Industrial Marketing Management 106 (2022) 58–70

Contents lists available at ScienceDirect

Industrial Marketing Management

journal homepage: www.elsevier.com/locate/indmarman

COVID-19-related innovations: A study on underlying motivations and inter-organizational collaboration

Marco Greco [a,*], Moreno Campagna [a], Livio Cricelli [b], Michele Grimaldi [a], Serena Strazzullo [b]

[a] Department of Civil and Mechanical Engineering, University of Cassino and Southern Lazio, Via G. Di Biasio 43, Cassino, FR 03043, (Italy)
[b] Department of Industrial Engineering, University of Naples Federico II, Piazzale Tecchio 80, 80125 Napoli, Italy

ARTICLE INFO

Keywords:
Inter-organizational collaboration
Radical innovation
COVID-19
Industrial motivations
Crisp set qualitative comparative analysis
Crisis
Corporate social responsibility
Marketing
Open innovation
Incremental innovation

ABSTRACT

While many COVID-related innovations have been profitable, others were not even conceived to bear revenues but were driven by other motivations. To what extent "traditional" profit-oriented motivations coexisted with other motivations (such as corporate social responsibility and marketing) remains largely under-investigated. Similarly, while many studies emphasized that inter-organizational collaborations enabled COVID-related innovation projects, how these collaborations intertwined with the motivations to innovate is unknown. This article fills the literature gaps by exploring the motivations underlying COVID-related innovations, the role of inter-organizational collaboration, and their relationship with innovation novelty. We studied 18 Italian COVID-19-related innovations developed during the initial pandemic phase. We considered two industrial motivations based on the exploration-exploitation dichotomy and two institutional motivations (corporate social responsibility and marketing). Using the crisp set Qualitative Comparative Analysis, we found that institutional motivations have driven most radical and incremental innovation projects. However, they were not sufficient conditions for them. We observed that radical innovations were supported by either transversal alliances, involving horizontal collaboration and R&D institutions, or by vertical alliances, where a supplier-customer collaboration aimed to explore new business opportunities while benefiting from the favorable contingent marketing effects. Incremental innovations often occurred without industrial motivations, supported by either vertical or horizontal collaboration.

1. Introduction

In the first days of March 2020, Italy was experiencing its first full-scale lockdown, Northern Italy's hospitals were close to collapse, hundreds of firms' core activities were suspended (only "essential" industries were allowed to continue production), and the death toll was unsettling. On March 18, a column of dozens of military trucks was needed to temporarily transfer the excess coffins from the city of Bergamo, vividly describing the ongoing tragedy.

In this historical context, firms felt the pressure to contribute somehow to addressing the grand challenge affecting the country. At the same time, the COVID-19 pandemic triggered an unprecedented economic recession, which heavily affected most industries and threatened their survival. During the pandemic, many firms attempted to identify opportunities and respond to the customers' changing needs through innovation. As a result, they converted some of their typical operations to offer new products and services, responding to the new needs the pandemic elicited. Notably, they were often rewarded by the media, which were keen to present new COVID-related products and services to emphasize the industry's resilience and inventiveness.

While firms generally see innovation as a means to improve their short- and long-term performance in terms of sales, market share, and competitive advantage over their competitors (Gunday, Ulusoy, Kilic, & Alpkan, 2011), the pandemic added a new perspective. Indeed, COVID-19 innovation also became a means to obtain favorable media exposure and pursue corporate social responsibility (CSR) goals by meeting society's undelayable needs (He & Harris, 2020).

The impulse to innovate outside firms' comfort zone, in different product and customer markets, naturally led them to seek partnerships with other organizations to rapidly fill their technology, logistics, or

Abbreviations: OI, Open Innovation; CSR, Corporate Social Responsibility; QCA, Qualitative Comparative Analysis.

* Corresponding author.
E-mail addresses: m.greco@unicas.it (M. Greco), moreno.campagna@gmail.com (M. Campagna), livio.cricelli@unina.it (L. Cricelli), m.grimaldi@unicas.it (M. Grimaldi), serena.strazzullo@unina.it (S. Strazzullo).

https://doi.org/10.1016/j.indmarman.2022.07.014
Received 30 June 2021; Received in revised form 5 July 2022; Accepted 30 July 2022
Available online 4 August 2022

knowledge gaps (Chesbrough, 2020). The collaboration aimed at innovation development has been particularly studied in the Open Innovation (OI) literature (Chesbrough, 2003). Such a stream of the literature focuses on how the flows of knowledge and technologies among collaborating organizations favor innovation development. OI enhances knowledge sharing, reduces risks, and increases development speed (Lassen & Laugen, 2017). Furthermore, collaboration among different stakeholders can be essential to survive a crisis (Zouaghi, Sánchez, & Martínez, 2018).

Despite the great number of studies discussing innovation endeavors during the COVID-19 pandemic (e.g., Antonelli, Leone, & Ricci, 2021; Ardito, Coccia, & Messeni Petruzzelli, 2021; Barragan-Quintero, Barragan-Quintero, & Ahumada-Tello, 2020; Chesbrough, 2020; Crick & Crick, 2020; Ferrigno & Cucino, 2021; Mention, Pinto Ferreira, & Torkkeli, 2020; Radziwon, Bogers, Chesbrough, & Minssen, 2021), the motivations triggering them remained under-researched. Furthermore, previous studies have not addressed the relationship between such motivations and the inter-organizational collaborations needed to complement the firm's knowledge and technology. Indeed, to our knowledge, only one very recent study explored the goals underlying COVID-related innovations (Ferrigno & Cucino, 2021). However, Ferrigno and Cucino (2021) did not consider how the goals intertwined with the OI activities needed to develop them. Yet, understanding how different combinations of motivations and OI drive innovation can be important to unveil the appropriateness of inter-organizational collaborations to serve different purposes. In addition, a better understanding of the motivations for innovation could allow predicting the degree of novelty resulting from them.

Hence, this article aims to fill the gaps in the literature by exploring the motivations underlying innovation and their combined effect with OI practices. Two research questions inspired the study:

1. What motivates COVID-related innovations?
2. How does OI intertwine with such motivations to develop COVID-related innovations?

To respond to the research questions, we proposed a framework comprising four possible motivations for a firm's resolution to develop a COVID-related innovation, leveraging the theory on exploration and exploitation strategies (March, 1991) and the institutional theory (Scott, 1995). Furthermore, the framework recognizes the role played by inter-organizational collaboration in innovation projects, considering three archetypal collaboration channels (vertical, horizontal, and R&D collaborations) and the stability of such collaborations.

We focused our analysis on COVID-related innovations introduced by Italian firms during the first pandemic wave, studying them according to the framework. We interviewed 14 firms about 18 COVID-related innovations using a semi-structured survey. We analyzed the relationships between the motivations, the inter-organizational collaborations, and the resulting incremental/radical COVID-related innovations. We adopted a configurational approach, the qualitative comparative analysis (QCA) (Ragin, 1989), which considers the joint contributions of multiple factors, hence allowing studying the joint contribution of motivations and inter-organizational collaboration to the development of COVID-related innovations. Since QCA aims to describe how certain conditions concur to determine an outcome, we deemed the method ideal to assess how motivations and inter-organizational collaboration concur to trigger innovation.

The paper is structured as follows. Section 2 discusses the state of the art against which the paper is set. Section 3 introduces the dataset and methodology. Section 4 presents the results that are discussed in Section 5. Finally, Section 6 closes the paper with conclusions and implications.

2. Theoretical background

2.1. Innovation in exceptional times

Typical innovation management practices are sometimes unsettled by exceptional events urging firms to adapt rapidly to the changing environment. The COVID-19 pandemic certainly emerged as a formidable disruption in the field of innovation.

2.1.1. The COVID-19 pandemic as a grand challenge

Bertello, Bogers, and De Bernardi (2021) described the COVID-19 pandemic as a 'grand challenge' due to its many interactions, nonlinear dynamics, unpredictability, and capability to cut across jurisdictional boundaries. When addressing a grand challenge, an "open-ended mission" emerges, many different actors are involved, and the nature of "the problem" and its possible solutions are perceived differently, giving space to multiple perspectives on innovation (Kuhlmann & Rip, 2018). As seen in other grand challenges – such as achieving sustainable development and growth – firms are heavily influenced by society's expectations over their social obligations (Anwar & El-Bassiouny, 2020). Hence, they implement measures as a part of their CSR programs to achieve a 'societal impact', which may generate social, cultural, environmental, and economic benefits (Ahn, Roijakkers, Fini, & Mortara, 2019). Notably, addressing grand challenges often entails multiple organizations' coordinated and collaborative efforts in innovation (Bogers, Chesbrough, & Strand, 2020; McGahan, Bogers, Chesbrough, & Holgersson, 2021).

The significant discontinuity caused by the pandemics immediately affected individuals' and organizations' needs, setting up multiple innovation opportunities. Digital technologies transformed industries by leveraging product dematerialization and enhanced product customization (Almeida, Duarte Santos, & Augusto Monteiro, 2020). Furthermore, the pandemic created an unprecedented demand for many products and services (Mention et al., 2020; Verma & Gustafsson, 2020), which society urgently needed. With the incumbent firms unable to cope with the growing demand, many other firms found space to reshape their business processes and enter such markets. The turbulence triggered by the pandemic induced firms to question their core goals and sometimes prefer short-run goals over longer-run, more ethereal objectives (He & Harris, 2020).

2.1.2. The COVID-19 pandemic as an economic crisis

The COVID-19 pandemic triggered an unprecedented economic crisis on a global scale. Indeed, Mora Cortez and Johnston (2020) emphasized how the pandemic caused a unique crisis, characterized by economic/financial factors and sociobiological factors, which generated a dramatic uncertainty shock.

Previous studies are not consistent on the role that crisis plays in firms' innovation activity. Some authors consider the crisis as a positive factor influencing the firms' growth and evolution (Archibugi, Filippetti, & Frenz, 2013a; Berchicci, 2013; Smith & Blundel, 2014). Others consider the economic crisis an adverse factor that reduces opportunity and innovation investments (Klapper & Love, 2011). In the 2008 financial crisis, most firms' investments in innovation decreased during the downturn, although some firms increased them (Archibugi et al., 2013a; Cruz-Castro, Holl, Rama, & Sanz-Menéndez, 2018). The latter firms were often already highly innovative before the crisis and more likely to cope with it (Archibugi et al., 2013a). Consistently, Cefis and Marsili (2019) observed that product innovation increases the likelihood of survival during and after a crisis, building long-term resilience for innovative firms.

