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Firm's innovation culture and external collaboration: Mapping the state of research

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ABSTRACT

Objective: The objective of the article is to systematically review the existing research on the linkages between the firm's innovation culture and external collaboration.

Research Design & Methods: This study employed a systematic literature review approach. For the review, we adapted the systematic review protocol advanced by Tranfield *et al*. (2003) and Snyder (2019). The review covers articles published between 2000 and 2022 and indexed in the Scopus and Web of Science databases.

Findings: The results show that the research in the area is still relatively limited but the interest in the field is growing. The review indicates that the research that has been done so far is not homogeneous and addresses various aspects of the relationships between the firm's innovation culture and collaboration with research organisations, customers, competitors, suppliers, clusters, retailers, distributors, and government institutions.

Implications & Recommendations: Although researchers have shed light on the topic, there is a need for an in-depth understanding of the relationship between the firm's innovation culture and external cooperation. The article provides implications for scholars by offering, among others, insights into future research directions including more research on large firms to compare whether the obtained results also apply to the size of firms and more longitudinal studies to increase the number of repeated observations in the field. Moreover, the study suggests the need for practitioners and policymakers to promote the strengthening of the firm's innovation culture and to reduce the potential mismatch of expectations between the innovation culture of the firm and collaboration with external partners.

Contribution & Value Added: The article extends the current knowledge on the drivers of firms' innovation activities by providing further findings on the connections between firms' innovation performance and knowledge diffusion. The study contributes to the field by providing a systematic review that specifically gives attention to the relationship between the firm's innovation culture and external collaboration.

Article type:	literature review
Keywords:	firm's innovation culture; external collaboration; firms' innovation activities; systematic literature review; descriptive analysis; thematic analysis
JEL codes:	O30, O50

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INTRODUCTION

There has long been academic interest in firms' innovation activities among the scholarly community (Knight, 1967; Becker & Dietz, 2004; Audretsch & Belitski, 2020; Heider *et al*., 2022). This stems from the perception that innovation performance affects many aspects of firms and contributes to their competitiveness (Stelmaszczyk, 2020; Yoon & Kwon, 2023). There are also strong theoretical and empirical reasons to believe that firms' innovation activities affect the competitiveness of regions and countries (Fritsch *et al*., 2020; Hervás-Oliver *et al.*, 2021). Thus, a large body of the literature focuses extensively on the drivers and sources of innovation performance (Edler & Fagerberg, 2017; Zygmunt, 2017; Vokoun

& Dvouletý, 2022; Zygmunt, 2022). In this regard, there is a growing interest in the relationship between knowledge diffusion and innovation processes in particular (Wang & Hu, 2020; Puślecki, 2023). This line of research is based on the assumption that knowledge sources play a crucial role in firms' innovation performance, enabling the enhancement of their competitive advantage (Soniewicki, 2022) and hence the development of regions and countries (Grillitsch *et al*., 2019; Audretsch & Belitski, 2024). This is coherent with theories of endogenous growth and knowledge spillovers, which offer a relevant ground for our study, pointing to the need to combine knowledge from different sources in firms' innovation processes. In response to the need for firms to adapt to changing environments, such a combination of knowledge from different sources becomes an increasingly important part of firms' innovation activities. Particular attention is paid here to external knowledge networks and external collaboration as the providing resources when internal knowledge sources are insufficient (Brettel & Cleven, 2011). In this context, theories of endogenous growth and knowledge spillovers emphasise the importance of efficient knowledge diffusion between external actors (Fritsch *et al*., 2020) highlighting the triple helix, as knowledge interactions between firms and, among others, other firms, research organisations and government institutions (Thomas *et al*., 2020). In this regard, many empirical studies provide evidence of the crucial role of external cooperation with other firms (*e.g.* competitors, suppliers, customers) as providers of key knowledge necessary for the continuous development of innovative ideas, products and services (Santos-Vijande *et al*., 2013). Moreover, many empirical studies also point to the pivotal contribution of research organisations to firms' innovation processes through the provision of highly skilled human resources and R&D research results (Thomas *et al.*, 2020; Audretsch & Belitski, 2020). Furthermore, a considerable number of empirical studies indicate the significant importance of government institutions for firms' innovation activities by creating conditions to promote firms' innovation performance and by supporting firms' innovative attitudes through policy instruments (Frangenheim *et al*., 2020).

Given the rising relevance of the relationship between firms' innovation performance and knowledge diffusion from external actors for both academics and practitioners, this area of research has been studied from different perspectives in recent years providing a set of valuable discussions. This is reflected in numerous literature reviews, which point to the complexity of the issues in the field and the need for further development. In this regard, for example, Pittaway *et al.* (2004) reviewed 163 studies on the linkages between the networking behaviour of firms and their innovative capacity, indicating the importance of firms' collaboration with external partners. Zahoor and Al-Tabbaa (2020) focused their review of 113 articles on small and medium-sized enterprises (SMEs) and their inter-organisational collaboration to enhance innovation activities, while Macpherson and Holt (2007) reviewed 152 articles that focused on small firms. Thorpe *et al.* (2006) also reviewed 69 studies in this area on SMEs, pointing to, among others, firms' ability to use and develop external knowledge resources for innovation processes. The impact of network resources, firm size, and spatial proximity on knowledge flow across inter-firm networks for innovation has been reviewed by Huggins and Johnston (2010). Inter-organizational collaboration in the context of eco-innovation was an area of interest in the review of 35 articles by Pereira *et al.* (2020). Greer and Lei (2012) focused their review on the relationship between innovation processes and customer collaboration, highlighting an openness to external knowledge and open innovation. Open innovation was also the focus of the review of 151 articles by West and Bogers (2013), who have considered external sources of firms' innovation. Castaneda and Cuellar (2020) have provided a comprehensive review of the 20 seminal articles on the development of knowledge sharing and innovation concepts in terms of their relationship, highlighting the growing interest in internalising external knowledge to increase firms' innovation performance.

