

Start-up collaboration units as knowledge brokers in Corporate Innovation Ecosystems: A study in the automotive industry



Vincenzo Corvello^{a,*}, Alberto Michele Felicetti^b, Annika Steiber^c, Sverker Alänge^d

^a Department of Engineering, University of Messina, Messina, Italy

^b Department of Mechanical, Energy and Management Engineering, University of Calabria, Rende, Italy

^c Department of Management, Menlo College, Atherton, California, United States

^d Institute for Management of Innovation and Technology, Gothenburg, Sweden

ARTICLE INFO

Article History:

Received 2 August 2022

Accepted 28 December 2022

Available online 11 January 2023

Keywords:

Start-ups

Knowledge brokers

Knowledge transfer

Corporate innovation ecosystems

Asymmetric partnerships

JEL:

M13

O32

ABSTRACT

Start-up collaboration units (SCUs) are organizational units specifically created by large companies to facilitate collaboration with start-ups within their corporate innovation ecosystems (CIEs). The purpose of this study is to analyze the role of SCUs with reference to the transfer of knowledge between start-ups and large companies in collaborative innovation projects. An embedded case study was undertaken with three large original equipment manufacturers (OEMs) in the automotive sector. Interviews were conducted with managers of the three OEMs, of the intermediaries they collaborate with, and of the start-ups involved. Data were systematically coded and analyzed. The main barriers to knowledge exchange in partnerships between large companies and start-ups were identified, i.e. mismatches in the interpretation of knowledge and mismatches in the expectations of the partners. In addition, strategies have been identified that can be used by SCUs to facilitate knowledge flows, namely building networks, integrating communication, knowledge elicitation, orchestrating dialog, thinking outside the box, and increasing agility. This study is one of the first to focus on SCUs. It contributes to understanding collaborative innovation processes involving start-ups by studying the knowledge-broker role played by SCUs in the complex network of actors (large companies, start-ups, innovation intermediaries, public institutions) that make up a CIE.

© 2022 The Authors. Published by Elsevier España, S.L.U. on behalf of Journal of Innovation & Knowledge. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Introduction

Collaboration between large corporations and start-ups is widely recognized as an approach that favors innovation processes (Freytag, 2019). It involves the participation of several different actors, including the large corporation in its multiple articulations, start-up companies, and also specialized intermediaries, as well as, in some cases, other organizations (partner corporations, research institutions) (Granstrand & Holgersson, 2020). This results in an innovation ecosystem centered around the focal corporation or corporate innovation ecosystem (CIE) (Ritala et al., 2013; Autio & Thomas, 2014; Giusti et al., 2020). On the one hand, innovation ecosystems allow large companies to speed up their innovation processes, quickly accessing new technologies and acquiring emerging talent (Steiber & Alänge, 2020; Rigtering & Behrens, 2021). On the other hand, being involved in an innovation ecosystem offers start-ups an opportunity to

improve their reputation, find their first customers, improve their organizational skills, and access new technologies (Bereczki, 2019; Kraus et al., 2020; Guo et al., 2022). The quality and the intensity of the collaboration in an innovation ecosystem are often facilitated by the presence of specialized intermediaries reducing the barriers to an effective collaboration (Crisan et al., 2021).

However, collaboration in innovation ecosystems is not without problems (Scott et al., 2019): information and knowledge asymmetries, as well as differences in operating methods, cultures, and objectives, pose challenges (Hutter et al., 2021). The emergence, development, and functioning of ecosystems are characterized by a multidirectional exchange of knowledge, the success of which coincides with the success of the ecosystem (Bacon et al., 2019). The transfer of knowledge is subject to several difficulties. The actors might lack the willingness to collaborate because of competing interests, a phenomenon sometimes referred to as paradoxical tensions (Remneland Wikhamn, 2020). These kinds of tensions have been observed both in interorganizational knowledge transfer (Ritala & Stefan, 2021) and in the transfer of knowledge between internal units within the same organization (Lalaounis & Nayak, 2022). In other

* Corresponding author at: Department of Engineering, University of Messina, Contrada di Dio, 98166 Messina, Italy.

E-mail address: vincenzo.corvello@unime.it (V. Corvello).

cases, even if the actors are willing to collaborate, barriers at the cognitive level might hinder knowledge transfer. Such barriers include knowledge ambiguity, different contexts for the exchanging partners, and information overload (Xie et al., 2018).

The presence within large companies of organizational units specifically dedicated to collaboration with start-ups is a powerful tool for improving innovation processes (Fang et al., 2013; Yao et al., 2020). These organizational units are referred to as start-up collaboration units (SCUs) (Dingler & Enkel, 2016; Kurpjuweit & Wagner, 2020). A relevant part of their work is to identify, collect, and transfer valuable knowledge. They have a transversal knowledge of corporate processes, acting as a bridge between the various departments of the corporation and the start-ups involved in the collaboration (Kurpjuweit & Wagner, 2020).

Several studies have been conducted over recent years on knowledge-sharing behavior in innovation ecosystems (e.g. Fang et al., 2013; Loebbecke et al., 2016; Öberg & Alexander, 2019), on the role of knowledge brokers (e.g. Chiambaretto et al., 2019; Crupi et al., 2020), and on collaboration between large corporations and start-ups (e.g. De Groote & Backmann, 2020; Steiber et al., 2021). In many studies, the unit of analysis has focused on the organizational or the ecosystem level. Few studies have focused on individual groups and organizational units, and even fewer on SCUs. This is somewhat surprising given the importance of these organizational units in the formation and functioning of CIEs.

The purpose of this paper is to explore the role of SCUs in knowledge transfer processes within CIEs. Our study aims to understand what prevents large corporations and start-ups from effectively exchanging knowledge and how SCUs can help overcome these difficulties. We maintain that SCUs play a crucial role in solving paradoxical tensions and translating knowledge between domains, since they serve as intermediaries between unrelated groups or individuals and are focused on knowledge gathering and dissemination (Chiambaretto et al., 2019).

Hence, the research questions we aim to address in this paper can be formulated as follows:

RQ1: What are the specific characteristics of knowledge exchanges in partnerships between large companies and start-ups?

RQ2: What is the role of SCUs in facilitating knowledge exchanges in partnerships between large companies and start-ups?

To answer these questions, we conducted an embedded case study with three original equipment manufacturers (OEMs) in the automotive industry. The case study involves three large Swedish OEMs that, in 2020, started a project to develop a partnership model for collaboration with start-ups. The project also included three intermediaries that are involved in the study, as well as the start-ups. This paper focuses on the role of the SCUs that each of the three OEMs implemented within their own organization.

The case-study analysis identifies: the main flows of knowledge for each phase of the collaboration process and for each actor involved; the main barriers to knowledge transfer; and the strategies enacted by the SCUs to overcome these barriers.

The paper contributes to practice by providing insights for managers of large corporations involved at various levels in collaboration with start-ups (e.g. managers in SCUs, as well as top managers and line managers), entrepreneurs in start-ups interested in collaborating with large companies, managers in intermediaries specializing in corporate–start-up collaboration, and policy-makers. From a theoretical point of view, the paper contributes to a better understanding of knowledge flows in complex systems and in CIEs.

The article is organized as follows. In Section 2, the literature on the relevant topics for the purpose of this study will be summarized, namely the collaboration between start-ups and large companies, the flows of knowledge between the actors of a CIE, and the role of the

SCUs as knowledge brokers. In Section 3, the methodology used will be detailed, and the paper will then move on to the description of the findings in Section 4. In particular, the paper details the knowledge flows between the actors in the case studied and the role played by the SCUs. In Section 5, the implications for theory will be highlighted, as well as managerial implications, limitations, and possible future developments.

Theoretical background

Collaboration between large companies and start-ups in CIEs

A considerable body of literature has indicated that partnerships between large companies and start-ups are a useful strategy for managing innovation processes (e.g. Dushnitsky & Lenox, 2005; Fabel et al., 2013; Weiblen & Chesbrough, 2015; Kurpjuweit & Wagner, 2020).

Building on Williamson's (1991) definition of strategic alliances, we define collaborations between corporations and start-ups as interactions in which the partners maintain autonomy but are mutually dependent. These collaborations can develop over a short-, medium-, or even on a long-term horizon.