As in the previous crises, the one triggered by the pandemic also induced managers to cut their investments in innovation, looking forward to resuming them in a more favorable future (Bar Am, Furstenthal, Jorge, & Roth, 2020). Hence, firms searched outside their organizational boundaries for the expertise and resources they needed to innovate,

either to respond to the crisis that hit their sectors (e.g., Radziwon et al., 2021) or to offer timely solutions to the problems caused by the pandemic (e.g., Ardito et al., 2021; Crick & Crick, 2020; Ferrigno & Cucino, 2021). Indeed, as Mention et al. (2020) observed, innovation during the pandemic has taken inspiring forms, with firms, universities, and governments cooperating to find timely solutions to the challenges that COVID-19 posed.

2.2. Motivations to innovate during the pandemic

We chose two different theoretical lenses to frame the answer to the RQ "What motivates COVID-related innovations?". The former leveraged March's (1991) view on exploitation versus exploration strategies, a dichotomy that hundreds of studies on innovation management have embraced. The latter leverages the institutional theory (Scott, 1995), describing how firms adhere to external institutional prescriptions.

We elaborate on these theoretical lenses in the following two subsections.

2.2.1. Explorative and exploitative motivations

The motivations to innovate are grounded in the classic innovation literature, starting from Schumpeter's (1934) theories on economic development that suggest how innovations occur when entrepreneurs need them. Such entrepreneurs need to balance their innovation activities between refining existing technologies or inventing new ones (Levinthal & March, 1981). While the refinement of existing technologies usually "exploits" the firm's knowledge base and guarantees reasonably safe returns in the short term, the invention of new technologies induces the firm to "explore" new knowledge and technology domains and comprises returns less certain and more remote in time (Greve, 2007; March, 1991).

Under normal circumstances, exploitation describes improving a focal firm's product or service, mainly based on its knowledge. The pandemic somewhat extended this perspective when it comes to COVID-related innovation. Indeed, during the pandemic, many firms introduced new-to-the-firm innovations that adopted or adapted other organizations' consolidated technologies. Such products are not radical innovations (e.g., face masks) and are not expected to offer long-term revenue streams to the firms that adapted their processes to produce them temporarily. Nonetheless, they respond to the entrepreneurs' short-term needs to maintain the production lines active when the demand for their usual products plummets, allowing their firms' survival (Ferrigno & Cucino, 2021). According to Wang, Hong, Li, and Gao (2020), such firms would be driven by a problemistic search, searching for a solution to their below-expectations performance.

Exploration describes the development of a significantly new product or service that forces the focal firm to go beyond its comfort zone and attempt combinations of its consolidated knowledge and technology with new knowledge and technology, often provided by other partnering organizations (Keupp & Gassmann, 2009). As mentioned before, exploration implies significantly more risks than exploitation, and returns, if any, are expected in the long term (March, 1991). However, many firms direct their innovation efforts towards exploration during a crisis. Indeed, Osiyevskyy, Shirokova, and Ritala (2020) recently observed that firms exposed to a severe crisis are more likely to improve their performance through exploration. In the context of COVID-related marketing innovations, Wang et al. (2020) suggested that firms with slack resources are more likely to develop COVID-related marketing innovations to build long-term competitive advantage.

2.2.2. Institutional motivations

Other motivations to innovate take the lead from neo-institutionalism, which advances that firms need to earn their legitimacy from stakeholders by conforming to their social rules and expectations (DiMaggio & Powell, 1983). Firms' strategies can be strongly influenced by the coercive, mimetic, and normative processes that institutions enact (Miemczyk, 2008). The coercive processes describe the formal (e.g., law and rules) and informal (e.g., social expectations) pressures exerted on organizations. In the COVID-19 pandemic context, informal pressures were particularly intense, with people expecting firms to mobilize and provide useful and timely solutions to the new needs brought in by the spread of the virus. Such informal pressure motivated many firms to pursue innovations hardly linked with their usual business. Consistently, Ferrigno and Cucino (2021) described many cases of firms whose innovation activities did not aim to achieve profit. As more and more firms embraced the challenge, mimetic pressures complemented the coercive ones, bringing new firms to imitate the behavior.

The willingness to respond to social expectations resonates with CSR, a concept that describes actions aimed to further social good, which go beyond the firm's interests and obeying the law (McWilliams & Siegel, 2001). He and Harris (2020) advanced that the COVID-19 pandemic may offer firms an opportunity to shift towards more genuine and authentic CSR. Indeed, the authors claim that firms are increasingly engaged in CSR activities, particularly to contrast the pandemic. Similarly, Ferrigno and Cucino (2021) also emphasized firms' propensity to adopt prosocial behavior to solve community problems. In the same vein, Crick and Crick (2020) discussed how the perspective of a "greater good for human health" was essential to favor the collaborative efforts to develop vaccines of competing pharmaceutical companies. The legitimacy a firm can achieve when driven by prosocial goals is likely to create durable bonds between firms and customers.

The same forces that motivate CSR may bring firms to purposely develop and disseminate innovation projects that meet society's expectations to improve the corporate image and obtain marketing benefits. Indeed, COVID-related innovation projects can become powerful marketing instruments, which can have great media resonance, as in the case of the Open COVID Pledge (Antonelli et al., 2021). While mimetic pressures may not induce all firms to embrace genuine CSR motivations to innovate, some firms could feel the marketing opportunity of being among those mobilizing against the pandemic. This perspective on marketing is close to the concept of cause-related marketing, a form of "*corporate philanthropy based on the rationale of profit-motivated giving*" (Varadarajan & Menon, 1988) and of "broadened marketing", according to which marketing actions also occur in fighting to overcome pandemic (Woodside, 2020). In other words, the visibility granted by media to firms' COVID-related innovations sets a bright background to introduce new products and services with little innovativeness and no expectations for revenue flows stemming from them. Moreover, such visibility enhances brand awareness at a fraction of the usual advertising costs and may trigger revenue-producing transactions from the firm's non-COVID-related products in the short run.

2.3. Inter-organizational collaboration to innovate during the pandemic

Firms' resources and technologies may not suffice to develop COVID-related innovations due to the need for a short time to market and the lack of (knowledge and financial) resources. The literature has shown how OI reduces time to market by allowing knowledge flows among the collaborating firms and favors risk- and cost-sharing (Greco, Grimaldi, & Cricelli, 2019). OI was defined as "*the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively*" (Chesbrough, 2006, p. 1). OI assumes particular relevance during a crisis because it allows firms to resist and survive (Laperche, Lefebvre, & Langlet, 2011). The inter-organizational collaboration assumed a crucial role in fighting the 2008 financial downturn, allowing firms to tackle the resource limitations and the risks surrounding innovation (Zouaghi et al., 2018). Similarly, multiple studies emphasized how the COVID-19 pandemic triggered countless OI initiatives (Antonelli et al., 2021; Ardito et al., 2021; Bertello et al., 2021; Chesbrough, 2020; Crick & Crick, 2020; McGahan et al., 2021), consistently with the idea that grand challenges can trigger OI (Ahn et al., 2019; Bogers et al., 2020; Kuhlmann & Rip,

2018; McGahan et al., 2021).

Regarding the type of partners involved in the innovation process, this study focuses on a three-sided perspective, including horizontal OI, vertical OI, and R&D OI. Horizontal OI pertains to the firm's collaboration with other organizations not in the same value chain, such as competitors and non-competitors operating in other sectors (Parida, Westerberg, & Frishammar, 2012). Non-competitors are attractive partners since the exchange of knowledge and technology is facilitated by the absence of a conflict of interest, whereas collaboration with competitors may trigger opportunistic behavior (Park & Russo, 1996). Indeed, collaboration with competitors can be riskier but also very rewarding in the presence of shared goals (Lee, Park, Yoon, & Park, 2010), given the complementarity and specialization that such collaborations can offer. Vertical OI describes the firm's collaboration with its suppliers and customers (Parida et al., 2012). Suppliers and customers are often very knowledgeable about the firm's product; therefore, they can offer valuable suggestions to improve it. Furthermore, they can benefit from a firm's innovation success since suppliers would benefit from an increase in its sales, while customers would benefit from products that better suit their needs (Greco, Grimaldi, & Cricelli, 2020). R&D OI describes the collaboration with R&D institutions, such as universities and research labs. Research institutions are ideal partners for firms that want to develop radical innovations (Wirsich, Kock, Strumann, & Schultz, 2016). However, different institutional norms and systems of knowledge production (Vick & Robertson, 2018) may threaten the effectiveness of the collaboration. R&D institutions have expensive laboratories and highly skilled human resources, which could greatly benefit firms' innovation process (Greco et al., 2020).

This study also analyses the collaboration's stability, comparing those collaborations limited to the pandemic period with more durable ones. Such dichotomy takes the lead from the research stream on collaboration duration stemming from Gulati's article (1995) on repeated ties in inter-organizational alliances. The rationale is that longer-term collaborations generate inter-organizational routines that facilitate knowledge exchange and discoveries (Zheng & Yang, 2015). Hence, repeatedly collaborating with a partner is likely to increase innovativeness (Belderbos, Gilsing, & Lokshin, 2012; Zheng & Yang, 2015). The relevance for COVID-related innovation is apparent due to the need to get acquainted with technologies that may be unknown to the firm (e.g., face masks) by interacting with new partners; and keeping contact with the historical partners to respond to the crisis in unison. Notably, the trust resulting from repeated collaboration (Bogers, 2011; Locatelli, Greco, Invernizzi, Grimaldi, & Malizia, 2021) plays an important role in tackling the key risks associated with OI, including the risk of experiencing opportunistic behavior and undesired leakages of knowledge (Greco et al., 2019).

2.4. The framework of the study

To respond to the two research questions, we developed a framework (Fig. 1) that synthesizes the literature discussed in Subsections 2.2 and 2.3. The framework describes how COVID-related innovation stems from two different groups of variables, one regarding the motivations and another regarding inter-organizational collaborations.

We distinguish between two sets of motivations: industrial and institutional. On the one hand, industrial motivations induce firms to innovate to obtain short-term or long-term revenues through exploitative or explorative strategies. On the other hand, institutional motivations do not imply an industrial benefit for the firm based on the corresponding innovation project. Indeed, such a set is more driven by the willingness to satisfy society's expectations. The four motivations included in the framework are described below.

Response to the economic crisis (RTC) pertains to the industrial set and describes innovations aimed to enhance existing products and respond to the pandemic from a short-term perspective. The short-term perspective and the little creative effort needed to achieve the innovation frame this as an exploitative motivation.

Seeking new innovation opportunities (NO) pertains to the industrial set. It describes innovation efforts motivated by the emergence of business opportunities that could gain momentum and be important in the future, regardless of the current pandemic. Taking on such opportunities implies developing new products and services significantly different from the existing ones and would induce the firm to seek support from other organizations. The long-term perspective and the significant creative effort needed to achieve the innovation frame this as an explorative motivation.

