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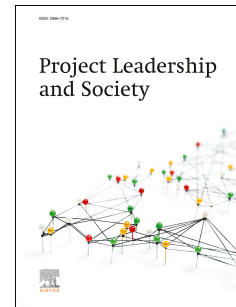
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How to manage open innovation projects? An integrative framework

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Abstract

The role of external parties in the innovation efforts has received much attention on the firm-level, but there are less studies on open innovation projects. This is surprising, since projects are frequently used to carry out open innovation activities. In this study, a systematic literature review was conducted to provide a framework for managing open innovation initiatives. The results revealed several key themes that were further grouped—based on their interrelatedness—into the management of knowledge sharing, openness, actors, and results. A closer look at the considerations showed that the management of open innovation projects requires balancing several contradictory effects and handling both the contingencies and complementarities of the subject matter. The management further becomes complex due to the multiple actors involved and their different roles. To this end, we outlined several practical implications for managers of open innovation projects to consider and recommended avenues for further research.

Key words: Open innovation, Project management, Literature review

1. Introduction

The business landscape is complex, rapidly changing, and more unpredictable than ever before (Michels & Murphy, 2021; Reeves et al., 2016), necessitating innovation to ensure organizational survival and competitive advantage (Dereli, 2015; Urbancova, 2013). Previous research has established a clear relationship between innovation and financial performance (Rousseau et al., 2016) but has also examined how innovations can provide solutions for the dilemmatic challenge of combining both business and societal goals (McGahan et al., 2021).

Within the larger domain of innovation, the concept of open innovation refers to “a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology” (Chesbrough, 2003, xxiv). Initially,

the open innovation concept emphasized knowledge flows between two companies; however, over time, it has grown to encompass the collaboration between various participants throughout the innovation process (Chesbrough, 2017). In recent years, open innovation has garnered considerable attention. According to open innovation proponents (Chesbrough et al., 2007), there are a number of advantages associated with open innovation, such as less lead time to market need adoption, the possibility of sharing resources, and spreading the risk across organizational boundaries, often leading to larger returns on investments (Du & Vanhaverbeke, 2014; Van Den Biesen, 2008). Therefore, it is argued that open innovation is essential for innovative firms, and an increasing number of businesses have adopted open innovation strategies in the innovation process.

However, it should be noted that within open innovation projects, innovation does not occur automatically. The literature suggests that, in a project setting, innovation-related activities require effective management (Bessant & Tidd, 2015; Dereli, 2015). The achievement of successful collaborative open innovation projects necessitates the presence of guidance, effective leadership, and a collective vision from multiple stakeholders (Mu et al., 2019). Adequate allocation of resources, conducive environments, and structures that strike a balance between flexibility and control are imperative to foster and facilitate such projects (Klessova et al., 2020). Effective communication is a crucial component of innovation management (Yan & Dooley, 2013). Furthermore, it is inadequate to contemplate solely the obstacles encountered within an organization, as external linkages are progressively indispensable in the contemporary innovation sphere (Bessant & Tidd, 2015).

Although all of these components hold significance, the involvement of external entities in the innovation process has garnered considerable focus in academia, practical applications, and policy-making in recent times (Bogers et al., 2018). Incorporating external sources of innovation presents clear benefits, as it involves acquiring access to inventions or capabilities necessary for innovations that are not present within the primary organization (West & Bogers, 2014). Open innovation is fundamentally reliant on knowledge, as it involves the reconfiguration of existing knowledge and the

inclusion of new knowledge. The knowledge in question is retrievable through internal search mechanisms; however, research has shown that integrating both internal and external knowledge yields more benefits (Tranekier & Søndergaard, 2013). The incorporation of insights from suppliers, customers, competitors, and research institutions has been observed to exert a substantial influence on the pace of new product development, the overall quality of new products, the potential for innovative concepts, and competitive advantages in terms of market performance (Ehls et al., 2020; Zhang & Min, 2022). According to Bogers and West (2012), the distribution of the creative process allows it to extend beyond the limitations of a singular organization.

The complex and advantageous yet difficult nature of interorganizational knowledge flows has led to the emergence of various research streams aimed at studying this topic. Illustrative research streams encompass knowledge management (Nonaka, 1994), crowdsourcing (Brabham, 2008; Pollok et al., 2019; Steils et al., 2021), and harnessing knowledge at the crossroads of industry and academia for open innovations (Du & Vanhaverbeke, 2014; Johnson & Johnson, 2004; Steinmo & Rasmussen, 2018). All of these streams share a common feature: the prioritization of effectively managing external contributions to innovation (Ehls et al., 2020).

Despite the prevalence of open innovation, additional research is necessary. The majority of research on open innovation has focused on the firm level (Bagherzadeh et al., 2021; Bogers et al., 2017; Hossain et al., 2016). The concept of open innovation is multifaceted and requires a thorough analysis of its various levels in order to comprehend the phenomenon (Bogers et al., 2017). Open innovation endeavors that are carried out are frequently executed in the form of projects, rendering them of paramount importance for an organization's innovation efficacy. The attributes of open innovation projects can vary significantly with respect to complexity, uncertainty, and knowledge requirements; consequently, critical determinations pertaining to open innovation are made at the project level. Thus, a comprehensive analysis is needed to explore the management of open innovations at the project level (Markovic et al., 2021). The purpose of this study is to explore the

key themes in open innovation project management and to analyze how they are interrelated. While doing so, we focus on the major themes in the management of open innovation projects and offer managerial suggestions for addressing these themes. In addition, with the aid of the created framework, we outline future study directions for this field.

2. Conceptual underpinnings

Innovation is essential to the survival of a business. However, the benefits of innovation are contingent on a company's capacity to regulate its openness to external knowledge. The sections that follow evaluate innovation as an outcome or a process in order to provide a theoretical framework for this study and to convey the current state of knowledge in this field. Additionally, both closed and open innovation concepts are addressed. To achieve the purpose of this study, the discussion concludes by analyzing projects as a context for open innovation. Examining these research streams provides the foundation for an exhaustive literature review of project management for open innovation.

2.1. Perspectives on innovation: Process and outcome

Schumpeter (1934) proposed a significant characterization of innovation, asserting that it encompasses a distinct combination of resources. The notion of business innovation comprises a range of endeavors, including the introduction of original products, the development of innovative techniques, the exploration of untapped markets, the acquisition of new input sources, and the establishment of novel entities. Schumpeter's concept has had a noteworthy impact on terminology. Nevertheless, the definition of innovation has undergone changes throughout history, and currently, there are alternative interpretations of the concept (Hidalgo & Albers, 2008). Divergent perspectives exist among scholars regarding the nature of innovation. While some scholars consider innovation as

an outcome, others regard it as a process leading to a final product. Additionally, certain scholars conceptualize innovation as both a process and an outcome (Dodgson, 2018; Gupta et al., 2007; Kahn, 2018; Quintane et al., 2011).