In this type of collaboration, large companies look for ways to accelerate innovation processes (Allmendinger & Berger, 2020) by making them more agile (Weiblen & Chesbrough, 2015) and ultimately increasing their productivity and effectiveness (Simon et al., 2019). For their part, start-ups can obtain funding and gain access to the resources of large companies (e.g. laboratories) and their organizational and market knowledge (Park & Steensma, 2018; Simon et al., 2019).

In several articles, the collaboration between large companies and start-ups has been indicated as a means of obtaining strategically relevant results, such as the generation of radical innovations or the cultural transformation of the organization (Wadhwa & Basu, 2013; Enkel & Sagmeister, 2020). Other studies have indicated how this type of collaboration is capable of efficiently producing incremental innovations and adaptability to new competitive contexts (Rothaermel, 2001a, 2001b).

Over the years, collaboration between large companies and start-ups has been structured, generating different types of programs, such as accelerators, incubators, the venture client model, and innovation hubs (Weiblen & Chesbrough, 2015; Steiber & Alänge, 2020), to name but a few. In this context, numerous specialized organizations have emerged, the mission of which is the facilitation of collaboration (e.g. Moshner et al., 2017; Boni & Joseph, 2019).

The network of interactions between the players in the system (start-ups, large companies, intermediaries, research institutions, and public institutions) becomes increasingly dense and the relationships more complex, giving rise to actual innovation ecosystems (Joseph et al., 2021).

Large companies have an active role in the development of these systems (Christensen & Karlsson, 2019). Many of them create a network of actors with which to collaborate more intensively and with respect to which each large company aims to take a central position. These ecosystems can be defined as CIEs (Ritala et al., 2013; Autio & Thomas, 2014).

Innovation develops within these environments in a non-linear and often unpredictable way. The development of such ecosystems, as well as the role and image that large companies build up within them, assume a strategic importance (Pushpanathan & Elmquist, 2022).

In CIEs, the management of collaborations with start-ups must consider a double level: on the one hand, it is important to manage correctly individual collaboration projects, because their results can be relevant both for large companies and start-ups; on the other hand, it is necessary to cultivate good relationships to favor the development of the ecosystem as a whole (Joseph et al., 2021).

The literature has highlighted various criticalities in the management of relations between start-ups and large companies, in particular attributing them to asymmetries between the two types of partners. These asymmetries concern not only size and power, but also culture and objectives (Minshall et al., 2021; Prashantham & Kumar, 2011). These asymmetries can compromise both the results of individual projects and the relationships between the actors involved in the medium to long term (Allmendinger & Berger, 2020).

Knowledge sharing in CIEs

The transfer of knowledge from one partner to another is one of the objectives of the partnerships formed between start-ups and large firms in CIEs (Dushnitsky & Shaver, 2009). A simplified representation of knowledge flows in CIEs is presented in Fig. 1. On the one hand, large companies are interested in technological knowledge and the entrepreneurial style of start-ups; on the other hand, start-ups are interested in the organizational and sector knowledge of large companies (Steiber et al., 2021).

The literature has often dealt with the issue of knowledge transfer between organizations, analyzing the problem in different contexts (Argote & Fahrenkopf, 2016). Much of this literature has dealt with the issue of barriers to knowledge transfer (e.g. Szulanski, 1996; Bechky, 2003), pointing out, among other aspects, problems such as the difficulty in exchanging tacit knowledge (Nonaka & Takeuchi, 1995) and the dependence of knowledge on the context in which it has been generated, with the consequent need to interpret, translate, and adapt it when transferred to another context (Boari & Riboldazzi, 2014). The cognitive distance between the actor that transmits knowledge and the actor that receives it is a factor that makes the process difficult (Cillo, 2005).

The literature on relative absorptive capacity (Lane & Lubatkin, 1998) suggests that the ability to absorb knowledge has a strong relational component, so it is easier to learn from similar than from different partners.

The literature has also highlighted that the exchange of knowledge requires a collaborative attitude (Loebecke et al., 2016). The fact that start-ups and large companies are not typically direct competitors seems to make this less relevant than in other forms of alliance (Prashantham & Kumar, 2011). However, several authors have stressed the importance of a collaborative climate and trust between start-ups and large companies for the success of the collaboration (Bereczki, 2019; Allmendinger & Berger, 2020), thus confirming the findings of other studies on knowledge transfer in other contexts (e.g. Levin & Cross, 2004).

SCUs as knowledge brokers

Knowledge brokers are individuals or groups that formally or informally have the role of creating links between producers and users of knowledge, sometimes creating knowledge themselves in the process (Verona et al., 2006).

Knowledge brokers play their role by placing themselves on the border between two communities, often developing a sense of belonging to both (Lupton & Beamish, 2014). In this position, they can activate learning processes with respect to knowledge in both communities (Del Giudice et al., 2017; Keszey, 2018). This makes it easier for these entities to enter the knowledge processes by becoming vectors, interpreters, and translators of the transferred knowledge (Crupi et al., 2020).

Knowledge brokers are therefore subjects capable of identifying potentially useful knowledge and effectively communicating it to recipients (Howells, 2002). In addition to this function, they also perform that of relationship managers (Paul & Whittam, 2010) as the transfer of knowledge does not occur smoothly when it is not supported by collaborative relationships.

The modes through which knowledge brokers achieve these results depend on the context and include reducing costs for knowledge transfer, mitigating competitive tensions, and fostering awareness and trust in external knowledge (Chiambaretto et al., 2019), to name but a few.

SCUs (Basu et al., 2011; Kurpjuweit & Wagner, 2020) are set up by large companies to work closely with start-ups in order to facilitate collaboration (Wouters et al., 2018). They are typically organized as small, agile groups (Basu et al., 2011) that perform their role in collaboration with external intermediaries, who have the task of identifying on behalf of large companies the most interesting start-ups. The tasks of SCUs and intermediaries overlap, although the SCUs mainly manage the internal processes of the large enterprise, while the intermediaries interact more closely with the start-up ecosystem (Kurpjuweit & Wagner, 2020).

Although studies on SCUs are rare, especially those analyzing their role in fostering knowledge flows, existing evidence suggests that knowledge transfer is a major concern of SCUs and that they act as knowledge brokers in this context (Basu et al., 2011; Wouters et al., 2018).

Knowledge flows in partnerships between large companies and start-ups are subject to conditions, as illustrated in the previous section. This suggests that, as happens for other knowledge brokers (Chiambaretto et al., 2019), SCUs must develop specific knowledge-brokering strategies.

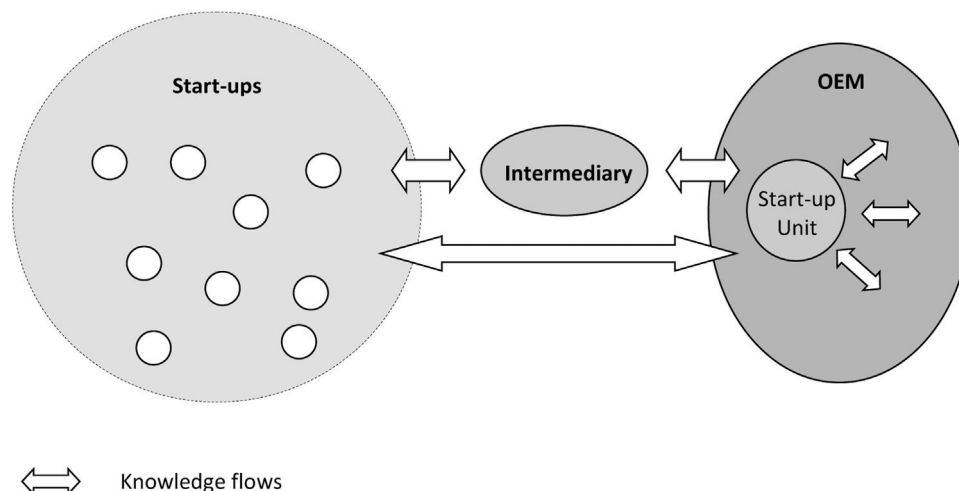


Fig. 1. Flows of knowledge in CIEs.

These latter aspects have been neglected by the existing literature, justifying the research questions posed in this article. By interpreting the role of SCUs as knowledge brokering, and applying the theory developed by existing research on the role of knowledge brokers, we intend to answer these questions, thus deepening the knowledge of SCUs and, more generally, of CIEs.