Corporate social responsibility (CSR) pertains to the institutional set since it describes innovation projects motivated by informal coercive and mimetic institutional pressures. Such pressures can induce the firm to mobilize to mitigate the negative effect of the pandemic.

Finally, improving the corporate image (MKT) defines innovation projects motivated by the extremely favorable visibility that COVID-related innovations guarantee. Such a motivation pertains to the institutional set since the rationale of the mediatic success lies in the good image conveyed by communicating that the firm is doing what society expects from it.

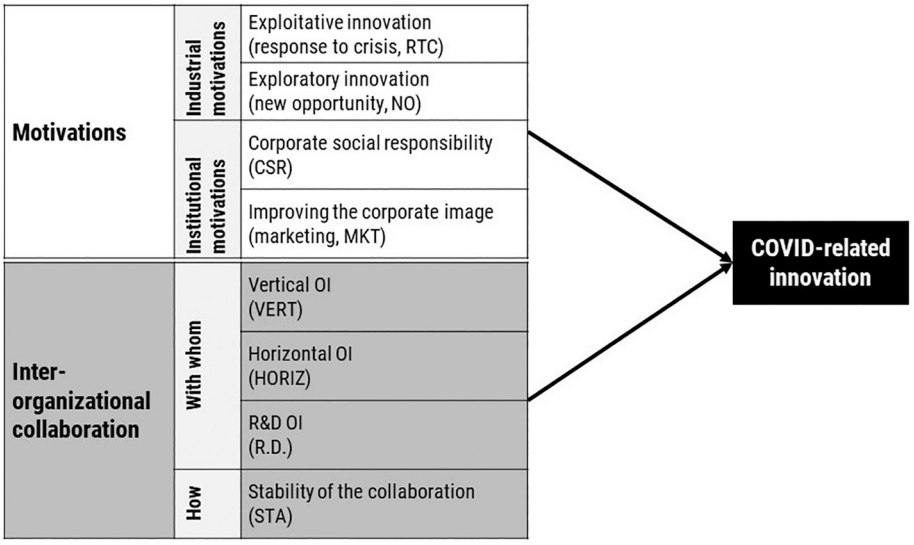


Fig. 1. Framework of the study.

The group describing the span of inter-organizational collaboration leverages the literature on OI described in Subsection 2.3. Three variables describe the active collaboration channels enabling the development of the COVID-related innovation projects, including OI vertical channels (VERT), OI horizontal channels (HORIZ), and OI channels involving universities and research institutions (R.D.). Finally, a fourth variable investigates the stability of such collaborations, distinguishing those collaborations limited to the pandemic period from the others.

The next section describes how we empirically tested the relationships shown in Fig. 1.

3. Methods

This section describes the variables under investigation, the methodology to analyze them, and the data.

Table 1
Firms and COVID-related innovations in the sample.

ID	Project	Description	Relevance	Type	Firm	Size	Sector
A	Advento live	Service to plan, manage, and deliver online or hybrid events	The lockdown period saw a dramatic increase in the delivery of online events	Service	Synesthesia S.r.l.	Medium-sized	J
B	Anonymized app	App to inform the users that they have been in the proximity of an infected individual	The app was strongly recommended by the institutions to slow down the pandemic	Service	Anonymized firm	Medium-sized	J
C	App scova asintomatici	The app leverages artificial intelligence to estimate the probability of being an asymptomatic carrier of the coronavirus	Especially in the early stages of the pandemics, swabs were not available, hence asymptomatic carriers were exceedingly difficult to find	Service	Humco S.r.l.	Small	J
D	Assistenza domiciliare	The service offers COVID-related home help	Due to the hospitals' overload, home help proved to be the only viable option to guarantee healthcare to the largest number of people	Service	Lifecure S.r.l.	Large	Q
E	BFxMED	Medical personal protection equipment (PPE)	The pandemic caused a shortage in medical PPE	Product	Bond Factory S.r.l.	Medium-sized	C
F	City Analytics - Mappa di Mobilità	Interactive map to display the mobility flows on the national, regional, and local levels	The map was used to assess the impact of the restraining measures and plan their gradual removal	Service	Enel X S.r.l.	Large	M
G	Easy-Covid 19	The product allows a snorkeling mask to be used as a ventilator in critical care	The product is a response to the shortage in valves and ventilators that hospitals were suffering	Product	Isinnova S.r.l.	Medium-sized	M
H	F2A risponde	A platform organizing all COVID-related regulations to help small and medium enterprises make sense of and comply with them	During the pandemics the Italian government and local governments have been very active. Unfortunately, the sequence of decrees and their prescriptions were difficult to follow, especially for smaller firms.	Service	F2A S.r.l.	Large	M
I	Face Shield	Face shield for medical use	The product is a response to the shortage in face shields that hospitals were suffering	Product	Leonardo S.p.a.	Large	C
J	Freya	Plastic face mask with disposable filter	The product could be used as a substitute to other disposable face masks and is specifically aimed to the use in firms (rather than in medical contexts)	Product	Ometec S.r.l.	Medium-sized	C
K	Futuremakers	Online Science, Technology, Engineering, and Mathematics courses	The service aims to support learning of children struck at home during the lockdown period	Service	Synesthesia S.r.l.	Medium-sized	J
L	Libri da asporto	Free delivery service of books from bookstores to the final customers	The service aims to support bookstores that were forcedly closed during lockdown	Service	NW Consulenza e Marketing Editoriale S.r.l.	Micro-enterprise	M
M	Smart Proximity	Wristband informing the users they are too close one to another	The product aims to help people maintain a safety distance, especially in firms, to contain the contagion risk	Product & Service	Engineering S.p.a.	Large	J
N	Spesasospesa.org	Website to collect donations aimed to buy food and essentials to the families in need	The pandemic caused 1 million of new poor people in Italy, compromising their capability to buy food and essentials	Product	Synesthesia S.r.l.	Medium-sized	J
O	Threat Intelligence	Service to improve firms' cybersecurity	As most firms activated remote working initiatives in response to lockdown, they Rwere unprepared to address the inherent cybersecurity risks.	Service	Leonardo S.p.a.	Large	C
P	Tutti connessi	The firm collects unutilized smartphones, laptop and tablets from firms and individuals. The hardware is sanitized, regenerated, and delivered to people in need	With most activities and services moving online, digital divide became a urgent matter to address.	Product & Service	Synesthesia S.r.l.	Medium-sized	J
Q	Valvole Dave e Charlotte	3D-printed valves for ventilators in critical therapy	The product is a response to the shortage in valves and ventilators that hospitals were suffering	Product	Leonardo S.p.a.	Large	C
R	Yomi: The Malware Hunter	Lite, free version of a virtual sandbox to isolate suspect files (an alternative approach to the traditional antivirus). A social contest was also promoted to collect suspicious files.	As most firms activated remote working initiatives in response to lockdown, they were unprepared to address the inherent cybersecurity risks.	Service	Yoroi S.r.l.	Small	J

Notes: Sector expressed in Nace Rev.2 Sections, C, Manufacturing; J, Information and communication; M, Professional, scientific, and technical activities; Q, Human health and social work activities.

3.1. Data

The units of analysis of the study are the COVID-related innovations introduced by Italian firms during the first pandemic wave. We focused on one country since the pandemic hit different countries at different times during the first half of 2020 and with different intensities. Furthermore, Italy has been the first European country to be heavily and suddenly hit by the pandemic, making the Italian firm's response to the shock more spontaneous.

We scraped two leading Italian press agencies' websites (ANSA and AGI) to identify our sample, using innovation- and COVID-related keywords and a time frame from March 5 to May 5, 2020. The time frame includes the first core pandemic period in Italy. The queries allowed identifying 125 Italian and foreign products and services. We excluded the innovations mainly developed by foreign firms and Italian R&D or medical institutions to ensure the consistency of innovating firms' mega-environment and corporate culture. After the exclusion criteria, 69 COVID-related innovations remained. We classified them according to their innovativeness (radical versus incremental) and contacted all the firms that developed them to arrange an interview.

3.2. Analytic approach

On the whole, we conducted 14 interviews on 18 innovation projects (some firms introduced multiple COVID-related innovations, see Table 1).

The interviews were conducted through VoIP, using a semi-structured survey (see Appendix) to obtain a thorough description of the innovation projects, their motivations, and the possible inter-organizational collaborations that enabled them. The questions were conceived to be neutral, tackle the social-desirability bias, and allow the interviewees to respond freely. We transcribed the interviews verbatim and analyzed them to identify the motivations triggering the innovation project, the characteristics of the inter-organizational collaborations underlying it, and the degree of innovativeness of the project's outcome.

During the first phase of the analysis, we attempted a thematic analysis of the transcripts by associating quotations with themes and sub-themes associated with motivations and inter-organizational collaboration. Nonetheless, such an approach did not intuitively identify how the motivations and the OI-related variables impacted innovation performance in the investigated cases. Hence, we extracted dummy variables from the identified themes and analyzed them through QCA (Ragin, 1989) - a technique combining quantitative and qualitative methodologies - to identify the antecedent factors that push firms to innovate during the crisis. The variables of the study are shown in Table 2.

All the variables were coded by the researchers autonomously, based on the interpretation of the transcripts. For instance, the researchers labeled each innovation project as having a “radical” or “incremental” degree of innovativeness (RADINN variable) based on:

- the interviewees' response to question 4, “How innovative do you consider X?”;
- the overall description of the project;
- and the researchers' general understanding of the offer of similar products in the market.

While analyzing the interviewees' responses, the researchers marked 1 whether the condition was explicitly mentioned and 0 otherwise. Indeed, for each project, the semi-structured questionnaire included items on the underlying motivations (question 3) and the extent to which inter-organizational collaboration contributed to its development (questions 6 and 7). However, all questions in the transcripts were analyzed to seek possibly complementary information on the conditions. For instance, an interviewee affirmed that “[…] *we fundamentally did it because we felt it was our social duty*” (project I), which brought the interviewees to mark 1 under the CSR motivations of the innovation project. As another instance, in the case of inter-organizational collaboration, if an interviewee mentioned collaborations with a university and a supplier, both R.D. and VERT variables would have been marked as 1.

Table 2
Variables of the study.

