.C., Grimaldi, M. and Malizia, S. (2021), "What about the people? Micro-foundations of open innovation in megaprojects", *International Journal of Project Management*, Vol. 39 No. 2, pp. 115-127.

Lokshin, B., Hagedoorn, J. and Letterie, W. (2011), "The bumpy road of technology partnerships: understanding causes and consequences of partnership mal-functioning", *Research Policy*, Vol. 40 No. 2, pp. 297-308.

Madsen, P.M. and Desai, V. (2010), "Failing to learn? The effects of failure and success on organizational learning in the global orbital launch vehicle industry", *Academy of Management Journal*, Vol. 53 No. 3, pp. 451-476.

Mason, M. (2010), "Sample size and saturation in PhD studies using qualitative interviews", *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, Vol. 11 No. 3, p. 8.

Messeni Petruzzelli, A. (2011), "The impact of technological relatedness, prior ties, and geographical distance on university–industry collaborations: a joint-patent analysis", *Technovation*, Elsevier, Vol. 31 No. 7, pp. 309-319.

Miner, A.S., Kim, J.-K., Holzinger, I.W. and Haunschild, P. (1996), "Fruits of failure: organizational failure and population level learning", *Academy of Management Proceedings*, Vol. 1996 No. 1, pp. 239-243.

Monteiro, F., Mol, M. and Birkinshaw, J. (2016), "Ready to be open? Explaining the firm level barriers to benefiting from openness to external knowledge", *Long Range Planning*, Vol. 50 No. 2, pp. 282-295.

Nieto, M.J. and Santamaría, L. (2007), "The importance of diverse collaborative networks for the novelty of product innovation", *Technovation*, Vol. 27 Nos 6-7, pp. 367-377.

Nowell, L.S., Norris, J.M., White, D.E. and Moules, N.J. (2017), "Thematic analysis: striving to meet the trustworthiness criteria", *International Journal of Qualitative Methods*, Vol. 16 No. 1, pp. 1-13.

Obradović, T., Vlačić, B. and Dabić, M. (2021), "Open innovation in the manufacturing industry: a review and research agenda", *Technovation*, Vol. 102, p. 102221.

Oumlil, R. and Juiz, C. (2016), "An up-to-date survey in barriers to open innovation", *Journal of Technology Management and Innovation*, Vol. 11 No. 3, pp. 137-152.

Penrose, E. (1959), *The Theory of the Growth of the Firm*, John Wiley & Sons, new york.

Roberts, R., Flin, R., Millar, D. and Corradi, L. (2021), "Psychological factors influencing technology adoption: a case study from the oil and gas industry", *Technovation*, Vol. 102, p. 102219.

Salge, T.O., Farchi, T., Barrett, M.I. and Dopson, S. (2013), "When does search openness really matter? A contingency study of health-care innovation projects", *Journal of Product Innovation Management*, Vol. 30 No. 4, pp. 659-676.

Slowinski, G. and Sagal, M.W. (2010), "Good practices in open innovation", *Research-Technology Management*, Vol. 53 No. 5, pp. 38-45.

Stefan, I., Hurmelinna-Laukkanen, P., Vanhaverbeke, W. and Oikarinen, E.-L. (2022), "The dark side of open innovation: individual affective responses as hidden tolls of the paradox of openness", *Journal of Business Research*, Vol. 138, pp. 360-373.

Tavoletti, E., Kazemargi, N., Cerruti, C., Grieco, C. and Appolloni, A. (2021), "Business model innovation and digital transformation in global management consulting firms", *European Journal of Innovation Management*. doi: 10.1108/EJIM-11-2020-0443.

Tranekjer, T.L. (2017), "Open innovation: effects from external knowledge sources on abandoned innovation projects", *Business Process Management Journal*, Emerald Publishing, Vol. 23 No. 5, pp. 918-935.

Trkman, P. and Desouza, K.C. (2012), "Knowledge risks in organizational networks: an exploratory framework", *The Journal of Strategic Information Systems*, Vol. 21 No. 1, pp. 1-17.

Tucci, C.L., Chesbrough, H.W., Piller, F. and West, J. (2016), "When do firms undertake open, collaborative activities? Introduction to the special section on open innovation and open business models", *Industrial and Corporate Change*, Oxford University Press, Vol. 25 No. 2, pp. 283-288.

Urbinati, A., Bogers, M., Chiesa, V. and Frattini, F. (2019), "Creating and capturing value from Big Data: a multiple-case study analysis of provider companies", *Technovation*, Elsevier, Vol. 84 No. 85, pp. 21-36.

Urbinati, A., Landoni, P., Cococcioni, F. and De Giudici, L. (2020), "Stakeholder management in open innovation projects: a multiple case study analysis", *European Journal of Innovation Management*, Vol. 24 No. 5, pp. 1595-1624.

van de Vrande, V., de Jong, J.P.J., Vanhaverbeke, W. and de Rochemont, M. (2009), "Open innovation in SMEs: trends, motives and management challenges", *Technovation*, Vol. 29 Nos 6-7, pp. 423-437.

Vanhaverbeke, W., Van de Vrande, V. and Cloodt, M. (2008), "Connecting absorptive capacity and open innovation", *SSRN Electronic Journal*. doi: 10.2139/ssrn.1091265.