Methods

Research design

We adopted an exploratory-based approach to design our research (Miles et al., 2014). We conducted an embedded case study (Yin, 2013) on three large Swedish OEMs. In-depth exploratory studies based on embedded case studies are widely used to observe and investigate emerging phenomena in innovation ecosystems (Jiang et al., 2019; Abbassi et al., 2022). The embedded case study approach is particularly suitable to examine an environment where boundaries are not clearly evident (Yin, 2013) and the phenomena to be observed are multifaceted (Scholz & Tietje, 2002). This is the case for CIEs, where the boundaries between organizations are dynamic and blurred (Hofman et al., 2016).

Case selection

To answer our research questions, we conducted a case study involving three OEMs in the automotive industry. We decided to focus on the automotive industry for several reasons. It can be considered as one of the most relevant sectors both in emerging and industrialized countries (Saeed et al., 2019). Since its inception, the automotive sector has represented the context for the development of many organizational innovations that have subsequently spread to other industries (Candelo et al., 2021). The sector is experiencing a dramatic discontinuity in the way carmakers design and deploy innovation (Lazzarotti et al., 2013). Innovation networks in the automotive sector are assuming an ever-growing relevance (Karlsson & Skold, 2013). OEMs are showing a growing predisposition towards the use of external knowledge in their innovation activities (Di Minin et al., 2010; Matricano et al., 2019). This has stimulated the attention of many scholars regarding the different aspects relating to knowledge management in open innovation projects in the automotive sector (Dodourova & Bevis, 2014; Wilhelm & Dolfsma, 2018).

The case study involves three large Swedish OEMs, named here OEM 1, OEM 2, and OEM 3. The choice of these firms is based on the following reasons. The program they started is intended as a strategic tool to strengthen the CIEs of the three OEMs as well as their position within the ecosystem. All three OEMs created a SCU their organization. Several studies have recognized the importance of these three companies in promoting open innovation projects (e.g. Börjesson &

Elmquist, 2011; Wikhamn et al., 2013; Ollila & Yström, 2017; Pushpanathan & Elmquist, 2022).

Data collection and analysis

We collected primary and secondary data to allow the use of triangulation-based approaches (Eisenhardt, 1989). Regarding the primary data, we conducted 18 interviews with 14 interviewees. The duration of the interviews ranged from 90 to 120 min, with an average duration of 100 min. All interviews were recorded and transcribed with the support of Otter software. Moreover, we participated in two workshops with representatives of all the partners in the project. The first workshop lasted three hours, and the second two hours. Finally, we participated in five one-hour program committee meetings (meetings between the representatives of the SCUs of the three OEMs in charge of the project). The two workshops and the meetings were also recorded and transcribed to preserve the quality of the data (Gibbert et al., 2008). Anonymity was ensured for all interviewees, with the interviewees being identifiable only through the organizational role held within the innovation project.

A summary of the information regarding the interviews is provided in Table 1.

Secondary data were obtained by analyzing both internal (e.g. reports, emails, contracts) and external documents (e.g. industry reports, newspapers, websites, project documentation). We combined the primary and secondary data to triangulate the collected information. Following the suggestions provided by Gioia et al. (2013), we adopted an inductive research approach based on three main steps. The first step consisted of an in-depth analysis of the raw data. We read the documents and interview transcriptions several times to identify common words, terms, and concepts mentioned by respondents to identify first-order categories of codes reflecting the views of the respondents. The second step consisted of the examination of the first-order concepts, allowing the identification of links and patterns among them. This yielded the identification of second-order constructs, representing theoretically distinct concepts arising from the combination of first-order categories. As a final step, we combined the second-order concepts into aggregate dimensions to investigate the relationships between them. An example of the coding is presented in the Appendix.

Empirical setting

The case study deals with a collaborative project, started in 2020, involving three large Swedish OEMs. The aim of the project is the development of a partnership model for collaboration with start-ups. Three intermediaries facilitating the matching between start-ups and corporations were involved in the project.

Table 1
Data sources.

Organization	Type of organization	Number of interviewees	Type of interviewees	Number of interviews	Total duration of interviews
OEM1	OEM	2	Innovation manager; SCU member	3	5 h 30 min
OEM2	OEM	1	Innovation manager	2	3 h
OEM3	OEM	2	Innovation manager; SCU member	3	5 h 30 min
Intermediary 1	Intermediary	2	Senior advisor	2	2 hour 30 min
Intermediary 2	Intermediary	2	Innovation manager	2	2 hour 30 min
Intermediary 3	Intermediary	1	Senior project leader	2	2 h 55 min
Start-up 1	Start-up / Innovative SME	1	Head of operations	1	1 hour 30 min
Start-up 2	Start-up / Innovative SME	1	Business designer/Partner	1	1 hour 30 min
Start-up 3	Start-up / Innovative SME	1	Head of research	1	1 hour 30 min
Vinnova	Governmental agency	1	Program manager	1	1 hour 30 min
Total		14		18	27 h 55 min
Workshops with all partners					2 workshops of 2 h each
Program committee meetings					5 meetings of 1 hour each

OEM 1 is a worldwide leader in the production, distribution, and sale of commercial vehicles, such as trucks, buses, construction equipment, and marine and industrial drive systems. The company has around 95,000 employees, with production plants in 19 countries and a dealership and service network in 190 countries.

OEM 2 is a multinational manufacturer of luxury vehicles, Sedans, SUVs, and station wagons. The company employees about 43,000 people.

OEM 3 is a major manufacturer of heavy trucks and buses. The company employs approximately 54,000 people around the world, with production facilities and assembly plants in several countries in Europe, Latin America, and Asia.

Intermediary 1 offers young companies with pioneering ideas regarding mobility and connectivity the opportunity to access the network and accelerate their development through strategic partnerships with partner companies.

Intermediary 2's venture client program is a joint initiative between several large Nordic companies aiming to facilitate matching between large companies and start-ups: industry leaders are constantly on the lookout for new technologies to define what is next in their field, while on the other hand it offers start-ups the chance to acquire global corporations as their clients.

Intermediary 3 is an association of more than 350 businesses, mainly small and medium-sized companies, with the specific goal of developing the associated businesses as suppliers in the automotive industry.

It is worth underlining that Swedish vehicle manufactures have limited experience in this way of working. Historically, new products and innovation have been created internally, and this is still the established way of working and can be considered the company culture. Although some initiatives have been started, adaptation to this new way of working takes time. The aim of the studied collaborative project is to accelerate the establishment of partnerships and develop and implement this new way of working. The project was funded by Vinnova, the Swedish Government's innovation agency.

Data regarding the partners in the case program is summarized in Table 2.

Findings

In this section, we will describe the knowledge flows that arise in the case studied. We will then focus on the barriers to knowledge transfer as they emerge from the interviews. Finally, we will describe the knowledge-brokering role of the SCUs, which aim to limit the negative effects of these barriers.

Knowledge exchanges

Collaborative projects between start-ups and large enterprises involve intentional exchanges of knowledge of which all participants are largely aware, as well as knowledge flows that are less obvious and that they are sometimes unaware of.

The interviewees distinguished two main phases. The first phase comprises the initial steps (set-up, scouting and, in part, matchmaking) in which OEMs interact with different start-ups with the support of the intermediaries, trying to identify the start-ups with which to collaborate. This phase is highly structured. The second phase includes the steps of matchmaking and testing in which, once a start-up has been chosen as a partner, a co-development project or other form of collaboration is initiated. This phase presents a high degree of variability.

In the initial phase, there are two main conscious knowledge flows: knowledge relating to the needs of the large company, for which a collaboration with start-ups is considered useful; and knowledge of the solutions proposed by start-ups and which can be usefully developed together with large companies.

Business needs are often formalized in the form of short paragraphs referred to as "challenges" or "topics." These are rather broad descriptions, each of which can include a wide range of solutions. These needs are advertised on the Internet or through the networks of the actors involved.

Generally, the need or opportunity is identified by a department or business unit of the large company. Sometimes this happens with the support of the SCU or the intermediary during dedicated meetings. The clarification and formalisation of the need undergoes a refinement process in which knowledge flows from the line unit, to the SCU, to the intermediary, and then to the final recipient, i.e. the start-up.