Type	Name	Description	Model
Outcome	Radical Innovation (RADINN)	The extent to which the COVID-related innovation is radical (1) or incremental (0)	1, 2, 3, 4
Condition	Motivation: New opportunity (NO)	It takes the value of 1 if the innovation aims to capture a long-term opportunity in an explorative perspective; 0 otherwise	3, 4
Condition	Motivation: Response to the economic crisis (RTC)	It takes the value of 1 if the innovation aims to generate short term-revenues in an exploitative perspective; 0 otherwise	3, 4
Condition	Motivation: Corporate social responsibility (CSR)	It takes the value of 1 if the innovation is motivated by internal CSR choices; 0 otherwise	3, 4
Condition	Motivation: Marketing (MKT)	It takes the value of 1 if the innovation is motivated by grasping favorable visibility on the media; 0 otherwise	3, 4
Condition	Motivation: Industrial (IND)	It takes the value of 1 if either NO = 1 or RTC = 1; 0 otherwise	1, 2
Condition	Motivation: Institutional (INS)	It takes the value of 1 if either CSR = 1 or MKT = 1; 0 otherwise	1, 2
Condition	OI: Horizontal (HORIZ)	It takes the value of 1 if the innovation process benefited from horizontal OI; 0 otherwise	1, 2
Condition	OI: Vertical (VERT)	It takes the value of 1 if the innovation process benefited from vertical OI; 0 otherwise	1, 2
Condition	OI: R&D (R.D.)	It takes the value of 1 if the innovation process benefited from R&D OI; 0 otherwise	1, 2
Condition	OI: Stability of the collaboration (STA)	The collaborations that were needed to develop the innovation were limited to the pandemic period and will probably not last in the future 0; or not 1	1, 2

Finally, the STA variable aimed to identify episodic, pandemic-specific collaborations that were not in place in the past and will not most likely be pursued in the future (these were marked with 0, as opposed to stable collaborations, which were marked with 1).

Since no conflicts emerged during the coding process, and since such a process stemmed from the interviewees' explicit statements, a validation of the coding was not deemed necessary.

3.3. The qualitative comparative analysis

We used QCA (Ragin, 1989), a technique that combines quantitative and qualitative methodologies particularly suitable for small-to-medium N comparison (Berg-Schlosser, 2012; Ragin, 1989; Rihoux & Lobe, 2012). When samples are too small for statistical analysis techniques such as linear regression yet too large for qualitative case-study methodology as thematic analysis, QCA comes in handy. It is typically used to analyze a moderate number of instances, typically between 10 and 50 (Ragin & Amoroso, 2011). The choice of adopting the QCA approach is the most appropriate when researchers have to balance between focusing on instances as a whole (qualitative study on similarities) and focusing on variables (quantitative research on correlations among variables) (Ragin & Amoroso, 2011).

Unlike conventional techniques, QCA does not aim to offer a single solution but to explain the complexity of the investigated phenomenon

by comparing configurations of conditions (Marx, Cambre, & Rihoux, 2013). QCA is characterized by three "pillars": conjunctural causation (the causal role of a single condition unfolding in combination with other conditions), asymmetric causality (an outcome can have a different explanation than its non-occurrence), and equifinality (multiple paths to the outcome may coexist) (Thomann & Maggetti, 2020).

QCA consists of several phases. First, the researchers need to identify the outcome they want to investigate and the factors theoretically expected to cause it. Second, they have to determine the collection of causal conditions likely to influence the outcome under investigation. To this aim, they have to retrieve cases where the 'outcome' occurred and similar cases where it did not. Subsequently, the researchers need to list the conditions that may have concurred to cause those outcomes in the cases under investigation. Once the cases and factors are identified, the researchers need to create scoring criteria. Crisp set QCA (CsQCA) and Fuzzy set QCA (FsQCA) are two scoring strategies researchers might use. The score in a crisp set is either 0 or 1. Instead, the score is set in a fuzzy set at any level in the 0–1 interval. The next step is the analysis of the necessary and sufficient conditions to achieve the outcome. A condition is necessary if present in all configurations of the outcome, which means that the outcome cannot be achieved without such a condition (Ragin, 2008). A condition is sufficient if the outcome depends on it. After identifying various combinations of conditions, the findings need to be interpreted. The interpretation entails visiting each case identified and determining whether or not the conclusions are valid (Marx et al., 2013).

In this study, the variables under investigation include the antecedents discussed in the framework (conditions) of COVID-related innovation (outcome). In addition, we distinguish between radical and incremental innovations (Ettlie, Bridges, & O'Keefe, 1984) to consider the different novelty of the investigated COVID-related products and services. Notably, the motivations and the OI archetypes are not mutually exclusive (i.e., all of them could coexist in a project). Given the dichotomous nature of conditions and outcomes, we opted for the csQCA.

Consistency and coverage are the main parameters adopted to analyze the findings (Goertz, 2006). Compared to all cases with condition X, the consistency parameter expresses the proportion of cases with condition X where the outcome Y occurs. The second parameter, coverage, is only useful when the corresponding conditions have proven to be "consistent enough" to be considered sufficient for Y (Ragin, 2006). Coverage is expressed as the share of cases where both the outcome Y and the condition X occur, compared to all the cases where Y occurs. The higher the coverage score for X, the more cases displaying Y are covered by the corresponding sufficient condition (Grofman & Schneider, 2009).

Ragin (2006, 2008) states that the minimum acceptable consistency level is 0.75. Consistency scores should generally be as near 1.0 as possible, describing a perfect consistency. Low consistency values point to issues with the explanatory model, such as omitted conditions or measurement errors. Coverage thresholds should be at least equal to 0.5 (Schneider & Wagemann, 2012). The analysis of sufficiency produces conservative, parsimonious, and intermediate solution formulas. The conservative solution formula is the most complex since it is based only on empirically observed evidence. The parsimonious solution formula is the least complex solution because it simplifies assumptions. The intermediate solution is often less complex than the conservative solution and more complex than the parsimonious solution (Schneider & Wagemann, 2012).

Using csQCA, we analyzed the condition that leads to an outcome (in our case, RADINN = 1, i.e., radical innovation) and the "non-outcome" (RADINN = 0, i.e., incremental innovation). The ~ symbol indicates the absence of the condition.

In our study, we proposed four models:

Model 1: RADINN = f(INS, IND, VERT, HORIZ, R.D., STA).

Model 2: ~RADINN = f(INS, IND, VERT, HORIZ, R.D., STA).

Model 3: RADINN = f(RTC, NO, MKT, CSR).

Model 4: ~RADINN = f(RTC, NO, MKT, CSR).

Models 1 and 2 include two motivations (INS, institutional motivations; and IND, industrial motivations) and four inter-organizational collaborations (VERT, vertical collaboration; HORIZ, horizontal collaboration; R.D., R&D collaboration; STA, stability of the collaboration) as conditions for radical (Model 1) and incremental innovation (Model 2). Given the number of investigated innovation projects, we followed De Villiers' suggestion (2017) to use models with no more than six conditions (which the author deems appropriate for 16–25 cases). Hence, we integrated Model 1 and Model 2 with two supplementary analyses, Model 3 and Model 4, including the four motivations described in our framework, to identify more specific regularities in their appearances in the innovation projects under investigation.

4. Results

4.1. Descriptive statistics

One-third of the innovation projects under investigation were radically new. Most innovations in our sample were developed collaboratively (55.6% required at least one partner) and were distributed for free (72.2%). Most collaborations involved organizations operating in different sectors and partners with whom previous collaborations had already been in place (70% of the cases where collaboration was present). The motivations declared for the COVID-related innovations had an industrial nature in 50% of the projects and an institutional nature in 89% (several projects had both motivations). More in detail, we observed the following motivations: CSR (61.1% of the projects), marketing (55.6%), short-term response to the crisis (33.3%), and pursuing new opportunities (50.0%).

The following two subsections describe the necessary (4.1) and sufficient solutions (4.2).

4.2. Analysis of necessary conditions

We considered 0.75 as a reference value for consistency to identify the necessary conditions (Ragin, 2006, p. 293). Table 3 shows the necessary solution analysis for Model 1 and Model 2. We observe how INS has perfect consistency in Model 1, which means that institutional motivations emerged in every radical innovation project (sometimes in conjunction with industrial motivations). However, the coverage of the INS condition is quite low, which does not allow considering it as a necessary condition. Institutional motivations emerge markedly also in Model 2, where INS has high consistency and coverage. The two results emphasize how pervasive institutional motivations are in most COVID-related innovation projects, particularly in incrementally innovative ones. Many interviewees vividly described how their firms felt pushed to innovate by institutional forces. For example, regarding project G, which

Table 3
Necessary conditions analysis for the main models (Model 1 and Model 2).

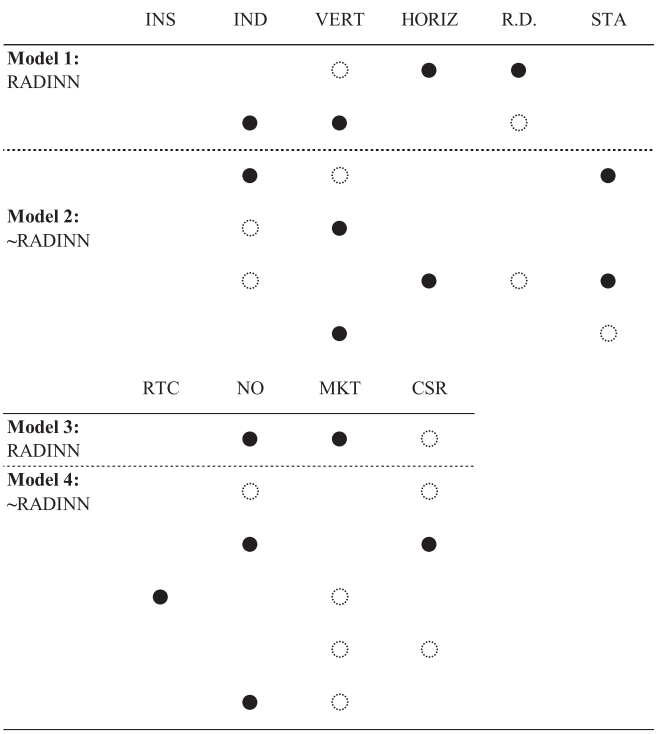
	Model 1		Model 2	
Condition	Consistency	Coverage	Consistency	Coverage
IND	0.500	0.333	0.500	0.667
INS	**1.000**	0.375	**0.833**	0.625
VERT	0.333	0.286	0.417	0.714
HORIZ	0.667	0.500	0.333	0.500
R.D.	0.333	0.500	0.167	0.500
STA	0.667	0.286	**0.833**	0.714
~IND	0.500	0.333	0.500	0.667
~INS	0.000	0.000	0.167	1.000
~VERT	0.667	0.364	0.583	0.636
~HORIZ	0.333	0.200	0.667	0.800
~R.D.	0.667	0.286	**0.833**	0.714
~STA	0.333	0.500	0.167	0.500

Notes: Bold font indicates that the condition's consistency reaches the 0.75 reference point.

aimed to adapt snorkeling masks to the use in intensive care, the interviewee stated, "*The hospital requested our help, and we were also aware of the needs and problems of others*". Similarly, project B, an app aimed to inform users about risky contacts, was motivated as follows, "*Just like when you are on a plane, if someone is sick, a doctor feels prompted to intervene, during the pandemic we – as one of the leading app developers in Europe – felt compelled to contribute*".