From a process perspective, innovation can be conceptualized as a procedure that involves the origination, endorsement, and execution of novel concepts, procedures, commodities, or amenities (Thompson, 1965). According to Baregheh et al. (2009), organizations engage in a multiphase process to transform ideas into improved or innovative products, services, or processes. Multiple viewpoints can be adopted to understand the process perspective, including, but not limited to, invention, development, and implementation (Garud et al., 2013), or idea generation, conversion, and diffusion (Gupta, 2018; Hansen & Birkinshaw, 2007). While there may be variations, perspectives on the innovation process share similarities and involve the key stages of ideation, conceptualization, and implementation.

In terms of its outcome, innovation can be described as an invention that has been introduced to the market in the case of a new product, or the initial use in a production process in the case of a process innovation (Utterback 1971). Additionally, innovation can encompass new products or services, process technologies, organizational structures, or administrative systems, or plans or programs (Baregheh et al., 2009; Damanpour, 1996; Kahn, 2018; Quintane et al., 2011).

The present research recognizes the numerous iterations of innovation-related terminologies and their contextual nuances. Singh and Aggarwal (2022) identified novelty as a fundamental criterion that is shared across various variations. Given its broad applicability, we adopted novelty as the criterion for this review study. According to Quintane et al. (2011), the novelty of innovations should not be considered as original to humanity, but rather as novel from the perspective of each participant. Furthermore, it is important to note that novelty does not necessarily imply revolutionary innovation, as even minor, yet significant, modifications can be considered novel (Kahn, 2018).

2.2. *Perspectives on open innovation*

Historically, endeavors related to innovation have been perceived as taking place within the boundaries of an individual organization, irrespective of whether they are outcome- or process-oriented. This assertion is no longer valid. External knowledge sources are regarded as indispensable to the process of innovation. Consequently, the limitations imposed by organizational boundaries on innovation have been removed, and the ideation process must now encompass external stakeholders, thereby giving rise to the concept of open innovation. While closed innovation is characterized as an outcome of internal organizational activities, open innovation underscores the importance of expanding the organization's boundaries to acquire and leverage external information flows (Chesbrough, 2017). Moreover, the concept of open innovation encompasses the dual aspects of knowledge inflow and outflow. The primary emphasis lies in regulating the dissemination of information across multiple innovation endeavors (Chesbrough & Bogers, 2014).

The dichotomy between closed and open innovation can be viewed alternatively as distinct points along a spectrum rather than as diametrically opposed alternatives. This idea holds that knowledge and a sound business plan are two requirements for open innovation. Incorporating knowledge sharing is imperative for distinguishing open innovation from closed innovation within the business model. The continuum is determined by three variables: the quantity of partners, the heterogeneity of those partners, and the heterogeneity of the innovation process stages. The more diverse the partners are, the more they participate in all stages of the innovation process, and the more partners there are, the more open the innovation is (Tynnhammar, 2017).

Open innovation as a concept has been conceptualized in multiple ways, such as outside-in (inbound) and inside-out (outbound) processes (Dahlander & Gann, 2010), coupled processes (Piller & West, 2014), and as a taxonomy of stakeholders (Recalde et al., 2022). The inbound process pertains to knowledge flows emanating from external sources. Enkel et al. (2009) assert that the

internal knowledge of a business is augmented by external knowledge. The inbound process can be bifurcated into two distinct subprocesses: sourcing and acquiring. The act of sourcing knowledge and ideas from multiple sources does not involve direct monetary compensation, but rather offers indirect benefits. Conversely, the act of acquiring knowledge implies a monetary exchange for said knowledge.

Outbound innovation refers to a process of innovation that is driven by the internal resources and capabilities of an organization, complemented by external knowledge sources (Dahlander & Gann, 2010). Similar to sourcing and acquiring, the subprocesses of the outbound process are commonly referred to as “revealing” and “selling.” As the term “revealing” implies, information is disseminated without remuneration with the aim of obtaining indirect benefits. The act of selling pertains to the vending or granting of licenses for technological advancements or innovative products (Enkel et al., 2009).

The research on coupled processes—the process that encompasses both inbound and outbound activities—has expanded and refined the notion of open innovation toward a more interactive approach. The concept of coupled open innovation is widely acknowledged to encompass multiple facets (Chou et al., 2016; Zhao, 2022). Coupled open innovation can manifest in three forms: dyadic, which involves two partners; networked, which involves multiple partners; and community-based, which involves the formation of a new entity (Piller & West, 2014).

From a stakeholder perspective, a taxonomy for open innovation classifies stakeholders into three distinct categories: business partners, scientific partners and knowledge agents, and institutions and civil society partners (Recalde et al., 2022). Individuals falling under the first category may include competitors, suppliers, consultants, clients, or users. The second classification comprises stakeholders, such as universities, incubators, and innovation and research centers. The third classification comprises entities such as foundations, associations, and government agencies, among others.

2.3. Open innovation projects

Open innovation happens at the nexus of shared knowledge among partners within and outside organizational boundaries. Projects are usually used as settings to manage these endeavors (Midler et al., 2016). The definition of a project is “a temporary endeavor undertaken to create a unique product, service or result” (Project Management Institute, 2021, 4). A project’s central features—that is, its temporariness and uniqueness—are considered suitable for performing open innovation activities from idea to product, service, process, or other commonly agreed-upon outcomes among partners (Kerzner, 2019). However, not every project is focused on innovation. This leads to the notion that conventional projects should be distinguished from innovative projects. Typically, project management is defined by structure and coordination, while innovation requires creative chaos and freedom (Kerzner, 2019).

Recognizing these commonalities and differences between innovation and project management, Marcovic et al. (2019) defined innovation projects as “a temporary entity comprising a set of interrelated innovation-oriented tasks purposefully planned to solve a particular innovation problem.” This definition was eventually expanded by incorporating the concept of open innovation, resulting in it being viewed as “a temporary entity comprising a set of purposively planned and managed knowledge flows between organizational representatives to solve a particular innovation problem” (Barbic et al., 2021, 175).