This is how one interviewee (Intermediary 1) described this:

"If we look at our process, we have divided it into five main steps. The first one is set-up. And that's about ideation and brainstorming and formulating possible cases, then we prioritize a few cases that we anticipate having the largest impact for the organization. In the second step we publish those cases on our website and other channels... In the third step we start going through a shortlist of start-ups together with the domain experts to really identify what we are looking for ... [for matchmaking and testing] how it is realized, it's extremely case dependent."

The communication process for the solutions proposed by the start-ups follows a reverse path. The start-up contacts the SCU or the intermediary. In the case of public calls, it typically does so by filling out a form. In some cases, this is the first contact between the start-up and the OEM ecosystem. In other cases, start-ups are already involved in the OEM's or intermediary's network. At this point, the knowledge is communicated according to a sequence that goes from the start-up, to the intermediary, to the SCU, to the department or business unit that can use the solution. Each of these actors has ways to gain additional knowledge regarding the solution. The pitches given by start-ups are an example of this, and meetings can be organized.

Subsequently, the selection process leads to the identification of start-ups that are subsequently involved in a process of more intense interactions (sometimes moving to the OEM facilities).

Table 2
Partners in the case program.

Partner	Approximate dimension	Main area of activity
OEM1	95.000 employees	Trucks, buses and construction equipment, marine and industrial drive systems
OEM2	43.000 employees	Manufacturer of luxury vehicles, Sedans, SUVs and station wagons cars
OEM3	42.000 employees	Manufacturer of heavy lorries, trucks and buses
Intermediary1	20 Employees	Provides services for start-ups in order to innovate in partnership with partner companies
Intermediary2	30 employees	Provides consulting and networking services for collaborative innovation
Intermediary3	10 employees	Provides services to associate companies (mostly suppliers of OEMs in the automotive industry)

For example, one innovation manager in the SCU of OEM 1 stated that:

"We have these need owners, they are the ones that select focus areas and the ones that choose which companies they are interested in listening to. They listen to the pitch week, and they vote for which corporations they would like to engage with to talk more. And then we [the start-up, SCU, and need owner] have a dialog to understand if we can potentially do something together."

The knowledge to be transferred, both in relation to the needs and to the solutions proposed by start-ups, is complex and strongly contextualized. The transfer process is considered by the interviewees to be extremely laborious. Both SCUs and intermediaries consider making the process efficient as their main goal.

According to an innovation manager in OEM 2:

"... it is a quite complex procedure also because it challenges our mindset ... we have to evaluate the technology offered by the start-up, how suitable it is to integrate into our operations; it may also be that other areas would like to make sure the solutions fit into our operations. Our intention is to do this quickly in our organization."

Despite the time and energy spent in this regard, everyone recognizes that a certain level of ambiguity and consequent misunderstandings remain until the advanced stages. To limit these shortcomings, the actors activate the transfer of other, less deliberate flows of knowledge.

Among these, in the direction that goes from the OEM to the start-up, the interviewees often recall flows of knowledge relating to: the automotive sector; internal processes and structures; and the OEM's corporate culture.

For example, a member of the SCU at OEM 1 stated that:

"We are dependent on other people in OEM 1, like people working with engineering, who have information that we need ... data on their own processes and their own routines that we need to give to those external small companies."

In the opposite direction, there are flows related to the work style of start-ups in general, the technological domain, and the overall context of the specific start-up involved.

For example, one interviewee in the SCU of OEM 3 explained that:

"It really pays out for those that have put in effort to describe themselves, describe what you want to do with OEM 3. What other relevant things you have done, and so on. It's interesting to see who their investors are, who are the customers."

As anticipated above, in the final stages (matchmaking and testing), the start-up and the OEM further develop the solution and test its technical and commercial validity. In this phase, the flows of knowledge are much more dependent on the specific case, and the ways in which they take place are less standardized. Several actors (start-up, SCU, intermediary, and representatives of business units) interact simultaneously.

In this phase, the transfer of knowledge is accompanied by knowledge creation: the encounter between the solution proposed by the start-up and the technologies, products, and knowledge of the OEM might lead to modification of the solution itself, as well as of the OEM's processes and possibly of its products. This change and innovation requires new knowledge not originally possessed by either partner.

For example, one member of a start-up stated that:

"They had not thought of it [the solution they are co-developing with the OEM] before. We're not doing anything they initially asked us to

do. We asked them if they would be interested. And yes, they were. It's disruptive."

Barriers to knowledge exchange

In this section, we will describe the main barriers to knowledge exchange, namely perspective mismatch and expectations mismatch, which are tightly interrelated.

Perspective mismatch

The interviewees underlined that start-ups and OEMs have very different cultures and ways of working. If at times this diversity produces creative contamination, it is often also a source of slowness in the transfer of knowledge and of misunderstandings.

A member of the SCU in OEM 3 put it this way:

"The way that corporations think and how start-ups think, I think they are completely different animals."

Departments such as purchasing or legal tend to assume that start-ups are familiar with standard purchasing or quality-assurance procedures. They sometimes assume start-ups know standard contract terms or are capable of sophisticated legal insight. This asymmetry, however, is less evident in the case of R&D departments and in general with business areas accustomed to dealing with innovation processes.

For example, discussing mutual understanding between corporate departments and start-ups, an innovation manager in OEM 3 stated that:

"The persons I work with [in R&D], they are probably, you know, more thinking outside the box, and more used to working with start-ups. So, if I only think of them, it [understanding each other] is easier than if I think about the organization in general."

Start-ups, for their part, find it difficult to understand standardized processes and hierarchical structures, ultimately interpreting as burdensome what makes sense in the context of a large company.

When there is a similarity in the technological background of the partners, the information asymmetries are further reduced, as suggested, for example, by the following statement by an interviewee in OEM 3:

"In the autonomous transport division, which is a more software-driven division, compared to many other business units of OEM 3 – and I believe the automotive industry in general – the development cycle is shorter. Compared to many other units, here both parties know rather well how the development cycle works."

Expectations mismatch

The mismatch of expectations between start-ups and large companies is one of the main reasons for friction during and after the collaboration.

It often happens, for example, that start-ups (especially the younger ones) expect to become a supplier of the large company at the end of the collaboration project, acquiring a customer for the solution they propose. This is generally considered a desirable outcome by both parties but occurs in a limited number of cases.

When expectations are not met, trusting relationships between partners can be compromised. The interviewees declared that the initial level of mutual trust (between start-ups and members of the SCU) is high, but many of them observed that it may decrease following disappointing interactions.

For example, one representative of Intermediary 2 stated that:

"Many start-ups have bad experiences with corporations, so it takes some time to overcome the mistrust from that bad experience."

On the other hand, large companies often tend to treat the start-up as a traditional supplier, equipped with a product or service and a defined business model capable of immediately guaranteeing its solution in a reliable manner. Instead, however, start-ups are entities that are still defining their business model, which, moreover, they are forced to modify to effectively interact with large companies.

According to a member of the SCU at OEM 3:

"In our collaboration with start-ups the hopes are very high. We think that, you know, they're like magicians, they can create anything, because they are a start-up, and we also believe that they have a ready-made solution which they only need to adapt a little bit for our purpose."

The mismatch between the expectations of start-ups and large companies is often due to knowledge asymmetries between the partners. Entrepreneurs in start-ups have strong technical skills but limited managerial and market skills. They also know little about the automotive world. Similarly, managers in large firms do not fully understand start-ups' way of working. Therefore, both actors might fail to understand the objectives of the partner and to adequately communicate their expectations.

The mismatch in expectations is a cause of inadequate knowledge transfer. Indeed, it may happen that the actors, due to the lack of clarity regarding the partner's expectations, pursue different objectives. Because of such misunderstandings, the participants strive to transfer elements of knowledge that are not functional to the project objectives or to a fruitful collaboration.

According to one interviewee in Intermediary 1:

"They [start-ups] usually consist of a lot of PhDs, for example, and people who love technology. They fall behind when it comes to business."

The meeting between these two worlds takes place initially based on structured knowledge exchanges formalized in the challenges and calls published by the OEMs or by the intermediaries they use for start-up scouting. The subsequent pitch phases allow for a deeper exchange, but it is difficult to convey the complexity of tacit knowledge.