The stability of inter-organizational collaborations was important to achieve incremental innovations, having high consistency and coverage. Project M offers one exemplary case, a wristband informing users they are too close to others, "*The main partnership was with the hardware supplier. We already had a collaboration with it, so we commissioned the product's development, bought the designs, and worked together to define the solution and industrialize it*". On the contrary, the absence of R&D collaborations emerged as a key condition to achieving incremental innovation.

The supplemental necessary condition analysis described in Table 4 shows the relevance of CSR motivations to achieve incremental innovations. This result suggests that CSR was probably more important than marketing in triggering incremental innovations. For instance, in project Q, which aimed to 3D-print ventilator valves for critical therapy, the interviewee stated, "*We did a part of our civic duty, even though it was not a given that a company like ours should invest its economic resources, materials, personnel and machinery for free*". Notably, marketing was never described as the only motivation for a project, being matched with at least one industrial motivation or CSR. For instance, in the case of project J, which encompassed the development of a plastic face mask for industrial use, the interviewee affirmed, "*We needed to think about something to survive during this period while keeping the company visible in the media*".



Notes: Sufficient conditions: ● condition present, ○ negation of the condition present

Fig. 2. Overview of the sufficiency conditions (parsimonious solution).

4.3. Analysis of sufficient conditions

We conducted a sufficient condition analysis using the parsimonious solution (see Fig. 2).

4.3.1. Sufficient conditions for radical innovation

We found that radical COVID-related innovations (Model 1) were triggered either by a combination of horizontal and R&D collaboration (without vertical collaboration and regardless of the underlying motivation) or by projects driven by industrial motivations and pursued through vertical collaboration (and without R&D collaboration). On the one hand, the first solution describes projects developed with the support of R&D institutions and other partners on the same level of the supply chain (a sort of "transversal alliance" to solve a challenging perceived problem). On the other hand, the second solution depicts a "vertical alliance" where supplier and customer join forces to either grasp a new opportunity or contrast the crisis. An example of combined horizontal and R&D collaboration came from project C, where both a healthcare professional and a team of professors from Italian and foreign research institutions were involved in the development. Differently, project J was an example of a product driven by industrial motivations "*We saw the diversification in this field as an opportunity for the future*" and nurtured by a collaboration with suppliers. As the interviewee specified, no R&D institution was involved in the project.

Our supplemental analysis of the four motivations (Model 3) also showed that explorative motivations (NO), matched with marketing aspirations but not with CSR motivations, were conducive to developing radical innovations. Such a combination evokes the abovementioned "vertical alliance", where a propensity to explore new business opportunities is nurtured by the opportunity to gather favorable visibility. Consistently, projects C and J were mainly driven by industrial motivations but rode the opportunity to obtain marketing visibility. Similarly, project M aimed to offer a new product line to the firm's customers and gain new customers while spreading a favorable brand image.

Table 4
Necessary conditions analysis for the supplemental models (Model 3 and Model 4).

	Model 3		Model 4	
Condition	Consistency	Coverage	Consistency	Coverage
RTC	0.333	0.333	0.333	0.667
NO	0.500	0.375	0.417	0.625
MKT	0.667	0.444	0.417	0.556
CSR	0.500	0.250	**0.750**	0.750
~RTC	0.667	0.333	0.667	0.667
~NO	0.500	0.300	0.583	0.700
~MKT	0.333	0.222	0.583	0.778
~CSR	0.500	0.500	0.250	0.500

Notes: Bold font indicates that the condition's consistency reaches the 0.75 reference point.

4.3.2. Sufficient conditions for incremental innovation

The incremental COVID-related innovations offered a more diverse set of possible sufficient solutions (Model 2). We can distinguish between those solutions triggered by industrial motivations and those not. On the one hand, industrial motivations were matched with stable inter-organizational collaborations not involving customers or suppliers, as in the case of project O. The project developed a service aimed to improve cybersecurity, which entailed collaborations with two universities (frequent partners of the firm).

On the other hand, incrementally new projects were frequently devoid of industrial motivations and collaboration with R&D institutions, whereas they involved stable horizontal collaborations or vertical collaborations. For instance, the long-lived collaboration with a startup active in contrasting food waste was vital for project N, a website to help collect food and essentials for families in need. Another example comes from product R, a lite version of a previously developed software and a related social contest. The project, which aimed to spread the software as much as possible, needed a supplier's contribution to set up the CSS and HTML of the initiative.

Another solution shows that vertical collaborations constrained to the pandemic may trigger incremental innovations (regardless of underlying motivation). This was the case of project E, which would not have been possible without the collaboration of the supplier, which may not last in the future since the firm's core business lies in fashion and not in PPE development. Overall, industrial motivations seem relatively infrequent as sufficient conditions for incremental innovation, whereas the absence of industrial motivations appears more frequently, supported by either vertical or horizontal collaboration.

Our supplemental analysis of the four motivations (Model 4) offers further insights. CSR and exploratory motivations show complex synergies: incremental innovation is likely to result when both occur (as in the cases of projects E, H, and O) or neither of the two occurs (as in the case of project K). In some circumstances, the lack of institutional-related motivations (CSR and/or marketing) may correspond to incremental innovation, suggesting that the firm mainly attempts to improve its products for industrial reasons. Two incrementally innovative projects, A and K, did not include any institutional motivation but were driven by the willingness to achieve new opportunities and guarantee continuity to the firm's activities, respectively.

5. Discussion

5.1. Motivations for COVID-related innovation

COVID-19 emerged as a catalyst for innovation (Barragan-Quintero et al., 2020; Chesbrough, 2020; Mention et al., 2020). To respond to our first research question, we explored two pairs of COVID-related motivations explaining innovation emerged.

5.1.1. Effect on radical COVID-related innovation projects

We found that institutional motivations, which in this study include CSR and marketing, are very frequently associated with radical COVID-related innovation projects. However, they did not emerge as sufficient conditions. In other words, COVID-19 - as a grand challenge - generated institutional pressures that pervaded most firms, pushing them towards action, but would not have sufficed to trigger radical innovations without the other concurring conditions discussed in this article. We observed two main patterns conducive to radical innovation: one involving horizontal collaboration and collaboration with R&D institutions (we called this a “transversal alliance”), and another driven by industrial motivations involving vertical collaboration (a “vertical alliance”).

The supplemental analysis showed that matching exploration and marketing motivations may also trigger radical COVID-related innovations. Such a combination is particularly frequent in the cases of vertical alliances, where the willingness to grasp new industrial opportunities that will sustain the whole supply chain does not disregard the opportunity to achieve favorable exposure through marketing.

We interpret these results by conjecturing that when innovation opportunities emerged, some firms embraced an explorative strategy (March, 1991). The innovations under investigation emerged during a severe economic crisis, consistently with previous evidence emphasizing the importance of exploration to achieve radical innovations in the event of a crisis (Archibugi et al., 2013a; Archibugi, Filippetti, & Frenz, 2013b). However, in our case, the innovation process was not mainly driven by the need to respond to the economic crisis but was rather inspired by other industrial considerations. The interviews showed how firms pursuing radical innovation exploited their current means and those of their partners to imagine new solutions. This approach is consistent with the “effectuation theory” (Sarasvathy, 2008), which advanced the Schumpeterian perspectives on innovation. Indeed, one of its underlying principles describes how firms on the verge of a new venture leverage their competencies and expertise and involve stakeholders willing to commit to the project without carrying out elaborate competitive analysis (which were not even thinkable during the period under investigation).

At the same time, many firms sensed the marketing potential embedded in their very innovative projects and exploited it willingly. The synergy between marketing and explorative motivations echoes the positive corporate image that firms can build thanks to their communicated innovativeness (Kunz, Schmitt, & Meyer, 2011). Such a positive effect on the corporate image would be particularly intense when a firm's innovation activities have positive externalities on society, as in the case of green innovation (Farza, Ftiti, Hlioui, Louhichi, & Omri, 2021). The grand challenge aura that characterized the COVID-19 pandemic realistically amplified the synergy, especially since the media started broadcasting technological innovations more frequently. The attention towards marketing we observed in our sample bears implications of a wider scope than the pandemic. Indeed, whenever institutional pressures are intense, such as in the case of eco-innovation (Hojnik & Ruzzier, 2016) or when tackling other grand challenges (Waldron, Navis, Karam, & Markman, 2022), firms have a strong incentive to disseminate their coherent (or namely coherent) innovation practices since this can significantly enhance performance (Amores-Salvadó, Castro, & Navas-López, 2014).

5.1.2. Effect on incremental COVID-related innovation projects

Given the very few months that firms had to innovate during the pandemic phase under investigation, incremental innovation was a more viable option to pursue than radical innovation. We found that institutional motivations played an important role, although again not sufficient to trigger incremental innovation. Such importance stems from the informal pressures underlying society's expectations (Anwar & El-Bassiouny, 2020). Indeed, during the pandemic, society expects firms to develop solutions to the issues caused by the virus, even when these solutions are not necessarily groundbreaking. Consistently, Ferrigno and Cucino (2021) mentioned multiple interviews where managers disclosed their willingness to do something useful and help alleviate the panic with their COVID-related innovations. Generally speaking, the results are also in-line with the ‘responsible innovation’ concept, i.e., innovation aimed to “*avoid harm, do good, and coordinate with others for the sake of protecting people and the planet*” (Scherer & Voegtlin, 2020, p. 1).

The analysis of the sufficient conditions showed that the presence or absence of industrial motivations might trigger incremental innovation depending on the contingent collaboration channel, as discussed in the next subsection. However, the absence of industrial motivations is more frequent than its presence, suggesting a preeminent role of institutional motivations.

As our supplemental analysis showed, incremental innovation may emerge when CSR and exploratory motivations co-occur. The result suggests that, when CSR motivations occur, an initially ambitious innovation project (i.e., driven by exploration) may be released earlier than its fulfillment to offer the society some support to deal with the crisis.

Conversely, when neither CSR nor NO motivates the innovation project, we see two possible incremental innovation paths. Indeed, either the firm envisioned the occasion to slightly improve one of its products (from a fully exploitative strategy perspective), or it wanted to leverage the communication potential of a slightly innovative COVID-related innovation project.