Previous research shows that apart from the smooth knowledge inflows and outflows (Lawson & Potter, 2012; Zhang & Min, 2022), the success of open innovation projects is highly dependent on the cultural understanding and leadership among the project partners (Bogers et al., 2017; Mu et al., 2019; Wang et al., 2021) and the establishment of clear governance mechanisms and interorganizational structures supporting the integration of internal and external innovation efforts

(Dodgson et al., 2006). Furthermore, the effective management of intellectual property rights among partners is essential to mitigate risks and ensure equitable benefits to all stakeholders (Laursen & Salter, 2014).

The extant literature also highlights that to achieve success in the abovementioned areas, there are several managerial aspects that project teams need to address. For example, establishing clear objectives and defining the scope of the project in the early stages of collaborative work can substantially help align the expectations of all stakeholders and encourage the timely and effective allocation of resources (Barbosa et al., 2021; Chesbrough & Appleyard, 2007). The management and resultant success of open innovation projects is also highly contingent on the robustness of the partner selection process, since partners help to ensure that complementary skills and resources are brought forward to enable the project (Duysters et al., 1999; Guertler & Sick, 2021). Similarly, through continuous open communication and the effective management of communication channels, project partners can ensure clarity around intellectual property rights and equitable benefits for all stakeholders (Cui et al., 2020; Mortara & Minshall, 2011).

The preceding discussion demonstrates that open innovation initiatives operate within a complex domain that encompasses numerous processes, structures, mechanisms, and collaborators, and that the success of such endeavors is highly dependent on the efficient management of these multifaceted and ever-changing factors. We undertake a comprehensive review of the literature pertaining to the aforementioned domains and investigate the key themes of open innovation project management. In addition, we evaluate their interrelationships in order to present a unified understanding of the literature and suggest avenues for future research.

3. Methodology

A systematic literature review is, at its core, a map of knowledge about the existing literature on a particular topic. A systematic literature review is essential for advancing the research stream, as the

management of open innovation initiatives requires additional scholarly attention. It can be used to summarize and interpret voluminous amounts of data in order to draw conclusions about what is known and what requires additional research (Fisch & Block, 2018; Pittaway, 2008). In this research, a convergent qualitative synthesis was utilized (cf. Efron & Ravid, 2019).

3.1. Data collection

EBSCO Business Source Complete was utilized for database research in order to include all pertinent literature and allow for extensive coverage (cf. Pittaway, 2008). The database contains more than 1,400 active, full-text business journals (Business Source Complete, 2022). In accordance with Aleem et al. (2023), this study's keywords were determined in a systematic manner. In the Supplemental Materials section, the comprehensive search string is presented.

In *step 1*, a preliminary search was conducted utilizing various synonyms and near-synonyms for the words in the phrase “open innovation project” in order to develop a functional search string. In *step 2*, additional procedures were performed. First, the search string was discussed among the authors to minimize the impact of individual vagueness (cf. Booth et al., 2012), and then a search was conducted on EBSCO Business Source Complete to determine if a systematic review on the research question already existed. The previously specified search string with the title, abstract, and keywords as search fields was supplemented by a search string that did not target a specific search field but instead considered all potential sections of the record. The additional search string associated with the AND operator was defined as ((“systematic*” AND “review*”) OR (“critical*” AND “review*”) OR “integrative review*” OR “meta-analysis” OR “bibliometric*” OR “state-of-the-art” OR “state of the art”). The document results were examined to determine if the literature on open innovation initiatives had previously been examined. Only one publication appeared to be pertinent. There has been a meta-analysis on the antecedents of interorganizational new product development project performance. In 2013, the results of the analysis were presented at a conference, but only an abstract

was available. Due to the differences between a meta-analysis and a systematic review, as well as the nine-year gap between the conference paper and this research, the meta-analysis was not deemed to diminish the significance of the research. *Step 3* was to choose and appraise the studies (Denyer & Tranfield, 2009). The overall screening process followed the approach presented by Booth et al. (2012) and is displayed in Figure 1.