Symmetrically, large companies might perceive start-ups' way of working, which is poorly adapted to structured processes, as unorganized or even chaotic.

SCUs' strategies for facilitating knowledge exchange

In this section, we summarize the strategies used by the SCUs in the OEMs analyzed to overcome the barriers to knowledge exchange illustrated in the preceding sections. The strategies adopted by SCUs are summarized in Table 3.

Building networks

One of the main goals for SCUs is to build an internal reference network. This network is made up of technicians, line employees, and, above all, managers who believe in the usefulness of collaboration with start-ups and support it. The role of managers, i.e. individuals capable of dedicating budget to projects and obtaining the commitment of collaborators, is essential.

By building this network, SCUs diffuse knowledge on how collaboration with start-ups works. Through these people, the levels of misalignment, both in terms of expectations and in terms of interpretation of knowledge, are reduced.

As expressed by one member of the SCU in OEM 1:

"You're educating them, how you should work with start-ups. I start showing them that this is required for the business to be viable. Slowly, the project progresses. You need to coach people step by step."

Furthermore, people in the network spread the brand of the SCU and pass on their experience to colleagues, diffusing the culture of collaboration with start-ups in the organization.

In the words of an innovation manager in the SCU of OEM 1:

"We can see that the rumors get around. Then we get in touch with all these different areas. We talk with our internal stakeholders.... We say, you know what we do? Have you heard that we have these tools? So, we create an internal brand."

At the same time, the internal network is made up of domain experts (e.g. in the purchasing function, R&D engineers, product owners) who are able to convey the knowledge of the OEM. With their support, SCUs and intermediaries can acquire and transmit the knowledge necessary to correctly interpret information communicated by the company.

Table 3
Strategies used by the SCUs to foster knowledge exchange.

Strategy	Implementation	Effects on interpretations misalignment	Effects on expectations misalignment
Building networks	<ul style="list-style-type: none"> Identifying experts to help interpret and communicate knowledge Diffuse knowledge on how collaboration with start-ups 	<ul style="list-style-type: none"> Involve reliable and competent interlocutors Create a shared knowledge base 	<ul style="list-style-type: none"> Gain commitment of key people Build a reputation as a reliable partner for the SCU
Integrating communication	<ul style="list-style-type: none"> Enrich communication Find right interlocutors Use effective language 	<ul style="list-style-type: none"> Reduce ambiguity by providing complementary knowledge 	<ul style="list-style-type: none"> Clarify mutual expectations Provide feedback on unexpected developments
Knowledge explication	<ul style="list-style-type: none"> Public calls (needs, topics, challenges) Standard tools and procedures 	<ul style="list-style-type: none"> Reduce ambiguity Increase efficiency/reducing costs 	<ul style="list-style-type: none"> Reduce ambiguity
Orchestrating dialog	<ul style="list-style-type: none"> Organizing and preparing meetings Managing follow-up 	<ul style="list-style-type: none"> Increase efficiency/reducing costs 	<ul style="list-style-type: none"> Facilitate mutual understanding
Thinking out of the box	<ul style="list-style-type: none"> Stimulate creative thinking in interlocutors Elaborating own original solutions 	<ul style="list-style-type: none"> Generating new shared knowledge 	<ul style="list-style-type: none"> Generating new, shared solutions
Increase agility	<ul style="list-style-type: none"> Creating alternative paths for innovation processes Assigning small budgets 	<ul style="list-style-type: none"> Facilitating adaptation to unexpected scenarios 	<ul style="list-style-type: none"> Facilitating adaptation to unexpected scenarios Incentivizing adaptation to unexpected scenarios

For example, an interviewee in OEM 1, while talking about the information needs of start-ups, explained that:

"Start-ups come to us, and we help them, for example with legal issues concerning setting up contracts. We have helped them with different areas in OEM 1. They need a laboratory to do something? Okay, I have a person working there that maybe can help. We need someone from services? Okay, I have a person there to ask."

Integrating communication

Direct communication between the OEM business units and the start-ups is limited to a relatively small number of meetings. Start-ups are not used to formal procedures and long waiting times. All this results in possible communication deficits that lead to misunderstandings, sometimes with serious consequences.

SCUs integrate this lack of direct communication by acquiring information from both sides, taking care to identify the right individual(s) to talk to, and using appropriate language (in this, they are supported by intermediaries).

A representative of the SCU in OEM 3 provided the following interesting example:

"You can imagine that if one case is coming from, let's say an electrical engineer, and another one is coming from some marketing person, there could be an imbalance in how attractive this case could be. So, we help reformulate the case description."

Knowledge elicitation and standardization

The SCUs, together with the intermediaries, are committed to explaining, synthesizing, and formalizing as many elements of knowledge as possible. This happens, for example, for the communication of the needs of the OEM (which are often translated into clear and general statements, to attract more start-ups), but also for technical elements such as purchase contracts.

The members of the SCUs spend a lot of their time in meetings or workshops with various company representatives, trying to extract their knowledge to translate it into documents and tools to be used in later stages of the work.

This emerges from several statements made by the interviewees; for example:

"We want to accelerate technology and business development through this toolbox that we have for, like, drawing up contracts, direct purchasing, helping to scope, helping with the dialog, all these kinds of things." (innovation manager in OEM 1)

"What we have done is that we have purchase order templates that have been pre-approved by the legal department." (innovation manager in the SCU in OEM 3)

A similar process takes place with start-ups. In this case, however, it is the intermediaries that play the main role. They extract and formalize the knowledge from start-ups for it to be more easily transferred to the OEM.

Orchestrating dialog

To make the meetings between the partners effective, the SCUs (and the intermediaries) prepare them, communicating on mutual expectations or providing context elements to both sides.

For example, an innovation manager at OEM 1 stated:

"We help them do things together. We have helped them to do that with different areas in OEM 1. We have a space for that, a lab. People arranging meetings."

Specifically, they are concerned with follow-up, collecting information on the results of meetings after their conclusion, following

the developments of the decisions taken, and informing the interested parties.

In the words of one interviewee:

"We have, like, checkpoints and regular checkups with partners and start-ups to gather feedback and status and, like, seeing what's happened since we last spoke, and then making sure they are talking to each other."

In this way, they help to prevent unexpected disappointments by providing explanations for unexpected outcomes.

Thinking outside the box

According to the interviewees, collaborative projects with start-ups are characterized by unexpected events. It is often necessary to find solutions beyond what was initially agreed.

The SCUs assume in these cases the role of creative units within the large company. They develop original solutions for large companies or stimulate their internal interlocutors to do so.

This was clearly stated by an innovation manager in OEM 1's SCU:

"I think that is the main work that we do: we team up with them and we help them to think a little bit outside the box. Even though we're still in OEM 1, we help with things that are not in the normal process."

Increasing agility

OEMs are characterized by structured, sometimes rigid processes. The interviewees underlined that corporate–start-up collaboration requires flexibility. SCUs are described as entrepreneurial units within the OEM, with flexible processes to adapt to unexpected events. These characteristics are considered fundamental in less structured phases of the collaborative process.

As stated by an innovation manager in the SCU at OEM 1:

"We try to keep our activities separate from other waterfall or product development processes that we have. We keep this as much aside as we can to gain flexibility... We have something we like to call Seed and Speed Budget ... like incentive money. Just so that, okay, we do not drop an interesting case, if it comes up."

Discussion and conclusions

In this section, we will illustrate the contributions of our work to the literature on knowledge transfer and, subsequently, to that on knowledge brokers. We will highlight how the partnerships between start-ups and large companies, due to their asymmetry, present peculiarities both for the methods of knowledge transfer and for the role of knowledge brokers. Implications for management and a discussion of the limitations and future developments conclude the paper.

Implications for theory regarding knowledge transfer in asymmetric partnerships

The collaboration between large companies and start-ups is asymmetrical. This asymmetry involves power, knowledge-resource, cultural, and strategic aspects (Minshall et al., 2021; Prashantham & Kumar, 2011; Allmendinger & Berger, 2020).

These asymmetries are in fact the very reason for the activation of collaborative projects: each of the participants seeks in the partner what they consider they are lacking. However, asymmetries are also a source of friction that slows the flow of knowledge (Prashantham & Kumar, 2011).