5.2. Open innovation for COVID-related innovations

To respond to our second research question, we explored the role of inter-organizational collaboration in COVID-related innovation development and the link with the underlying motivations. Consistent with Chesbrough's (2020) insights on OI during COVID-19, our results emphasize the relevance of inter-organizational collaboration in the pandemic for radical and incremental innovation projects. The results also intertwine with a recent study on crowdsourcing and the supporting role of “the sense of community” that emerged during the pandemic (Al-

Omoush, Orero-Blat, & Ribeiro-Soriano, 2020) in individuals. Such a sense of community - applied to firms -motivated most innovative projects and facilitated inter-organizational collaborations.

5.2.1. Effect on radical COVID-related innovation projects

While OI conditions for radical innovation did not emerge during the necessary condition analysis, the sufficient condition analysis returned two possible solutions we mentioned in Subsection 5.1.1: transversal and vertical alliances. Transversal alliances included a combination of horizontal and R&D collaboration, which echoes the literature emphasizing the positive impact of horizontal collaboration (Gao, Li, Cheng, & Feng, 2017; Yami & Nemeh, 2014) and collaboration with research institutions (Inauen & Schenker-Wicki, 2011; Neyens, Faems, & Sels, 2010) on radical innovations. The results also support D'Agostino and Moreno's (2018) findings regarding inter-organizational collaboration's importance in implementing an explorative strategy and enhancing innovation performance during a crisis. Indeed, the authors found a positive effect of 'institutional collaborations' (which included universities, private and public research centers, institutes, laboratories, consultants, or technological centers) on sales from radical innovation. However, the participation of R&D institutions in developing the investigated COVID-related radical innovations is far from obvious. Indeed, as noted by Perkmann and Salter (2012), "*the clock speed of academic research and business practice can be wildly divergent*", and universities are usually more likely to be involved in long-term, far-reaching projects. In contrast, the investigated projects were due in a few months. Based on our experience, we may conjecture that the pandemic allowed academics to accelerate their 'response-time' and increasingly close the cultural gap with the industry. The matching of horizontal and R&D collaboration also supports the importance of using multiple (but not too many) collaboration channels to obtain radical innovations, both during normal periods (Bayona-Saez, Cruz-Cázares, García-Marco, & Sánchez García, 2017; Kobarg, Stumpf-Wollersheim, & Welpe, 2019; Laursen & Salter, 2006) and specifically during a crisis (D'Agostino & Moreno, 2018; Zouaghi et al., 2018). These results echo Crick and Crick's research (2020), which exemplified the several remarkable coopetition initiatives where competitors teamed up to face the pandemic, such as competing pharmaceutical companies from multiple countries sharing knowledge and equipment to develop a vaccine. Another consistent example of horizontal collaboration characterized AirAsia's efforts to build an innovation ecosystem spreading outside the airline sector (e.g., training, food delivery, e-commerce) and survive the crisis (Radziwon et al., 2021).

The solution describing vertical alliances includes industrial motivations matched with vertical collaborations but without collaborations with R&D institutions. The result is consistent with the literature, which showed how vertical collaboration increased the likelihood of radical innovations (Santamaria & Surroca, 2011). A similar result was found in the context of a crisis when vertical collaboration enhanced sales from radical innovations (D'Agostino & Moreno, 2018). These "vertical alliances" leverage the synergies between client and supplier. Indeed, by knowing each other's technologies, capabilities, and industrial goals, it is easier to identify mutually interesting innovation projects and assess their viability. Furthermore, vertical collaboration entails reducing transaction costs and a smoother knowledge-sharing process (de Paula, de Campos, Pagani, Guarnieri and Kaviani, 2019), implying an acceleration of the time-to-market, which was essential in the context under investigation.

5.2.2. Effect on incremental COVID-related innovation projects

OI suited the effort to deliver incremental innovation rapidly, being a well-known accelerator for time-to-market (Greco et al., 2019; Lassen & Laugen, 2017). However, during the months under investigation, Italy was under lockdown, and firms may have had no time nor the occasion to quickly start from scratch new projects or collaborations to develop COVID-related innovations, as suggested by Ferrigno and Cucino (2021). Consistently, stability emerged while analyzing the necessary conditions and appeared in two sufficient solutions. The result also aligns with the literature, which states that familiarity between partners is critical to developing innovation (Zheng & Yang, 2015) and confirms analogous findings observed during the pandemic by other authors (Corvello, Verteramo, Nocella, & Ammirato, 2022). The result also remarks on the importance of repeated collaborations to enable innovation, as emphasized in previous studies (Belderbos et al., 2012; Zheng & Yang, 2015).

Another interesting insight emerged from the necessary condition analysis, which does not recommend R&D collaboration to achieve incremental COVID-related innovations. Indeed, R&D collaborations are typically associated with radical innovation (D'Agostino & Moreno, 2018). Universities and research institutions are usually involved in very sophisticated research projects to which they can contribute with their state-of-the-art knowledge and advanced laboratories (Greco et al., 2020). Conversely, firms rarely involved R&D institutions in COVID-related incremental innovation projects, possibly due to the limited interest of researchers in marginally innovative initiatives. Indeed, collaboration with R&D institutions is more frequently associated with breakthrough innovation projects (Sarpong & Teirlinck, 2018) or basic research (van Beers & Zand, 2014).

The sufficient condition analysis suggested that, when industrial motivations occur, stable non-vertical collaboration emerges. Instead, in the absence of industrial motivations, either vertical or horizontal collaborations may concur to the development of incremental innovations. This suggests that – moved by institutional motivations – firms teamed up with other firms to offer timely responses to the pandemic. The interviewees' stories reflect an approach echoing the effectuation theory (Sarasvathy, 2008). Indeed, based on the pressing needs society was experiencing, relatively simple innovation ideas emerged. To transform these ideas into actions, many firms promptly searched for partners that could offer the necessary complementary skills, technologies, or materials, without enacting long-term plans. While usually effectuation theory is applied to create new ventures, in this case, the new project is not fostered by the willingness to obtain new revenue flows but by the common mission of facing a grand challenge. The widespread commitment of partners underlies a more collaborative attitude to tackle the common challenge, which several authors have recently emphasized (Antonelli et al., 2021; Chesbrough, 2020; McGahan et al., 2021).

Our supplemental analyses showed that CSR motivations are more likely to occur than marketing ones. This suggests that the grand challenge posed by COVID-19 had a preeminent role in developing incrementally new products or services. However, the sufficient condition analyses showed that CSR becomes a sufficient solution only when matched with the industrially-oriented exploration of new opportunities. Other sufficient solutions were characterized by the lack of institutional-related motivations (CSR and/or marketing), which suggested other underlying industrial motivations.

6. Conclusions

This is one of the first studies to explore the motivations and inter-organizational collaborations underlying COVID-related innovation development. We found evidence that institutional motivations (CSR or marketing) are important for radical and – particularly - for incremental innovation but rarely emerge among the sufficient conditions for their development. The results have implications for scholars and practitioners.

Among the implications for scholars, our study unveils the important relationship between innovation, marketing, and CSR to address a grand challenge while a crisis hits the economy. While such a relationship has been apparent during the pandemic, it is rooted in the past, may persist in the future (e.g., responsible innovations), and deserves further investigation. Institutional pressures at least partially drove nearly all the projects we investigated. While the importance of institutional

pressure on innovation has been discussed in the past, such as in eco-innovation (Hojnik & Ruzzier, 2016), to our knowledge, no previous study acknowledged such a role in COVID-related innovation projects. Indeed, some of the most recent studies on the topic observed firms' somewhat generous attitude during the pandemic (e.g., Crick & Crick, 2020; Ferrigno & Cucino, 2021), but the fine line between CSR and marketing was never investigated before. Such a fine line elicits several possible research questions. Are marketing motivations less likely to result in radical innovations than CSR ones? To what extent does marketing drive innovation outside the context of a pandemic? Which institutional pressures prevail in determining marketing and CSR motivations? Future studies could also usefully explore the inter-organizational learning dynamics triggered by the collaborations, verifying whether and how institutional pressures favor knowledge-sharing and trim the not-invented-here syndrome.

We also observed an interesting synergy between marketing and explorative motivations in determining radical innovations. Conversely, matching CSR and explorative motivations is more often associated with incremental innovations. We conjecture that CSR may induce firms to settle for less innovative projects than anticipated, possibly delivering them sooner and helping society. This synergy between marketing and explorative motivations calls for more research on the effect of firms' actual and perceived innovativeness on their marketing metrics (such as corporate image and brand awareness). Future research could also explore how marketing and CSR affect innovation projects' conception and development.

Ferrigno and Cucino (2021) recently claimed that – during the pandemic - there was no time to start new projects or inter-organizational collaborations unless they were extremely fast. Our results proved that firms found the time to activate these collaborations and that these have been functional to innovate. However, the pandemic induced a peculiarly accelerated development speed that highlighted a neglected variable in the OI debate: time. Future studies could take the lead from this to analyze – also outside of the pandemic context – how the impact of OI on performance varies with the developmental time. Which OI channels are more suitable for fast, collaborative development projects? Which OI practices are more appropriate to manage such collaborations?

Among the implications for practitioners, we found that radical innovation projects with extremely short time-to-market need to rely either on transversal collaborations (i.e., horizontal collaboration and collaboration with R&D institutions) or vertical collaborations driven by industrial motivations. Instead, incremental innovation projects are determined through more varied solutions. A new season of grand challenges and related economic crises is approaching. The growing cost of energy is urging firms to invest in renewables and energy saving, addressing at the same time the global warming challenge. Similarly, the growing cost of raw materials and metals greatly boosts the circular economy. As a result, firms will have the chance to pursue their economic and CSR goals synergically, as we observed in this study, which could pave the ground for a new perspective on innovation.

The main limitation of this research lies in its sample, a relatively small number of Italian cases, which leaves space for replications of our study on larger, cross-country samples. These few cases constrained the number of investigated conditions in the csQCA. Hence, a larger-scale study could allow testing models that include the four motivations we identified along with multiple OI variables and other endogenous and exogenous conditions that could be important to define the outcome. Additional insights could also be drawn by studying cases of failed COVID-related innovations. Finally, while we used crisp conditions in our research, future studies could offer richer insights by assessing fuzzy scores for each condition.

Acknowledgements

The authors wish to thank the two reviewers for their very insightful comments. The authors also thank Gabriella Ferruzzi for her initial contribution in the research project.