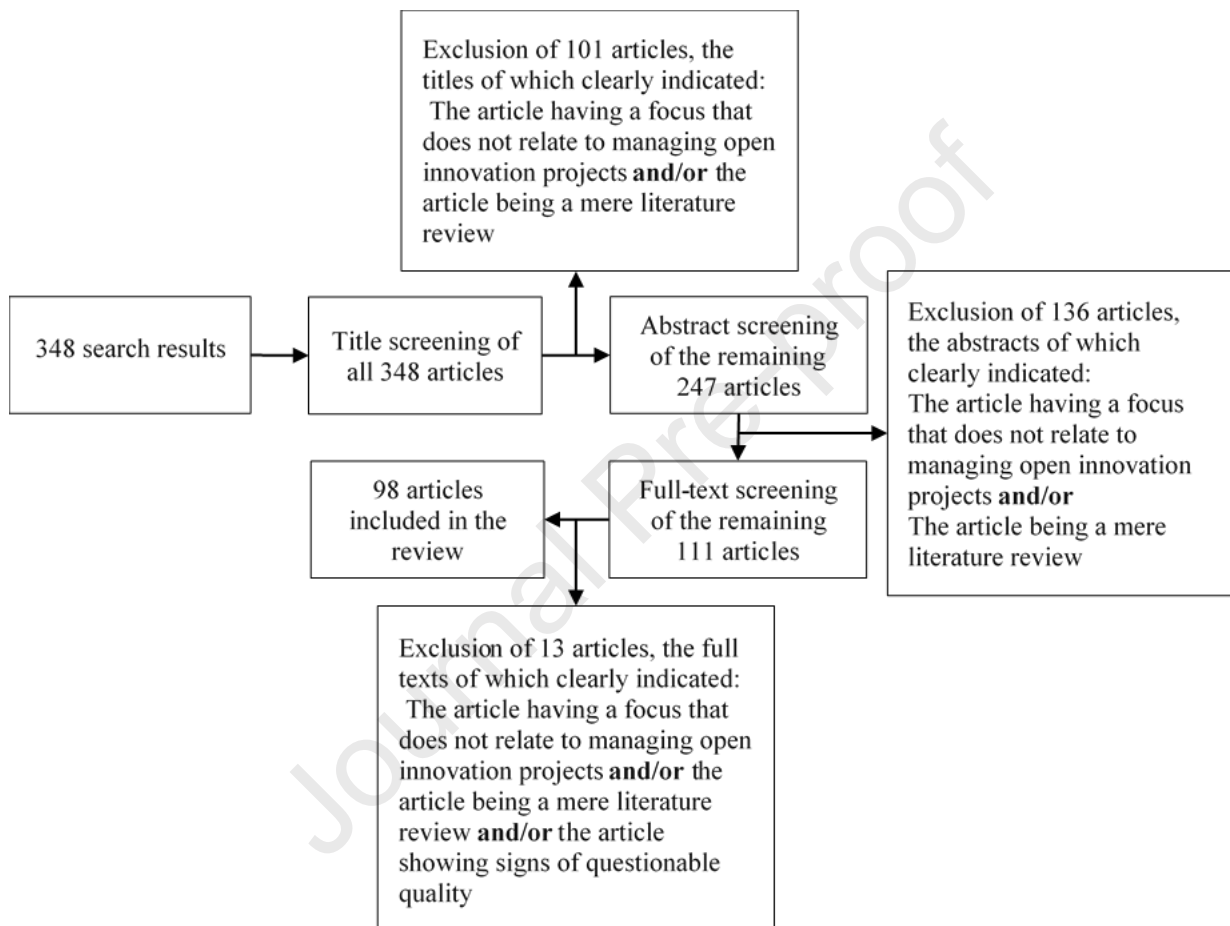


Figure 1: Inclusion–exclusion criteria

In the early stages of the research process, the search function of EBSCO was configured to look for terms in the title, abstract, or keyword field, and for articles that were peer-reviewed and written in English. As depicted in Figure 1, this research comprised the review and analysis of 98 articles (see the supplementary materials for a list of the articles) that passed the screening process. While we have been following a meticulous process for the data collection we acknowledge that criteria for article selection may be limiting to finding some of the relevant sources.

3.2. *Data analysis*

In a review study, the analysis and synthesis are distinguished by distinguishing essential components and creating a distinct whole from newly gathered insights (Denyer & Tranfield, 2009), as opposed to merely summarizing previous studies. In doing so, the goal is to make the new knowledge more accessible through a thorough synthesis (Pittaway, 2008). For the purpose of analysis in this study, a combination of narrative and thematic synthesis approaches was employed. It was determined that these two approaches would complement each other and offer deeper insights. The emphasis of a narrative synthesis is on summing up the findings of the selected documents with words and text. In turn, a thematic synthesis is the process of grouping findings into themes. The combination of these methods is consistent with and appropriate for a convergent qualitative synthesis. Overall, a synthesis strategy is necessary for a review study in order to emphasize the need for activities and procedures that must be planned and explicitly established during the research process (Booth et al., 2012).

Initially, a narrative synthesis was conducted with an Excel sheet containing all the included studies and their title, author(s), journal, and year of publication. The Excel spreadsheet also included columns for key findings, research methods, key themes, key management considerations, and additional thoughts. It served as a framework for the analysis of the data (cf. Bodoliga & Spraggon, 2018). The articles were arranged and read in chronological order according to their publication dates. Within each year, the articles were arranged and read in alphabetical order, as it was impractical to arrange them according to their precise publication dates. Each article was read individually and coded with the aid of NVivo. In accordance with Allard-Poesi et al. (2001), the process of classification involved identifying and categorizing the most important aspects of the articles. The categories consisted of descriptive data, key themes, and the management issues of key themes in

accordance with the research objective (cf. Booth et al., 2012; Snyder, 2019). In addition to being highlighted in NVivo, the key themes were also noted in Excel (cf. Bodolica & Spraggon, 2018).

A thematic synthesis was conducted in order to develop the themes. After reading and coding every article and populating the Excel sheet with the main themes, the findings were organized and themes were identified. This was accomplished with the aid of the Excel sheet (see Bodolica & Spraggon, 2018). In particular, the categories “key themes” and “management of key themes” required in-depth analysis and reflection. Regarding the former, the articles investigated or unearthed multiple themes. While some themes were readily distinguishable from others, others were interconnected. During the analysis process, a number of patterns were discovered among the themes, culminating in a small number of higher-order key themes. These themes were “Communication,” “Control,” “Goals,” “Governance,” “Knowledge Flows,” “Openness,” “Partners,” “Roles,” “Social Relations,” “Tensions,” and “Outcomes.”

Numerous factors for managing these themes were then added to the list. Overall, careful contemplation and consideration were required to facilitate the data structure and organization. This was a crucial stage in the research process, as one of the central concepts of a systematic literature review is to consider what the examined literature means (Booth et al., 2012). Therefore, a simple examination of the articles’ findings was insufficient. In addition to focusing on explicit meanings, it was essential to consider implicit ones, as some of the most intriguing findings may have been concealed. In accordance with Fisch and Block (2018), while it was essential to develop a comprehensive understanding of the literature’s findings, the study also sought to strike a balance between the breadth and depth of the analysis. The process of encoding enabled the extraction of numerous insights, which were then organized, analyzed, and synthesized into a coherent whole that embodied the most crucial aspects. This allowed for the identification of gaps and the recommendation of future actions pertaining to the topic (Booth et al., 2012).

The presentation and utilization of the results is the final stage in conducting a systematic review. Coherence and structure are essential (Bodolica & Spraggon, 2018), and the emerging themes must be articulated (Short, 2009). The section that follows presents our findings in terms of descriptive data, key themes in open innovation initiatives, and the management issues of these key themes.

4. Findings

4.1. Descriptive findings

In this section, we present the descriptive findings to contextualize the qualitative content analysis. The 98 articles included in the review were published in 45 different scientific journals, suggesting a certain degree of spread, but five journals (*International Journal of Project Management*, *Industrial Marketing Management*, *International Journal of Innovation Management*, *Journal of Product Innovation Management*, and *Research Policy*) clearly dominated. The focus of the journals varied from projects and innovation management to general management.

Figure 2, depicting the publication years of the articles, shows that the oldest article was from 2001 and that the topic has become more prevalent over the years. This supports the argument about the importance of open innovation projects (Marcovic et al., 2021).