Veer, T., Lorenz, A. and Blind, K. (2016), "How open is too open? The mitigating role of appropriation mechanisms in R&D cooperation settings", *R&D Management*, Vol. 46 No. S3, pp. 1113-1128.

von Briel, F. and Recker, J. (2017), "Lessons from a failed implementation of an online open innovation community in an innovative organization", *MIS Quarterly Executive*, Vol. 16 No. 1, pp. 35-46.

Vos, J.F.J. and Achterkamp, M.C. (2006), "Stakeholder identification in innovation projects going beyond classification", *European Journal of Innovation Management*, Emerald Group Publishing, Vol. 9 No. 2, pp. 161-178.

Williamson, O.E. (1979), "Transaction-cost economics: the governance of contractual relations", *The Journal of Law and Economics*, Vol. 22 No. 2, pp. 233-261.

Corresponding author
Serena Strazzullo can be contacted at: serena.strazzullo@unina.it

Appendix

Semi-structured questionnaire

(1) Can you describe a successful innovative project implemented in the three-year period 2018–2020 that involved external partners?

(2) What are the main reasons that led you to implement this innovative project?

(3) What were the categories of partners that were key to the success of the project?

(4) How was the project funded?

(5) Why do you consider it successful?

(6) Were there any problems in carrying out the project?

(7) How did the interaction with the other people involved in the project go?

(8) Can you tell me instead about an innovative project in the three-year period 2018–2020 that did not achieve the desired result, was abandoned or failed after being completed?

(9) What are the main reasons that led you to implement this innovative project?

(10) Which were the categories of partners in the failed/abandoned project?

(11) What were the sources of funding?

(12) If the project was abandoned, at what stage did this happen?

(13) What do you think were the main causes of the failure/abandonment of the project?

(14) What are the risks you assess when an innovative project is undertaken?

Table A1.
Sample characteristics

Case study company	Age range	Informant's role	Informant's education level	Firm founded	Type of partners	Type of business	Technological level	Industry sector
Company 1	50–60	Owner	Degree	2002	International	Non-family	High	Manufacture of computer, electronic and optical products
Company 2	40–50	Owner	Degree	2012	International	Family	Low	Other manufacturing industries
Company 3	40–50	Owner	Diploma	2004	National	Family	Low	Other manufacturing industries
Company 4	30–40	Owner	Degree	2010	National	Non-family	Low	Other manufacturing industries
Company 5	40–50	Owner	Degree	1993	International	Non-family	High	Manufacture of basic pharmaceutical products and pharmaceutical preparations
Company 6	40–50	Owner	Diploma	2000	National	Non-family	Low	Printing and reproduction of recorded media
Company 7	40–50	Owner	Degree	2015	International	Non-family	Medium-High	Manufacture of medical and dental instruments and supplies
Company 8	30–40	Manager	Degree	2002	International	Non-family	High	Manufacture of computer, electronic and optical products
Company 9	40–50	Owner	Degree	1960	International	Non-family	Medium-High	Manufacture of machinery and equipment
Company 10	40–50	Owner	Degree	1980	International	Non-family	High	Manufacture of air and spacecraft and related machinery
Company 11	50–60	Owner	Diploma	1970	International	Family	Low	Printing and reproduction of recorded media
Company 12	50–60	Manager	Degree	1960	International	Family	High	Manufacture of air and spacecraft and related machinery
Company 13	40–50	Manager	Degree	1980	International	Non-family	High	Manufacture of air and spacecraft and related machinery
Company 14	40–50	Manager	Degree	2013	International	Non-family	Medium-Low	Construction of ships and boats
Company 15	20–30	Manager	Degree	1969	International	Family	Medium-High	Manufacture of machinery and equipment
Company 16	50–60	Manager	Degree	1993	International	Non-family	Low	Manufacture of food products
Company 17	40–50	Owner	Diploma	2000	International	Non-family	Low	Manufacture of food products
Company 18	30–40	Manager	Degree	1998	National	Non-family	Low	Manufacture of food products

(*continued*)

Case study company	Age range	Informant's role	Informant's education level	Firm founded	Type of partners	Type of business	Technological level	Industry sector
Company 19	50–60	Owner	Degree	1995	International	Family	Medium-Low	Manufacture of rubber and plastic products
Company 20	40–50	Manager	Diploma	1992	National	Family	Medium-High	Manufacture of machinery and equipment
Company 21	40–50	Manager	Diploma	1995	National	Family	Medium-Low	Manufacture of other non-metallic mineral products
Company 22	20–30	Manager	Diploma	2019	National	Family	High	Manufacture of air and spacecraft and related machinery
Company 23	30–40	Owner	Degree	2016	National	Family	High	Manufacture of computer, electronic and optical products
Company 24	30–40	Owner	Degree	2015	National	Non-family	Low	Printing and reproduction of recorded media
Company 25	40–50	Manager	Degree	2006	International	Non-family	Low	Printing and reproduction of recorded media
Company 26	50–60	Owner	Degree	2000	International	Non-family	Low	Manufacture of food products
Company 27	50–60	Owner	Diploma	1948	National	Family	Medium-High	Manufacture of machinery and equipment

Table A1.