Appendix A. Semi-structured questionnaire

1) Could you please describe X[1]?
2) Could you please describe the innovation process that allowed the development of X?
3) What motivated your firm to begin such innovation process?
4) How innovative do you consider X?
5) Is X offered free of charge to the market?
6) Did you need the contribution of any other organization to fulfil the innovation process?
7) If yes…
   a. Can you describe it?
   b. Was it a durable inter-organizational collaboration or was it limited to the pandemic period?
   c. Did information sharing with other organizations imply risks? How did you address them?
8) How is X performing on the market?

References

Ahn, J. M., Roijakkers, N., Fini, R., & Mortara, L. (2019). Leveraging open innovation to improve society: Past achievements and future trajectories. *R&D Management, 49*(3), 267–278. https://doi.org/10.1111/radm.12373

Almeida, F., Duarte Santos, J., & Augusto Monteiro, J. (2020). The challenges and opportunities in the digitalization of companies in a post-COVID-19 world. *IEEE Engineering Management Review, 48*(3), 97–103. https://doi.org/10.1109/EMR.2020.3013206

Al-Omoush, K. S., Orero-Blat, M., & Ribeiro-Soriano, D. (2020). The role of sense of community in harnessing the wisdom of crowds and creating collaborative knowledge during the COVID-19 pandemic. *Journal of Business Research*. https://doi.org/10.1016/j.jbusres.2020.10.056

Amores-Salvadó, J., Castro, G. M., & Navas-López, J. E. (2014). Green corporate image: Moderating the connection between environmental product innovation and firm performance. *Journal of Cleaner Production, 83*, 356–365. https://doi.org/10.1016/j.jclepro.2014.07.059

Antonelli, G. A., Leone, M. I., & Ricci, R. (2021). Exploring the open COVID pledge in the fight against COVID-19: A semantic analysis of the manifesto, the pledgors and the featured patents. *R&D Management*. https://doi.org/10.1111/radm.12493. radm.12493.

Anwar, Y., & El-Bassiouny, N. (2020). Marketing and the sustainable development goals (SDGs): A review and research agenda. In S. Idowu, R. Schmidpeter, & Z. L (Eds.), *The future of the UN sustainable development goals. CSR, sustainability, ethics & governance*. Springer.

Archibugi, D., Filippetti, A., & Frenz, M. (2013a). The impact of the economic crisis on innovation: Evidence from Europe. *Technological Forecasting and Social Change, 80*(7), 1247–1260.

Archibugi, D., Filippetti, A., & Frenz, M. (2013b). Economic crisis and innovation: Is destruction prevailing over accumulation? *Research Policy, 42*(2), 303–314. https://doi.org/10.1016/j.respol.2012.07.002

Ardito, L., Coccia, M., & Messeni Petruzzelli, A. (2021). Technological exaptation and crisis management: Evidence from COVID-19 outbreaks. *R&D Management*. https://doi.org/10.1111/radm.12455. radm.12455.

Bar Am, J., Furstenthal, L., Jorge, F., & Roth, E. (2020). Innovation in a crisis: Why it is more critical than ever. https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/innovation-in-a-crisis-why-it-is-more-critical-than-ever.

Barragan-Quintero, R. V., Barragan-Quintero, F., & Ahumada-Tello, E. (2020). The impact of COVID-19 on innovation: Old projections or new expectations after the pandemic? *IEEE Engineering Management Review, 48*(3), 197–201. https://doi.org/10.1109/EMR.2020.3016043

Bayona-Saez, C., Cruz-Cázares, C., García-Marco, T., & Sánchez García, M. (2017). Open innovation in the food and beverage industry. *Management Decision, 55*(3), 526–546. https://doi.org/10.1108/MD-04-2016-0213

van Beers, C., & Zand, F. (2014). R&D cooperation, partner diversity, and innovation performance: An empirical analysis. *Journal of Product Innovation Management, 31*(2), 292–312. https://doi.org/10.1111/jpim.12096

Belderbos, R., Gilsing, V., & Lokshin, B. (2012). Persistence of, and interrelation between, horizontal and vertical technology alliances. *Journal of Management, 38*(6), 1812–1834. https://doi.org/10.1177/0149206310386962

[1] The interviewee is asked about the specific product or service "X", which was identified from the press.

Berchicci, L. (2013). Towards an open R&D system: Internal R&D investment, external knowledge acquisition and innovative performance. *Research Policy, 42*(1), 117–127. https://doi.org/10.1016/j.respol.2012.04.017

Berg-Schlosser, D. (2012). Comparative research designs and case selection. *Mixed Methods in Comparative Politics, 32–40*. https://doi.org/10.1057/9781137283375_3

Bertello, A., Bogers, M. L. A. M., & De Bernardi, P. (2021). Open innovation in the face of the COVID-19 grand challenge: insights from the Pan-European hackathon 'EUvsVirus.'. *R&D Management*. https://doi.org/10.1111/radm.12456. radm.12456.

Bogers, M. (2011). The open innovation paradox: Knowledge sharing and protection in R&D collaborations. *European Journal of Innovation Management, 14*(1), 93–117. https://doi.org/10.1108/14601061111104715

Bogers, M., Chesbrough, H., & Strand, R. (2020). Sustainable open innovation to address a grand challenge. *British Food Journal, 122*(5), 1505–1517. https://doi.org/10.1108/BFJ-07-2019-0534

Cefis, E., & Marsili, O. (2019). Good times, bad times: Innovation and survival over the business cycle. *Industrial and Corporate Change, 28*(3), 565–587. https://doi.org/10.1093/icc/dty072

Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business School.

Chesbrough, H. W. (2006). Open innovation: A new paradigm for understanding industrial innovation. In H. W. Chesbrough, W. Vanhaverbeke, & J. West (Eds.), *Open innovation: Researching a new paradigm* (pp. 1–19). Oxford University Press.

Chesbrough, H. W. (2020). To recover faster from Covid-19, open up: Managerial implications from an open innovation perspective. *Industrial Marketing Management, 88*, 410–413. https://doi.org/10.1016/j.indmarman.2020.04.010

Corvello, V., Verteramo, S., Nocella, I., & Ammirato, S. (2022). Thrive during a crisis: The role of digital technologies in fostering antifragility in small and medium-sized enterprises. *Journal of Ambient Intelligence and Humanized Computing*. https://doi.org/10.1007/s12652-022-03816-x

Crick, J. M., & Crick, D. (2020). Coopetition and COVID-19: Collaborative business-to-business marketing strategies in a pandemic crisis. *Industrial Marketing Management, 88*, 206–213. https://doi.org/10.1016/j.indmarman.2020.05.016

Cruz-Castro, L., Holl, A., Rama, R., & Sanz-Menéndez, L. (2018). Economic crisis and company R&D in Spain: Do regional and policy factors matter? *Industry and Innovation, 25*(8), 729–751. https://doi.org/10.1080/13662716.2017.1355231

D'Agostino, L. M., & Moreno, R. (2018). Exploration during turbulent times: An analysis of the relation between cooperation in innovation activities and radical innovation performance during the economic crisis. *Industrial and Corporate Change, 27*(2), 387–412. https://doi.org/10.1093/icc/dtx035

De Villiers, R. (2017). QCA in empirical marketing research: An experiment featuring Dorah Explorah, investigating celebrity endorsement's effect on product selection. *Australasian Marketing Journal, 25*(3), 225–250. https://doi.org/10.1016/j.ausmj.2017.09.001

DiMaggio, P. J., & Powell, W. W. (1983). The Iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review, 48*(2), 147. https://doi.org/10.2307/2095101

Ettlie, J. E., Bridges, W. P., & O'Keefe, R. D. (1984). Organization strategy and structural differences for radical versus incremental innovation. *Management Science, 30*(6), 682–695. https://doi.org/10.1287/mnsc.30.6.682

Farza, K., Ftiti, Z., Hlioui, Z., Louhichi, W., & Omri, A. (2021). Does it pay to go green? The environmental innovation effect on corporate financial performance. *Journal of Environmental Management, 300*, Article 113695. https://doi.org/10.1016/j.jenvman.2021.113695

Ferrigno, G., & Cucino, V. (2021). Innovating and transforming during COVID-19: Insights from Italian firms. *R&D Management, 51*(4), 325–338. https://doi.org/10.1111/radm.12469

Gao, Y., Li, Y., Cheng, M., & Feng, G. (2017). How does market learning affect radical innovation? The moderation roles of horizontal ties and vertical ties. *Journal of Business & Industrial Marketing, 32*(1), 57–74. https://doi.org/10.1108/JBIM-11-2015-0215

Goertz, G. (2006). *Social science concepts: A User's guide* (Princeton (ed.) (pp. 1–66). PrincetonUniversity Press.

Greco, M., Grimaldi, M., & Cricelli, L. (2019). Benefits and costs of open innovation: The BeCO framework. *Technology Analysis & Strategic Management, 31*(1), 53–66. https://doi.org/10.1080/09537325.2018.1484442

Greco, M., Grimaldi, M., & Cricelli, L. (2020). Interorganizational collaboration strategies and innovation abandonment: The more the merrier? *Industrial Marketing Management, 90*, 679–692. https://doi.org/10.1016/j.indmarman.2020.03.029

Greve, H. R. (2007). Exploration and exploitation in product innovation. *Industrial and Corporate Change, 16*(5), 945–975. https://doi.org/10.1093/icc/dtm013

Grofman, B., & Schneider, C. Q. (2009). An introduction to crisp set QCA, with a comparison to binary logistic regression. *Political Research Quarterly, 62*(4), 662–672. https://doi.org/10.1177/1065912909338464

Gulati, R. (1995). Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal, 38*(1), 85–112. https://doi.org/10.5465/256729

Gunday, G., Ulusoy, G., Kilic, K., & Alpkan, L. (2011). Effects of innovation types on firm performance. *International Journal of Production Economics, 133*(2), 662–676. https://doi.org/10.1016/j.ijpe.2011.05.014

He, H., & Harris, L. (2020). The impact of Covid-19 pandemic on corporate social responsibility and marketing philosophy. *Journal of Business Research, 116*, 176–182. https://doi.org/10.1016/j.jbusres.2020.05.030

Hojnik, J., & Ruzzier, M. (2016). What drives eco-innovation? A review of an emerging literature. *Environmental Innovation and Societal Transitions, 19*, 31–41. https://doi.org/10.1016/j.eist.2015.09.006

Inauen, M., & Schenker-Wicki, A. (2011). The impact of outside-in open innovation on innovation performance. *European Journal of Innovation Management, 14*(4), 496–520. https://doi.org/10.1108/14601061111174934

Keupp, M. M., & Gassmann, O. (2009). Determinants and archetype users of open innovation. *R&D Management, 39*(4), 331–341. https://doi.org/10.1111/j.1467-9310.2009.00563.x