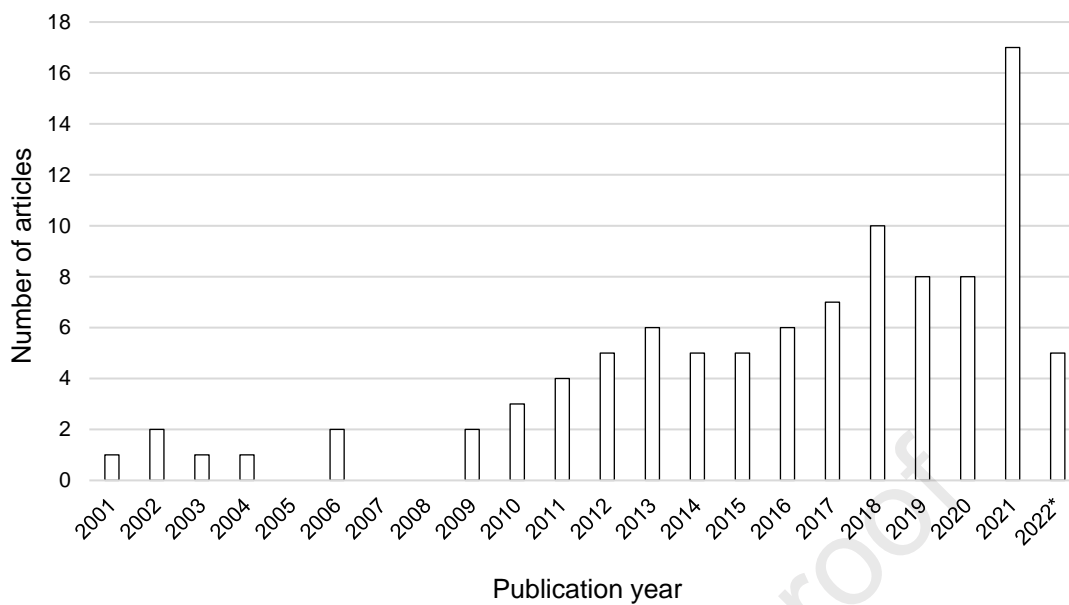


Figure 2. Distribution of the reviewed articles along the timeline (*2022 is characterized by a low number of articles, but this is due to the timing of the article selection process, which started in April 2022.)

The articles adopted a range of different methodological approaches. Some articles (3) were conceptual, but most (95) were characterized by empirical data. Within the latter, qualitative (45), quantitative (34), and mixed-methods articles (16) were identified. Questionnaires and interviews were common methods in the empirical articles, but, for instance, observations and documents were also utilized. The exemplary informants in these studies included project managers, purchasing managers, technical experts, developers, engineers, and CEOs.

The industries and types of open innovation partners researched were diverse. The industry sectors included, for instance, the manufacturing, telecommunications, high tech, automotive, aerospace, logistics, and health care sectors. Examples of open innovation partners included companies, universities, public sector organizations, and users. Furthermore, the number of different partners varied from dyadic or triadic projects to projects involving as many as 10 different partners.

The descriptive findings presented in this section reveal the diversity of research methods and contexts at the crossroads of project and open innovation, providing the setting for open innovation project management discussed in the following section.

4.2. *Managing key themes in open innovation projects*

A careful analysis of the data revealed several key themes that have been regarded as significant and worthy of attention in open innovation projects. They include knowledge flows, openness, goals, partners, roles, governance, control, social relations, communication, tensions, and outcomes. Even though these themes are interrelated in various ways, from a managerial perspective, they can be grouped based on the scope in which the management of open innovation projects takes place.

The first group consisted of themes related to the management of knowledge sharing, and included themes of communication and knowledge flows. The second group was formed by the themes of the degree of openness, control, and governance, which can all be subsumed under the management of openness. The third group entailed themes related to the management of the actors, and it was formed by the themes of partners, roles, and social relations. The fourth group included the themes of goals, outcomes, and tensions, which belong to the management of the results. These groups are further discussed in the following sections.

4.2.1. *Managing knowledge sharing in open innovation projects*

Communication and knowledge flows can be seen as the core of knowledge, and they are closely related to each other, yet some of the analyzed articles did not even distinguish between them. Intensity is a central consideration in *communication*. Our analysis of the existing research indicates that intensity is contingent on radicalness (Ates et al., 2015) and uncertainty (Yan & Dooley, 2013). The importance of a shared language between the project participants was also accentuated (Canhoto et al., 2016; Marullo et al., 2020; Zanzouri & Francois, 2013), as was the use of design to help with communication (Pedersen et al., 2022; Simeone et al., 2017).

Moreover, the analyzed studies showed that there was no simple solution regarding the choice of communication channel or type. There have been mixed results about superior communication channels, and it seems that different channels have different strengths (Barnes et al., 2006; Cui et al., 2020; Hsieh & Tidd, 2012; Steils et al., 2021; Terhorst et al., 2018; Thomas, 2013; Zanzouri & Francois, 2013). Past studies noted the importance of both formal and informal communication (Barbosa et al., 2020, 2021; Barnes et al., 2006; Dietsch & Khemiri, 2018; Steils et al., 2021; Zanzouri & Francois, 2013), thus showing that they complement each other.

The analyzed articles highlighted how *knowledge flows* must be enabled and nurtured. One central point was that instead of acquiring the knowledge of project partners, it was advantageous to access and combine knowledge (Bosch-Sijtsema & Postma, 2009; Lawson & Potter, 2012; Steils et al., 2021). Capacities and capabilities were also regarded as essential in enabling and exploiting knowledge flows (Cui et al., 2018, 2020; Faccin et al., 2019; Lawson et al., 2015). However, knowledge flows were not always desirable; therefore, it was viewed as important to prevent negative flows by favoring selective revealing (Bahemia et al., 2018; Marullo et al., 2020; Stefan et al., 2021).

4.2.2. *Managing openness in open innovation projects*

Openness could be argued to be an essential feature of any open innovation project. From the project management perspective, the degree of openness is closely related to control, governance, and tension. The degree of openness has been researched from several angles, but the two main perspectives in open innovation project studies are breadth and depth. The former concerns the number of external partner types, while the latter refers to how deep the collaboration with the partners is (see, for example, Bahemia & Squire, 2010; Kobarg et al., 2019).

In our analysis, we identified three central considerations for managing *the degree of openness*. First, the theoretical and empirical discoveries indicated that breadth was contingent on innovation

radicalness. For incremental innovation, there was no evidence of a positive impact from breadth (Kobarg et al., 2019; Salge et al., 2013). In contrast, projects aiming for more radical newness benefited from a relatively larger number of external partner types based on conceptual and empirical arguments (Bahemia & Squire, 2010; Salge et al., 2013). Kobarg et al. (2019) concluded that the relationship between breadth and the achievement of radical innovation goals was U-shaped.

Second, the evidence reviewed demonstrated that project complexity may indicate a relatively low or high level of breadth. On the one hand, complexity may increase breadth (Bagherzadeh et al., 2021; Steils et al., 2021), since there is demand for the expertise of different partners (Steils et al., 2021). On the other hand, complex innovation requires maintaining control, which may make broad openness undesirable (Bahemia & Squire, 2010).