Among the most evident barriers, there is certainly the difficulty, for each partner, of understanding what is transmitted by the other

(s). Knowledge transfer implies the need to translate the knowledge of the sharing unit into an easily transmittable format (Nonaka & Takeuchi, 1995). An inverse process of translation is needed in the receiving unit.

The issue is highly relevant because the exchange of knowledge between large companies and start-ups does not only concern technology, but also other aspects, such as the functioning of the OEM business, of the start-up, or of the automotive sector. Adapting start-up solutions to corporate business involves the transfer of complex, contextual knowledge from large corporations, which is stickier and more difficult to transfer (Szulanski, 1996). In the opposite direction, which goes from start-ups to large companies, it is just as difficult to communicate knowledge relating to what many define as a completely different “world” from that of the incumbents. The consequence of this situation is an increase in costs for the transfer of knowledge (Bae & Koo, 2008) as the cognitive distance between the transmitting and receiving unit grows (Bechky, 2003; Cillo, 2005).

Another aspect clearly pointed out by the interviewees is that the transfer of knowledge requires a strong willingness to collaborate (Loebecke et al., 2016). Misunderstandings and asymmetrical expectations can cause disappointment and distrust, which in turn inhibits the transfer of knowledge. In previous studies, the perception that the exchange is not fair has been shown to be a factor capable of compromising the knowledge-exchange process (Levy et al., 2003; Schulz, 2001). If one of the two partners is perceived as less engaged in the exchange of knowledge, or is perceived as obtaining greater benefits than its commitment, the relationship can be compromised. In the collaboration between start-ups and large companies, it can happen that asymmetrical expectations between the partners lead to a negative evaluation of the relationship and the consequent failure of the initiative from the point of view of knowledge exchange.

Implications for theory regarding SCUs and knowledge brokering in asymmetric partnerships

Like other knowledge brokers, SCUs must identify strategies suited to the context in which they operate to obtain their results (Chiambaretto et al., 2019).

The transfer of knowledge is an activity that involves considerable costs. One objective of knowledge brokers is to reduce these costs. Formalizing knowledge is one way to accomplish this (Nonaka & Takeuchi, 1995). Another is to centralize the formalisation process. SCUs collect the needs of several organizational units in the OEM. In formulating the topics or challenges proposed to start-ups, they summarize these different needs. This enables centralizing the exchange of knowledge in the initial stages, where many start-ups are involved. Without this approach, ideally, each department would need to interact with each start-up, generating excessive costs.

As mentioned above, one of the strategies that knowledge brokers adopt to facilitate knowledge transfer is the formalisation of knowledge. This makes knowledge easily accessible to many actors that are not closely related. However, this is a strategy that involves the loss of tacit and contextual knowledge (Keszei, 2018). In the collaboration between large companies and start-ups, this knowledge plays a decisive role because the knowledge exchanged, to be understood, must be framed in the context of the partner who generated it, and it must also be adapted to the context of the partner receiving it (Boari & Riboldazzi, 2014). In these situations where the cognitive distance between the participants is high, it is necessary to integrate the knowledge flows of the partners with the communication of further content (Lupton & Beamish, 2014). Above all, in the later stages of the collaboration process, knowledge brokers tend to enrich the knowledge exchanged by involving their network of reference and expending great effort in communication.

Knowledge brokers often find themselves in the position of having to mediate between partners among whom there is some

competition (Garcia Martinez & Walton, 2014). This aspect is less pronounced in the asymmetric cooperation between start-ups and large companies. However, there is no lack of suspicions. For example, start-ups often fear misappropriation by large companies. Large companies, on the other hand, fear improper behavior that leads to leaks of strategically relevant knowledge, or the abuse of their brand. In this case, SCUs, as knowledge brokers, must work to create a collaborative climate. This objective is mainly pursued through clear and timely communication that avoids misunderstandings.

Finally, SCUs, like other knowledge brokers, play a role in knowledge creation (Mariano & Awazu, 2017). Collaboration with start-ups involves a high level of uncertainty. Many of the premises based on which the collaboration is initiated change during the project. SCUs help in adapting to such change. This is primarily achieved by stimulating the creativity of the partners. However, there are cases in which original solutions are developed by the representatives of the SCUs themselves.

Furthermore, SCUs represent an interlocutor for anyone in the ecosystem who has original ideas. By creating spaces for discussion and agile working methods, they create a context in which to experiment with an entrepreneurial attitude to solutions that would not find space in the structured processes of OEMs.

Implications for theory regarding innovation through collaboration between large corporations and start-ups

Collaboration between large companies and start-ups is a phenomenon in which knowledge flows are of great importance. By investigating how these flows take place and what the contribution of the SCUs is, our article clarifies several critical aspects of open-innovation phenomena. In this article, we have highlighted how several difficulties are due to asymmetries between partners, which are sometimes cognitive asymmetries and sometimes asymmetries in objectives. From a theoretical point of view, then, it is important to tackle the analysis of collaborations between large companies and start-ups through approaches that focus on the differences between the partners. Institutional theory, organizational culture theory, and communication and knowledge management theories are just some examples of approaches that can shed light on aspects of the phenomenon that are still poorly understood.

Another element that emerges from our study is that working together not only favors the exchange of existing knowledge, but also favors the creation of new knowledge. Prior studies have underlined the importance of new knowledge creation through collaboration with start-ups (e.g. Wadhwa & Basu 2013; Enkel & Sagmeister 2020). However, there can also be negative consequences (Polidoro & Yang, 2021). If large companies focus solely on exploitation, neglecting exploration, the ecosystem can suffer as a result. The SCUs, which are the organizational units of large companies most directly involved in the collaboration, must strive to mitigate this negative effect.

Managerial implications

This article provides several implications for managers. First, it explores the characteristics of knowledge flows in collaborations between large companies and start-ups. The asymmetry in this type of partnership makes the exchanges of knowledge in this context subject to different dynamics compared to other forms of inter-organizational collaboration, for which different facilitating strategies are needed.

The article also highlights the role of SCUs in facilitating knowledge flows with start-ups and, therefore, in the development of CIEs. In particular, the article is useful for the top management of large companies in the initial phase of a collaboration program with start-ups, in order to better understand the functions and dynamics of

SCUs. It is also useful for the managers of SCUs, as it explores the peculiarities of knowledge exchanges in asymmetrical partnerships and identifies strategies to overcome the difficulties that inevitably arise. Formalizing knowledge, integrating communication, generating knowledge, and increasing system agility are ways in which the SCU contributes to making collaboration fluid.

Finally, the article can be useful for members of the entrepreneurial team of start-ups: SCUs are their main interlocutors within large companies, and knowing their characteristics can facilitate fruitful collaboration.

Limitations and future developments

Our study is the first that the authors are aware of dealing with SCUs in relation to knowledge exchange. However, the study has some limitations.

From a methodological point of view, it focuses on an embedded case study (Yin, 2013). This choice may limit the generalizability of the results. Although the automotive sector is often a sector that generates organizational innovations and that acts as a model for other manufacturing industries (Candelo et al., 2021), the results are not necessarily generalizable. Similarly, the fact that the three OEMs are all Swedish may have influenced their approach to knowledge exchange.

Furthermore, the three OEMs are included in a single program. The presence of other large companies in the program undoubtedly influences the exchanges of knowledge: on the one hand, it is an additional learning opportunity; on the other, it could push partners not to reveal some knowledge. Collaboration programs with start-ups that involve several large companies at the same time, among other things, are quite common (Moschner et al., 2019), so the analysis of knowledge flows in these contexts would be an interesting area for future research.

The collaboration program analyzed had recently started. Consequently, some aspects may have been influenced by the initial phase during which the analyzed SCUs were investigated, for example the emphasis given by respondents to the need to build a reference network within the OEM. As the role of SCUs consolidates, this activity is expected to transform from “building a network” to “maintaining a network.”

Finally, our study does not consider the performance of the projects analyzed, nor of the actors involved. A performance evaluation would be important to better understand the criteria for designing SCUs. Our study focused on a limited period of time (one year). In this timeframe, especially in a sector such as the automotive sector, it is difficult to grasp the implications of innovation projects in terms of the results. It is therefore necessary to conduct studies that analyze the performance of collaboration projects with start-ups over a medium to long time horizon.