Klapper, L., & Love, I. (2011). The impact of the financial crisis on new firm registration. *Economics Letters, 113*(1), 1–4. https://doi.org/10.1016/j.econlet.2011.05.048

Kobarg, S., Stumpf-Wollersheim, J., & Welpe, I. M. (2019). More is not always better: Effects of collaboration breadth and depth on radical and incremental innovation performance at the project level. *Research Policy, 48*(1), 1–10. https://doi.org/10.1016/j.respol.2018.07.014

Kuhlmann, S., & Rip, A. (2018). Next-generation innovation policy and grand challenges. *Science and Public Policy, 45*(4), 448–454. https://doi.org/10.1093/scipol/scy011

Kunz, W., Schmitt, B., & Meyer, A. (2011). How does perceived firm innovativeness affect the consumer? *Journal of Business Research, 64*(8), 816–822. https://doi.org/10.1016/j.jbusres.2010.10.005

Laperche, B., Lefebvre, G., & Langlet, D. (2011). Innovation strategies of industrial groups in the global crisis: Rationalization and new paths. *Technological Forecasting and Social Change, 78*(8), 1319–1331. https://doi.org/10.1016/j.techfore.2011.03.005

Lassen, A. H., & Laugen, B. T. (2017). Open innovation: On the influence of internal and external collaboration on degree of newness. *Business Process Management Journal, 23*(6), 1129–1143. https://doi.org/10.1108/BPMJ-10-2016-0212

Laursen, K., & Salter, A. J. (2006). Open for innovation: The role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal, 27*(2), 131–150. https://doi.org/10.1002/smj.507

Lee, S., Park, G., Yoon, B., & Park, J. (2010). Open innovation in SMEs—An intermediated network model. *Research Policy, 39*(2), 290–300. https://doi.org/10.1016/j.respol.2009.12.009

Levinthal, D. A., & March, J. G. (1981). A model of adaptive organizational search. *Journal of Economic Behavior and Organization, 2*(4), 307–333. https://doi.org/10.1016/0167-2681(81)90012-3

Locatelli, G., Greco, M., Invernizzi, D. C., Grimaldi, M., & Malizia, S. (2021). What about the people? Micro-foundations of open innovation in megaprojects. *International Journal of Project Management, 39*(2), 115–127. https://doi.org/10.1016/j.ijproman.2020.06.009

March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science, 2*(1), 71–87. https://doi.org/10.1287/orsc.2.1.71

Marx, A., Cambre, B., & Rihoux, B. (2013). CRISP-SET qualitative comparative analysis in organizational studies. In *Research in the sociology of organizations*. https://doi.org/10.1108/S0733-558X(2013)0000038006

McGahan, A. M., Bogers, M. L. A. M., Chesbrough, H., & Holgersson, M. (2021). Tackling societal challenges with open innovation. *California Management Review, 63*(2), 49–61. https://doi.org/10.1177/0008125620973713

McWilliams, A., & Siegel, D. (2001). Corporate social responsibility: A theory of the firm perspective. *The Academy of Management Review, 26*(1), 117. https://doi.org/10.2307/259398

Mention, A.-L., Pinto Ferreira, J. J., & Torkkeli, M. (2020). Coronavirus: A catalyst for change and innovation. *Journal of Innovation Management, 8*(1). https://doi.org/10.24840/2183-0606_008.001_0001

Miemczyk, J. (2008). An exploration of institutional constraints on developing end-of-life product recovery capabilities. *International Journal of Production Economics, 115*(2), 272–282. https://doi.org/10.1016/j.ijpe.2008.04.013

Mora Cortez, R., & Johnston, W. J. (2020). The coronavirus crisis in B2B settings: Crisis uniqueness and managerial implications based on social exchange theory. *Industrial Marketing Management, 88*, 125–135. https://doi.org/10.1016/j.indmarman.2020.05.004

Neyens, I., Faems, D., & Sels, L. (2010). The impact of continuous and discontinuous alliance strategies on startup innovation performance. *International Journal of Technology Management, 52*(3/4), 392–410. http://inderscience.metapress.com/index/G32973GG6N14K24U.pdf.

Osiyevskyy, O., Shirokova, G., & Ritala, P. (2020). Exploration and exploitation in crisis environment: Implications for level and variability of firm performance. *Journal of Business Research, 114*, 227–239. https://doi.org/10.1016/j.jbusres.2020.04.015

Parida, V., Westerberg, M., & Frishammar, J. (2012). Inbound open innovation activities in high-tech SMEs: The impact on innovation performance. *Journal of Small Business Management, 50*(2), 283–309. https://doi.org/10.1111/j.1540-627X.2012.00354.x

Park, S. H., & Russo, M. V. (1996). When competition eclipses cooperation: An event history analysis of joint venture failure. *Management Science, 42*(6), 875–890. https://doi.org/10.1287/mnsc.42.6.875

de Paula, I. C., de Campos, E. A. R., Pagani, R. N., Guarnieri, P., & Kaviani, M. A. (2019). Are collaboration and trust sources for innovation in the reverse logistics? Insights from a systematic literature review. *Supply Chain Management: An International Journal, 25*(2), 176–222. https://doi.org/10.1108/SCM-03-2018-0129

Perkmann, M., & Salter, A. (2012). How to create productive partnerships with universities. *MIT Sloan Management Review, 53*(4), 79–88.

Radziwon, A., Bogers, M. L. A. M., Chesbrough, H., & Minssen, T. (2021). Ecosystem effectuation: Creating new value through open innovation during a pandemic. *R and D Management*. https://doi.org/10.1111/radm.12512

Ragin, C. (1989). *The comparative method: Moving beyond qualitative and quantitative methods*. University of California Press.

Ragin, C. (2006). Set relations in social research: Evaluating their consistency and coverage. *Political Analysis, 14*(3), 291–310. https://doi.org/10.1093/pan/mpj019

Ragin, C. (2008). *Redisigning social inquiry: Fuzzy sets and beyond* (p. 240). University of Chicago Press.

Ragin, C., & Amoroso, L. (2011). *Constructing social research: The unity and diversity of method* (3rd ed.). Sage Publications.

Rihoux, B., & Lobe, B. (2012). The case for qualitative comparative analysis (QCA): Adding leverage for thick cross-case comparison. In , *February 2020. The SAGE Handbook of Case-Based Methods* (pp. 222–242). https://doi.org/10.4135/9781446249413.n13

Santamaria, L., & Surroca, J. (2011). Matching the goals and impacts of R&D collaboration. *European Management Review, 8*(2), 95–109. https://doi.org/10.1111/j.1740-4762.2011.01012.x

Sarasvathy, S. D. (2008). Effectuation: Elements of entrepreneurial expertise. In *Effectuation: Elements of entrepreneurial expertise*. https://doi.org/10.4337/9781848440197

Sarpong, O., & Teirlinck, P. (2018). The influence of functional and geographical diversity in collaboration on product innovation performance in SMEs. *The Journal of Technology Transfer, 43*(6), 1667–1695. https://doi.org/10.1007/s10961-017-9582-z

Scherer, A. G., & Voegtlin, C. (2020). Corporate governance for responsible innovation: Approaches to corporate governance and their implications for sustainable development. *Academy of Management Perspectives, 34*(2), 182–208. https://doi.org/10.5465/amp.2017.0175

Schneider, C. Q., & Wagemann, C. (2012). *Set-theoretic methods for the social sciences: A guide to qualitative comparative analysis (strategies for social inquiry)*. Cambridge University Press. https://doi.org/10.1017/cbo9781139004244

Schumpeter, J. A. (1934). *The theory of economic development*. Harvard University Press.

Scott, W. R. (1995). *Institutions and organizations*. Sage.

Smith, D. J., & Blundel, R. K. (2014). Improvisation and entrepreneurial bricolage versus rationalisation: A case-based analysis of contrasting responses to economic instability in the UK brass musical instruments industry. *Journal of General Management, 40*(1), 53–78.

Thomann, E., & Maggetti, M. (2020). Designing research with qualitative comparative analysis (QCA): Approaches, challenges, and tools. *Sociological Methods & Research, 49*(2), 356–386. https://doi.org/10.1177/0049124117729700

Varadarajan, P. R., & Menon, A. (1988). Cause-related marketing: A Coalignment of marketing strategy and corporate philanthropy. *Journal of Marketing, 52*(3), 58–74. https://doi.org/10.1177/002224298805200306

Verma, S., & Gustafsson, A. (2020). Investigating the emerging COVID-19 research trends in the field of business and management: A bibliometric analysis approach. *Journal of Business Research, 118*, 253–261. https://doi.org/10.1016/j.jbusres.2020.06.057

Vick, T. E., & Robertson, M. (2018). A systematic literature review of UK university–industry collaboration for knowledge transfer: A future research agenda. *Science and Public Policy, 45*(4), 579–590. https://doi.org/10.1093/scipol/scx086

Waldron, T. L., Navis, C., Karam, E. P., & Markman, G. D. (2022). Toward a theory of activist-driven responsible innovation: How activists pressure firms to adopt more responsible practices. *Journal of Management Studies, 59*(1), 163–193. https://doi.org/10.1111/joms.12548

Wang, Y., Hong, A., Li, X., & Gao, J. (2020). Marketing innovations during a global crisis: A study of China firms' response to COVID-19. *Journal of Business Research, 116*, 214–220. https://doi.org/10.1016/j.jbusres.2020.05.029

Wirsich, A., Kock, A., Strumann, C., & Schultz, C. (2016). Effects of university-industry collaboration on technological newness of firms. *Journal of Product Innovation Management, 33*(6), 708–725. https://doi.org/10.1111/jpim.12342

Woodside, A. G. (2020). Interventions as experiments: Connecting the dots in forecasting and overcoming pandemics, global warming, corruption, civil rights violations, misogyny, income inequality, and guns. *Journal of Business Research, 117*, 212–218. https://doi.org/10.1016/j.jbusres.2020.05.027

Yami, S., & Nemeh, A. (2014). Organizing coopetition for innovation: The case of wireless telecommunication sector in Europe. *Industrial Marketing Management, 43*(2), 250–260. https://doi.org/10.1016/j.indmarman.2013.11.006

Zheng, Y., & Yang, H. (2015). Does familiarity Foster innovation? The impact of Alliance partner Repeatedness on breakthrough innovations. *Journal of Management Studies, 52*(2), 213–230. https://doi.org/10.1111/joms.12112

Zouaghi, F., Sánchez, M., & Martínez, M. G. (2018). Did the global financial crisis impact firms' innovation performance? The role of internal and external knowledge capabilities in high and low tech industries. *Technological Forecasting and Social Change, 132*, 92–104. https://doi.org/10.1016/j.techfore.2018.01.011