Third, the depth of collaboration with a project partner seems to be contingent on innovation radicalness and the significance of the partner's role. Moreover, there was evidence of customer-supplier projects in which openness depth varied depending on the customer's role (Lehtimäki & Komulainen, 2021), indicating that a major role implied more depth. Considering the optimal level of depth, it was proposed—on conceptual grounds—that increasing depth contributed to performance (Bahemia & Squire, 2010). For incremental innovation, the relationship was positive and curvilinear, but for radical innovation, some inconclusive evidence existed (Kobarg et al., 2019). Uncertain and complex projects were found to be characterized by a relatively high level of depth (Bagherzadeh et al., 2021), and these project features could be assumed to be connected to radical innovation.

Governance and control were closely connected in this review. In some cases, scholars stated that they researched one of these key themes, but the definition or operationalization that was provided was more in line with the other key themes. In other cases, control appeared to cover aspects related to governance. Contract- and trust-related themes were grouped together under governance in this review, and control was seen as a more generic concept. This is how most of the reviewed articles perceived the distinction between the two concepts.

Beginning with *governance*, the overall governance mode seems to be contingent on uncertainty (Bagherzadeh et al., 2021), complexity, and knowledge hiddenness (Bagherzadeh et al., 2022). In addition to the general modes, transactional and relational mechanisms were utilized to govern a project of any mode. Due to their complementary nature, several papers argued that both types of governance mechanisms were required (Arranz & Arroyabe, 2012; Barbic et al., 2021; Bosch-Sijtsema & Postma, 2009; Chin et al., 2011; Lehtimäki & Komulainen, 2021; Marullo et al., 2020; Melander & Lakemond, 2015; Olander et al., 2010; Parker, 2012). However, their relative importance differed depending on the project stage (Faccin et al., 2016; Olander et al., 2010; Sjödin et al., 2011) and radicalness (Arranz & Arroyabe, 2012; Solís-Molina et al., 2020).

Considerations about *control* can be consolidated into one principle: the balance between control and autonomy. The analyzed studies highlighted the significance of control in open innovation projects (Ahlfänger et al., 2022; Baggio et al., 2018; Bahemia et al., 2018; Chin et al., 2011; Couchman & Fulop, 2009; Dyball & Wang, 2017; Kim & Lee, 2003; Patrucco et al., 2022; Wang et al., 2021), but excessive control was harmful (Biswas & Akroyd, 2016) and autonomy brought benefits (Johnson, 2002; Johnson & Johnston, 2004). Hence, when balanced with autonomy, control fulfilled the function it aimed to have.

4.2.3. *Managing the actors in open innovation projects*

Managing the actors can be divided into three interrelated themes: managing partners, roles, and social relations. In the analyzed articles, the considerations around managing *partners* covered the partner selection process (e.g., Guertler & Sick, 2021), desirable partner characteristics (e.g., Barnes et al., 2002), and the optimal partner type (e.g., Garcez et al., 2014). While the two latter aspects have attracted scholarly attention, the partner selection process has been studied in a limited manner, with

a proposed process framework that may be burdensome to follow in practice (Guertler & Lindemann, 2016).

Our analysis shows that desirable partner characteristics have been considered either explicitly or implicitly by several scholars. They highlighted the importance of complementarities (Bahemia et al., 2018; Barnes et al., 2002, 2006; Bosch-Sijtsema & Postma, 2009; Canhoto et al., 2016; Garcez et al., 2014; Marullo et al., 2020; Maurer & Valkenburg, 2014; Patrucco et al., 2022; Polova & Thomas, 2020; Weck, 2006; Zhang et al., 2022), trustworthiness (Barnes et al., 2002; Garcez et al., 2014; Maurer & Valkenburg, 2014), and prior experience with the project partners (Barnes et al., 2006; Garcez et al., 2014; Pinheiro et al., 2016), or the general collaboration experience of the partners (Barnes et al., 2002; Dominguez-Blanco et al., 2021).

Another central consideration was that certain partner types were suitable for certain situations, since different partner types have different competences, attributes, and strengths. The existing research has discussed, for example, suppliers (Du & Vanhaverbeke, 2014; Garcez et al., 2014; Lassen & Laugen, 2017), customers (Du & Vanhaverbeke, 2014; Garcez et al., 2014; Kim & Lee, 2003; Lehtimäki & Komulainen, 2021), end users (Sjödén et al., 2011; Steils et al., 2021), competitors (Garcez et al., 2014), innovation intermediaries (Dietsch & Khemiri, 2018; Katzy et al., 2013), universities (Du & Vanhaverbeke, 2014; Garcez et al., 2014; Lassen & Laugen, 2017; Steils et al., 2021), and research institutes (Du & Vanhaverbeke, 2014; Garcez et al., 2014).

The discussion on partner types was closely linked to another key theme: *roles*. The central considerations regarding managing roles can be captured in four remarks. First, the innovation or knowledge champion role seemed to be crucial for open innovation projects (Barnes et al., 2006; Goduscheit, 2014; Hamadi et al., 2018; Knudsen et al., 2019; Terhorst et al., 2018). Second, leadership and management roles were vital. They extend from individual leadership characteristics (Barnes et al., 2006; Polova & Thomas, 2020; Salge et al., 2013), to lead researcher roles (Barnes et al., 2002, 2006), to the commitment of senior management (Barnes et al., 2002; Goduscheit, 2014).

Third, the articles noted that well-managed roles were characterized by clarity and common understanding (e.g., Barbosa et al., 2021; Barnes et al., 2006; Faccin et al., 2016; Weck, 2006; Westergren, 2011). Fourth—and connected to partners—different partner types had different competences, attributes, and strengths, implying differences in ideal roles (Dietsch & Khemiri, 2018; Garcez et al., 2014; Katzy et al., 2013; Kim & Lee, 2003; Lassen & Laugen, 2017; Sjödin et al., 2011; Steils et al., 2021).

The key theme of *social relations* was characterized by the contradictory effects of embeddedness. On the one hand, embedded relationships were considered advantageous (Kim & Lee, 2003), particularly with the most important project partner (Tranekjer & Søndergaard, 2013). On the other hand, embedded relationships may result in decreased innovation novelty (Tranekjer & Søndergaard, 2013) or opportunistic behavior (Noordhoff et al., 2011). Another finding about social relationships was the use of different forms of social capital. Past research indicated that cognitive and relational social capital were complementary; both have distinctive roles in the project, but at the same time, they support each other (Steinmo & Rasmussen, 2018).