Acknowledgements

this study was partially funded by the Swedish innovation agency Vinnova, under the FFI Strategic Vehicle Research and Innovation program.

Appendix. An example of coding

Original statement	First-order concepts	Second-order constructs	Aggregate dimension
<i>The way how corporations think and how start-ups think, I think they are completely different animals</i>	<ul style="list-style-type: none"> - The way corporations/ start-ups think - Differences 	<ul style="list-style-type: none"> - Organizational mindset - Cultural difference 	Cognitive differences
<i>The persons I work with in R&D, they are probably, you know, more thinking outside the box, and more used to work with start-ups.</i>	<ul style="list-style-type: none"> - Functional membership - Thinking outside of the box - Experience in working with start-ups 	<ul style="list-style-type: none"> - Functional culture - Creative thinking* - Experience 	

*The construct “creative thinking” did not contribute to the dimension “cognitive differences”

References

- Abbassi, W., Harmel, A., Belkahl, W., & Ben Rejeb, H. (2022). Maker movement contribution to fighting COVID-19 pandemic: Insights from Tunisian FabLabs. *R&D Management*, 52(2), 343–355.
- Allmendinger, M. P., & Berger, E. S. C. (2020). Selecting corporate firms for collaborative innovation: Entrepreneurial decision making in asymmetric partnerships. *International Journal of Innovation Management*, 24(1), 2050003.
- Argote, L., and Fahrenkopf, E. (2016). Knowledge transfer in organizations: The roles of members, tasks, tools, and networks organizational behavior and human decision processes, celebrating fifty years of organizational behavior and decision making research (1966–2016), 136, 146–159, 10.1016/j.obhdp.2016.08.003.
- Autio, E., & Thomas, L. (2014). Innovation ecosystems: Implications for innovation management. Dodgson, M., Gann, D. M. a d Phillips, N., *The oxford handbook of innovation management* (pp. 204–288) Dodgson, M., Gann, D. M. a d Phillips, N. .
- Bacon, E., Williams, M. D., & Davies, G. H. (2019). Recipes for success: Conditions for knowledge transfer across open innovation ecosystems. *International Journal of Information Management*, 49, 377–387.
- Bae, J., & Koo, J. (2008). Information loss, knowledge transfer cost and the value of social relations. *Strategic Organization*, 6(3), 227–258.
- Bechky, B. A. (2003). Sharing meaning across occupational communities: The transformation of understanding on a production floor. *Organization Science*, 14, 312–330.
- Berezcki, I. (2019). An open innovation ecosystem from a Start-up's perspective. *International Journal of Innovation Management*, 23(8), 1940001.
- Boari, C., & Riboldazzi, F. (2014). How knowledge brokers emerge and evolve: The role of actors' behavior. *Research Policy*, 43, 683–695.
- Boni, A. A., & Joseph, D. (2019). Four models for corporate transformative, open innovation. *Journal of Commercial Biotechnology*, 24(4).
- Börjesson, S., & Elmquist, M. (2011). Developing innovation capabilities: A longitudinal study of a project at Volvo Cars. *Creativity and Innovation Management*, 20(3), 171–184.
- Candelo, E., Troise, C., Matricano, D., Lepore, A., & Sorrentino, M. (2021). The evolution of the pathways of innovation strategies in the automotive industry. The case of fiat Chrysler automobiles. *European Journal of Innovation Management* ahead-of-print No. ahead-of-print.
- Chiambaretto, P., Massé, D., & Mirc, N. (2019). All for One and One for All? -Knowledge broker roles in managing tensions of internal competition: The Ubisoft case. *Research Policy*, 48(3), 584–600.
- Christensen, I., & Karlsson, C. (2019). Open innovation and the effects of crowdsourcing in a pharma ecosystem. *Journal of Innovation and Knowledge*, 4(4), 240–247. doi:10.1016/j.jik.2018.03.008.
- Cillo, P. (2005). Fostering Market knowledge use in innovation: The role of internal brokers. *European Management Journal*, 23, 404–412.
- Crîșan, E. L., Salanță, I. I., Beleiu, I. N., Bordean, O. N., & Bunduchi, R. (2021). A systematic literature review on accelerators. *The Journal of Technology Transfer*, 46(1), 62–89.
- Crupi, A., Del Sarto, N., Di Minin, A., Gregori, G. L., Lepore, D., Marinelli, L., et al. (2020). The digital transformation of SMEs—a new knowledge broker called the digital innovation hub. *Journal of Knowledge Management*, 24(6), 1263–1288.