4.2.4. *Managing the results of open innovation projects*

Managing the results can be seen to involve the attainment of goals and outcomes and the handling of tensions in the projects. Managing *goals* was among the most addressed of the key themes in terms of the number of studies. Although the term “goals” is utilized in this paper, the articles that were reviewed referred to a variety of concepts, such as goals (e.g., Johnson & Johnston, 2001), objectives (e.g., Barnes et al., 2002; Polova & Thomas, 2020), purpose (Canhoto et al., 2016), and management direction (Bstieler & Hemmert, 2010). Despite the fact that the definitions of these terms varied slightly depending on the article, nevertheless, they referred to the existence of a specified aim or desirable outcome.

Our analysis of the extant literature highlights different features characterizing well-managed goals. It was considered important that the goals were developed early (Polova & Thomas, 2020; Sjödin et al., 2011) and were beneficial for all project partners (Barnes et al., 2002). It was also highlighted that the goals should be clear (Barbosa et al., 2021; Barnes et al., 2002, 2006; Bstieler & Hemmert, 2010; Sjödin et al., 2011), specific (Bstieler & Hemmert, 2010; Johnson, 2002; Polova & Thomas, 2020; Sjödin et al., 2011), and realistic (Johnson & Johnston, 2001). Furthermore, the articles remarked on goals being agreed upon together (Barnes et al., 2002), shared (Canhoto et al., 2016; Pinheiro et al., 2016; Polova & Thomas, 2020), and communicated (Sjödin et al., 2011). However, the existing research examined, on a rather general level, how these features were achieved and how goals were managed as a process.

Many of the articles addressing *outcomes* shared a common view: A well-managed open innovation project generated some value or benefits for all participants (Barnes et al., 2002, 2006; Stefan et al., 2021; Weck, 2006). The empirical evidence indicated that a lack of added value for a project partner contributed to the failure of the project, and that the partner would have valued a well-defined value proposition (Westergren, 2011).

Tensions can arise with regard to any of the other key themes, but here, the focus was on a general level and the addressment of emerging tensions, not prevention. The tensions in collaborative projects were related to uncertainty (Gomes et al., 2021; Stefan et al., 2021) and equivocality, the latter meaning “multiple and conflicting interpretations of a goal, situation, or task” (Eriksson et al., 2016, 691; Marcandella & Guèye, 2018). The reviewed articles indicated that examining causes and effects, as well as developing protection against new or existing tensions, was effective for both equivocality and uncertainty (Gomes et al., 2021; Marcandella & Guèye, 2018; Stefan et al., 2021). Furthermore, it may be that not every tension has negative effects. In particular, there was some contradictory evidence regarding the effects of task conflicts (Mu et al., 2019; Yan & Wagner, 2017).

4.2.5. *Synthesis*

The identified groups are depicted in Figure 3. Based on our analysis, considerations for managing each key theme, as recognized in the reviewed articles, are also presented in the figure. A closer look at the considerations reveals that the management of open innovation projects is not straightforward, but includes balancing several contradictory effects and handling both the contingencies and complementarities of the subject matter.



Figure 3. Key themes in the management of open innovation projects

5. Discussion

5.1. Theoretical contributions and suggestions for future studies

This systematic literature review on open innovation projects synthesizes existing knowledge on the topic and advances the research in several ways. Research on open innovation projects is an emerging and developing field, and by providing a synthesis of the existing studies, we were able to form a holistic view on a variety of key themes in open innovation projects. This is significant because relatively little is known about open innovation at the project level (Bagherzadeh et al., 2021; Markovic et al., 2021). Project-level research on open innovation is considered valuable because projects are a common setting for undertaking innovation activities (Markovic et al., 2021).

By discussing the literature, we have attempted to display the key findings related to the management of open innovation projects. We hope that the identified key themes will facilitate the discussion and research on open innovation projects. By focusing on the management of key themes in open innovation projects, our study sheds light on the various considerations for general project management when focusing on open innovation, thus complicating it.

Furthermore, many of the identified considerations were characterized by contradictory effects and the need to find a balance between extreme actions, which also adds more complexity to the management of open innovation projects. This supports the research emphasizing agility (e.g., Pellizzoni et al., 2019) and suggests that the acknowledgment of trade-offs should also be regarded as part of open innovation project management.

The holistic view also enabled us to show the interlinkages between the key themes, which have gained only limited attention in studies focusing on certain key themes. Thereby, the results suggest that a more holistic approach to research on open innovation projects is required. This approach would acknowledge the complexities of collaboration and innovation as an inherent part of open innovation project management.

Our study also identifies avenues for further research, and thereby advances the knowledge frontiers of not only open innovation but also of open innovation projects (cf. Fisch & Block, 2018; Pittaway, 2008). The review of the current research revealed several gaps in the current knowledge that can be used to guide future research topics and to develop research questions in this field.

Regarding *the management of knowledge sharing*, the central considerations are related to the importance of a shared language, and the mechanisms or processes to achieve that deserve further attention. Furthermore, the actions required to mitigate the negative effects of knowledge loss once it has occurred is a novel avenue, as suggested by Frishammar et al. (2015).

Concerning *the management of openness*, the opposing requirements for breadth, where project complexity has indicated the importance of examining how such requirements are balanced, is of some consequence. Furthermore, the degree of control and autonomy granted may be determined on a case-by-case basis at the level of an individual or a partnering organization, but we lack knowledge on how the control–autonomy configurations that differ between individuals or organizations are balanced as a whole. It is also possible to combine several governance modes, but the benefits and challenges of such an approach deserve further study.

There are also promising areas for future research in terms of *the management of actors*. Since a process framework for partner selection exists, but the evidence indicates that it may be difficult to implement (Guertler & Lindemann, 2016), further research is warranted on how organizations approach the partner selection process in open innovation projects. Concerning roles, shared leadership and management is sometimes advantageous and practiced, but additional research could be conducted to investigate how sharing is implemented. Furthermore, embedded relationships have advantages and disadvantages, some downsides of which are mitigable. Nonetheless, future research could determine if embeddedness benefits all projects or whether a particular project's attributes impact the value of embedded relationships and, if so, what those project attributes are.

As for *the management of results*, only a superficial understanding exists about the goal-setting process, and future research could examine how goals are determined, aligned, and communicated. Furthermore, while the importance of shared value is acknowledged, more research is needed on the kinds of value project partners capture in addition to profits. Concerning tensions, how the contradictory effects of task conflicts are managed could be investigated, since only quantitative evidence revealing the effects was identified in the review.

5.2. Managerial implications

We suggest that practitioners should pay specific attention to the identified key themes and the related considerations. Table 1 summarizes the practical implications connected to the management of knowledge sharing, openness, actors, and results. Although the table outlines the general implications, they can be tailored to project managers, project partners, investors, and supporting organizations.

Project managers are encouraged to take the practical implications into account when managing open innovation projects. Project partners often have some degree of power and the possibility of influencing the project; therefore, they should consider the practical implications stated in Table 1. In turn, investors may use the implications to evaluate and select well-managed projects for investing in, potentially impacting the management of such projects. Supporting organizations, including government agencies, can encourage open innovation projects by developing guidelines and identifying the aspects for which projects require specific support.

Table 1. Practical implications

Management of...	Practical implications
... knowledge sharing	Projects that are characterized by high levels of radicalness and uncertainty benefit from intensive communication more than incremental, less uncertain projects do. A shared language between partners is required.

	<p>Informal and formal communication should both be present. Positive knowledge flows should be nurtured, and negative flows prevented.</p>
... openness	<p>Radical projects benefit from a higher number of external partner types and deeper cooperation between partners compared to incremental projects. Control is required, but it should be balanced with autonomy. The appropriate governance mode depends on uncertainty, complexity, and the hiddenness of the required knowledge. Relational and transactional governance mechanisms are both required, but the emphasis should be determined by the project stage and radicalness.</p>
.... actors	<p>Ideal partners have complementary competences, are trustworthy, and have prior collaboration experience. Roles should be clear and understood by all partners. Different partner types are suitable for different roles. Cognitive and relational social capital are both required over the lifecycle of a project.</p>
... results	<p>Goals should be developed early and agreed together, provide value for all partners, and be clear, specific, realistic, and widely communicated. The project should provide value for all participants.</p>

6. Conclusion

In today's fast-paced business climate, innovation is essential. Since projects are frequently used to carry out innovation activities in organizations, they are crucial to the success of organizations' innovation efforts. Furthermore, researchers, decision-makers, and business professionals are currently interested in open innovation. To contribute to this research stream, we examined the management of open innovation projects through a systematic literature review.

The review showed the diversity of research methods and contexts in this emerging research field. The findings of the review further identified 11 key themes: openness, goals, partners, roles, governance, control, social relations, communication, knowledge flows, tensions, and outcomes. These themes were further grouped—based on their interrelatedness—into the management of knowledge sharing, openness, actors, and results. Several considerations for managing the key themes were identified. A closer look at the considerations showed that the management of open innovation projects requires balancing several contradictory effects and handling both the contingencies and complementarities of the subject matter. We also identified avenues for further research and outlined some practical implications for managers of open innovation projects to consider.

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SUPPLEMENTARY MATERIAL:

Search string for locating the articles:

“open innovation project*” OR “open research and development project*” OR “open R&D project*” OR “open NPD project*” OR “collaborative innovation project*” OR “open new product development project*” OR “collaborative research and development project*” OR “collaborative R&D project*” OR “collaborative new product development project*” OR “collaborative NPD project*” OR “cooperative innovation project*” OR “cooperative research and development project*” OR “cooperative R&D project*” OR “cooperative NPD project*” OR “co-operative innovation project*” OR “cooperative new product development project*” OR “co-operative research

and development project*" OR "co-operative R&D project*" OR "co-operative new product development project*" OR "co-operative NPD project*" OR "interorgani* innovation project*" OR "interorgani* research and development project*" OR "interorgani* R&D project*" OR "interorgani* new product development project*" OR "interorgani* NPD project*" OR "interorgani* innovation project*" OR "inter-organi* research and development project*" OR "inter-organi* R&D project*" OR "inter-organi* new product development project*" OR "inter-organi* NPD project*" OR "interfirm innovation project*" OR "interfirm research and development project*" OR "interfirm R&D project*" OR "interfirm new product development project*" OR "interfirm NPD project*" OR "inter-firm innovation project*" OR "inter-firm research and development project*" OR "inter-firm R&D project*" OR "inter-firm new product development project*" OR "inter-firm NPD project*" OR "joint innovation project*" OR "joint research and development project*" OR "joint R&D project*" OR "joint new product development project*" OR "joint NPD project*" OR ("open innovation" AND "project*") OR "co-innovation project*"

Articles included in the systematic literature review:

Author(s)	Article title	Journal	Year
Ahlfänger, Gemünden & Leker	Balancing knowledge sharing with protecting: The efficacy of formal control in open innovation projects	International Journal of Project Management	2022
Arranz & Arroyabe	Effect of formal contracts, relational norms and trust on performance of joint research and development projects	British Journal of Management	2012
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Maurer & Valkenburg	Approaches to networked innovation	International Journal of Innovation & Technology Management	2014
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Parker	Knowledge acquisition and leakage in inter-firm relationships involving new technology-based firms	Management Decision	2012
Patrucco, Frattini & Di Benedetto	Characteristics of supplier performance measurement systems in collaborative	Supply Chain Management	2022

	innovation projects: The role of the purchasing department		
Pedersen, Bogers & Clausen	Navigating collaborative open innovation projects: Staging negotiations of actors' concerns	Creativity & Innovation Management	2022
Pellizzoni, Trabucchi & Buganza	When agility meets open innovation: Two approaches to manage inbound projects	Creativity & Innovation Management	2019
Pinheiro, Serôdio, Pinho & Lucas	The role of social capital towards resource sharing in collaborative R&D projects: Evidences from the 7th framework programme	International Journal of Project Management	2016
Pollok, Lüttgens & Piller	Attracting solutions in crowdsourcing contests: The role of knowledge distance, identity disclosure, and seeker status	Research Policy	2019
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Solís-Molina, Hernández-Espallardo & Rodríguez-Orejuela	Governance and performance in co-exploitation and co-exploration projects	Journal of Business & Industrial Marketing	2020
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Weck	Knowledge creation and exploitation in collaborative R&D projects: Lessons learned on success factors	Knowledge & Process Management	2006
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Zhang, Li & Li	Partner technological heterogeneity and innovation performance of R&D alliances	R&D Management	2022
Zhang & Min	Research on the NPD coordination, knowledge transfer process and innovation performance of interfirm projects in China	Asia Pacific Journal of Management	2022

Journal Pre-proof

Highlights

Framework on management in open innovation projects integrates ten key issues.

Alignment of goals, partners & roles in open innovation projects is critical for success.

Management of governance, control and social relations influence processes in projects.

Managing communication and knowledge flows among partners ensures capacity building.

By managing tensions and outcomes both internal & external partners gain value.

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