- De Groote, J. K., & Backmann, J. (2020). Initiating open innovation collaborations between incumbents and Start-ups: How can David and Goliath get along? *International Journal of Innovation Management*, 24(2), 2050011.
- Del Giudice, M., Nicotra, M., Romano, M., & Schillaci, C. E. (2017). Entrepreneurial performance of principal investigators and country culture: Relations and influences. *Journal of Technology Transfer*, 42(2), 320–337. doi:10.1007/s10961-016-9499-y.
- Di Minin, A., Frattini, F., & Piccaluga, A. (2010). Fiat: Open innovation in a downturn (1993–2003). *California Management Review*, 52(3), 132–159.
- Dingler, A., & Enkel, E. (2016). Socialization and innovation: Insights from collaboration across industry boundaries. *Technological Forecasting and Social Change*, 109, 50–60.
- Dodourova, M., & Bevis, K. (2014). Networking innovation in the European car industry: Does the open innovation model fit? *Transportation Research Part A: Policy and Practice*, 69, 252–271.
- Dushnitsky, G., & Lenox, M. J. (2005). When do incumbents learn from entrepreneurial ventures? Corporate venture capital and investing firm innovation rates. *Research Policy*, 34(5), 615–639.
- Dushnitsky, G., & Shaver, J. M. (2009). Limitations to interorganizational knowledge acquisition: The paradox of corporate venture capital. *Strategic Management Journal*, 30(10), 1045–1064.
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550.
- Enkel, E., & Sagneister, V. (2020). External corporate venturing modes as new way to develop dynamic capabilities. *Technovation*, 96–97, 102128.
- Fabel, O., Hopp, C., & Weber, T. (2013). When teams of employees spin-off partnerships: Matching-technology, information structure, and the pure incubator effect. *Journal of Business Economics*, 83(4).
- Fang, S.-C., Yang, C.-W., & Hsu, W.-Y. (2013). Inter-organizational knowledge transfer: The perspective of knowledge governance. *Journal of Knowledge Management*, 17(6), 943–957.
- Freytag, R. (2019). On a growth track with Start-ups: How established companies can pursue innovation. *Strategy & Leadership*, 47(4), 26–33.
- García Martínez, M., & Walton, B. (2014). The wisdom of crowds: The potential of online communities as a tool for data analysis. *Technovation*, 34(4), 203–214.
- Gibbert, M., Ruigrok, W., & Wicki, B. (2008). What passes as a rigorous case study? *Strategic Management Journal*, 29(13), 1465–1474.
- Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational Research Methods*, 16(1), 15–31.
- Giusti, J. D., Alberti, F. G., & Belfanti, F. (2020). Makers and clusters. knowledge leaks in open innovation networks. *Journal of Innovation and Knowledge*, 5(1), 20–28. doi:10.1016/j.jik.2018.04.001.
- Granstrand, O., & Holgersson, M. (2020). Innovation ecosystems: A conceptual review and a new definition. *Technovation*, 90, 102098.
- Guo, H., Guo, A., & Ma, H. (2022). Inside the black box: How business model innovation contributes to digital start-up performance. *Journal of Innovation and Knowledge*, 7(2). doi:10.1016/j.jik.2022.100188.
- Hofman, E., Halman, J. I., & Van Looy, B. (2016). Do design rules facilitate or complicate architectural innovation in innovation alliance networks? *Research policy*, 45(7), 1436–1448.
- Hutter, K., Gfrerer, A., & Lindner, B. (2021). From popular to profitable: Incumbents' experiences and challenges with external corporate accelerators. *International Journal of Innovation Management*, 25(3), 2150035.
- Jiang, S., Hu, Y., & Wang, Z. (2019). Core firm based view on the mechanism of constructing an enterprise innovation ecosystem: A case study of Haier group. *Sustainability*, 11(11), 3108.
- Joseph, D., Windham-Bannister, S., & Mangold, M. (2021). What corporates can do to help an innovation ecosystem thrive – and why they should do it. *Journal of commercial biotechnology*, 26(1).
- Karlsson, C., & Skold, M. (2013). Forms of innovation openness in global automotive groups. *International Journal of Automotive Technology and Management*, 13(1), 1–17.
- Keszei, T. (2018). Boundary spanners' knowledge sharing for innovation success in turbulent times. *Journal of Knowledge Management*, 22(5), 1061–1081.
- Kraus, S., Kailer, N., Dorfer, J., & Jones, P. (2020). Open innovation in (young) SMEs. *The International Journal of Entrepreneurship and Innovation*, 21(1), 47–59.
- Kurpjuweit, S., & Wagner, S. M. (2020). Start-up supplier programs: A new model for managing corporate- Start-up partnerships. *California Management Review*, 62(3), 64–85.
- Lalaounis, S. T., & Nayak, A. (2022). Dynamic stability: Unfolding dynamics of vicious cycles in a design firm. *European Management Journal*, 40(1), 137–150.
- Lane, P. J., & Lubatkin, M. (1998). Relative absorptive capacity and interorganizational learning. *Strategic Management Journal*, 19(5), 461–477. doi:10.1002/(sici)1097-0266(199805)19:5<461::aid-smj953>3.3.co;2-c.
- Lazzarotti, V., Manzini, R., Pellegrini, E., & Pizzurno, E. (2013). Open Innovation in the automotive industry: Why and how? Evidence from a multiple case study. *International Journal of Technology Intelligence and Planning*, 9(1), 37–56.
- Levin, D. Z., & Cross, R. (2004). The strength of weak ties you can trust: The mediating role of trust in effective knowledge transfer. *Management Science*, 50, 1477–1490. doi:10.1287/mnsc.1030.0136.
- Levy, M., Loebecke, C., & Powell, P. (2003). SMEs, co-opetition and knowledge sharing: The role of information systems. *European Journal of Information System*, 12, 3–17.
- Loebbecke, C., Van Fenema, P. C., & Powell, P. (2016). Managing inter-organizational knowledge sharing. *The Journal of Strategic Information Systems*, 25(1), 4–14.
- Lupton, N., & Beamish, P. (2014). Organizational structure and knowledge-practice diffusion in the MNC. *Journal of Knowledge Management*, 18(4), 710–727.
- Mariano, S., & Awazu, Y. (2017). The role of collaborative knowledge building in the co-creation of artifacts: Influencing factors and propositions. *Journal of Knowledge Management*, 21(4), 779–795.
- Matricano, D., Candelò, E., Sorrentino, M., & Martínez-Martínez, A. (2019). Absorbing in-bound knowledge within open innovation processes. The case of Fiat Chrysler Automobiles. *Journal of Knowledge Management*, 23(4), 786–807.
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A method sourcebook*. USA: SAGE, Arizona State University Third Edition.
- Moschner, S. L., Fink, A. A., Kurpjuweit, S., Wagner, S. M., & Herstatt, C. (2019). Toward a better understanding of corporate accelerator models. *Business Horizons*, 62(5), 637–647.
- Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. Oxford: Oxford University Press.
- Ollila, S., & Yström, A. (2017). An investigation into the roles of open innovation collaboration managers. *R&D Management*, 47(2), 236–252.
- Öberg, C., & Alexander, A. T. (2019). The openness of open innovation in ecosystems – integrating innovation and management literature on knowledge linkages. *Journal of Innovation and Knowledge*, 4(4), 211–218. doi:10.1016/j.jik.2017.10.005.
- Park, J., & Bae, Z. (2018). When are 'sharks' beneficial? Corporate venture capital investment and start-up innovation performance. *Technology Analysis & Strategic Management*, 30(3), 324–336.
- Prashantham, S., & Kumar, K. (2011). How do new ventures in MNC ecosystems proactively overcome interfirm asymmetries? *Indian Institute of Management Bangalore Management review*, 23(3), 177–188.
- Paul, S., & Whittam, G. (2010). Business angel syndicates: An exploratory study of gatekeepers. *Venture Capital*, 12, 241–256.
- Polidoro, F., & Yang, W. (2021). Corporate Investment Relationships and the Search for Innovations: An Examination of Start-ups' Search Shift Toward Incumbents. *Organization Science*, 32(4), 909–1148.
- Pushpanathan, G., & Elmquist, M. (2022). Joining forces to create value: The emergence of an innovation ecosystem. *Technovation*, 115, 102453.
- Remmeland Wikhamn, B. (2020). Open innovation change agents in large firms: How open innovation is enacted in paradoxical settings. *R&D Management*, 50(2), 198–211.
- Rigtering, J. P., & Behrens, M. A. (2021). The effect of corporate—Start-up collaborations on corporate entrepreneurship. *Review of Managerial Science*, 15(8), 2427–2454.
- Ritala, P., & Stefan, I. (2021). A paradox within the paradox of openness: The knowledge leveraging conundrum in open innovation. *Industrial Marketing Management*, 93, 281–292.
- Ritala, P., Agouridas, V., Assimakopoulos, D., & Gies, O. (2013). Value creation and capture mechanisms in innovation ecosystems: A comparative case study. *International Journal of Technology Management*, 63(3–4), 244–267.
- Rothaermel, F. T. (2001a). Complementary assets, strategic alliances, and the incumbent's advantage: An empirical study of industry and firm effects in the biopharmaceutical industry. *Research Policy*, 30(8), 1235–1251.
- Rothaermel, F. T. (2001b). Incumbent's advantage through exploiting complementary assets via interfirm cooperation. *Strategic Management Journal*, 22(6–7), 687–699.
- Saeed, B. B., Afsar, B., Cheema, S., & Javed, F. (2019). Leader-member exchange and innovative work behavior: The role of creative process engagement, core self-evaluation, and domain knowledge. *European Journal of Innovation Management*, 22(1), 105–124.
- Scholz, R. W., & Tietje, O. (2002). *Embedded case study methods: Integrating quantitative and qualitative knowledge*. Sage.
- Schulz, M. (2001). The uncertain relevance of newness: Organizational learning and knowledge flows. *Academy of Management Journal*, 44, 661–681.
- Scott, S., Hughes, M., & Kraus, S. (2019). Developing relationships in innovation clusters. *Entrepreneurship & Regional Development*, 31(1–2), 22–45.
- Steiber, A., & Alänge, S. (2020). Corporate- Start-up collaboration: Effects on large firms' business transformation. *European Journal of Innovation Management*, 24(2), 235–257.
- Steiber, A., Alänge, S., & Corvello, V. (2021). Evaluating corporate- start-up co-creation: a critical review of the literature. *International Journal of Innovation Management*, 25(7), 2150073.
- Verona, G., Prandelli, E., & Sawhney, M. (2006). Innovation and virtual environments: Towards virtual knowledge brokers. *Organization Studies*, 27(6), 765–788.
- Weiblen, T., & Chesbrough, H. W. (2015). Engaging with start-ups to enhance corporate innovation. *California Management Review*, 57(2), 66–90.
- Wikhamn, B. R., Ljungberg, J., & Styhre, A. (2013). Enacting hard and soft product offerings in mature industries: Moving towards servitisation in Volvo. *International Journal of Innovation Management*, 17(4), 1350014.
- Wilhelm, M., & Dolsma, W. (2018). Managing knowledge boundaries for open innovation – Lessons from the automotive industry. *International Journal of Operations & Production Management*, 38(1), 230–248.
- Williamson, O. E. (1991). Comparative economic organization: The analysis of discrete structural alternative. *Administrative Science Quarterly*, 36(2), 269–296.
- Xie, X., Wang, L., & Zeng, S. (2018). Inter-organizational knowledge acquisition and firms' radical innovation: A moderated mediation analysis. *Journal of Business Research*, 90, 295–306.
- Yao, J., Crupi, A., Di Minin, A., & Zhang, X. (2020). Knowledge sharing and technological innovation capabilities of Chinese software SMEs. *Journal of Knowledge Management*, 24(3), 607–634.
- Yin, R. K. (2013). *Case study research: Design and methods* (5th Ed.). Thousand Oaks, CA: SAGE Publications.