These studies provide a comprehensive insight into the connections between innovation processes and knowledge diffusion between external actors indicating the complexity of the issues in the field and raising new research questions. In particular, the issues of collaboration with external partners together with the internalisation of external knowledge to enhance firms' innovation activities have attracted our attention as a need to strengthen internal capabilities for innovation processes to be more resilient to changes in the environment (Netz *et al.*, 2022). In this context, the issues related to the internal innovation capabilities of firms by leveraging the effects of external collaboration are particularly important. This is addressed by the resource-based view theory (Huggins & Johnston, 2010).

Considering this, we found that the resource-based view theory additionally complements the ground of our study by referring to our understanding of the mechanism of firms' internal capabilities to generate and absorb knowledge from external knowledge networks and external collaboration to increase competitive advantage (Martínez-Costa *et al*., 2018; Cooper *et al.*, 2023).

On this basis, we found that in recent years, the firm's innovation culture has emerged as a prominent area in the debate on knowledge from external actors and firms' innovation activities. This is because innovation culture is seen as a driver of firms' innovation performance, which is oriented towards the acquisition, transformation, and use of knowledge for innovation processes (Naranjo-Valencia & Calderon-Hernández, 2018; Gui *et al.*, 2024). The systematic literature review of 61 articles in this area provided by Tian *et al.* (2018) highlights this. The review indicates that culture plays an important role in firms' innovation processes. Notably, due to its multi-faced nature, the literature provides various definitions of the firm's innovation culture (Olmos-Peñuela *et al*., 2017). This is also a consequence of the intangible nature of the firm's innovation culture, which is difficult to measure directly (Brettel & Cleven, 2011). Thus, the firm's innovation culture can be seen as a multidimensional context that promotes the intention to innovate, the environment to introduce innovation, the orientation towards external partners and the infrastructure to support innovation (Dobni, 2008).

Over the years, many scholars have attracted interest in the firm's innovation culture and innovation performance, but the studies have mostly focused on external knowledge networks rather than external collaboration. For instance, Nowak (2019) has considered the joint efforts of the heterogeneity of external networks and the firm's innovation culture. Arsawan *et al*. (2022) have explored the sustainable competitive advantage of SMEs through the prism of knowledge sharing and the firm's innovation culture, indicating the rank of external knowledge networks in leveraging innovation culture. Gabaldón-Estevan and Ybarra (2017) reported on the interactions between networking (especially with customers and suppliers), innovation culture and firms' innovation activities in selected European SMEs. However, we have noticed that in recent years there has been a growing interest in the firm's innovation culture in relation to external collaboration. The origin of this lies in the consideration of how collaboration with different external partners contributes to the firm's innovation culture (Olmos-Peñuela *et al*., 2017). This is because the involvement of external partners in firms' innovation processes is considered crucial for enhancing firms' competitive advantage (Brettel & Cleven, 2011; Martínez-Costa *et al*., 2018). From this point of view, the linkages between the firm's innovation culture and external collaboration can be an important contribution to strengthening internal capabilities for innovation processes in order to be more resilient to changes in the environment (such as financial or pandemic crises). In this sense, external collaboration can lead to the firm's openness to new ideas and solutions which can shift the attitude towards innovation (Bader *et al.*, 2014). Thus, this area of research is worthy of further investigation. We have noted that despite the growing interest in the relationship between the firm's innovation culture and external collaboration, the existing literature exploring this area lacks a comprehensive review of this emerging phenomenon. Therefore, a systematic literature review is needed to provide, among others, a synthesis of methodological approaches, main findings of the field and ideas for future research. Our study was motivated by this gap in the literature and the need to understand better how the firm's innovation culture is related to external collaboration. Thus, we aimed to provide a systematic review of the existing research on the linkages between the firm's innovation culture and external collaboration.

Therefore, we asked the following research questions*:*

RQ1: How have scholars analysed the linkages between the firm's innovation culture and external collaboration?

RQ2: What are the main findings in the literature that link external collaboration with the firm's innovation culture?

To answer these research questions, we have applied a systematic review protocol developed by Tranfield *et al*. (2003) and Snyder (2019) to guide our literature review. On this basis, we have selected, analysed, and systematically reviewed a final set of 25 articles that focus on the relationship between the firm's innovation culture and cooperation with external partners. In the review,

we have considered the English language peer-reviewed academic articles with full-text availability selected from Scopus and Web of Science and published between the years 2000 and 2022.

This study contributes to the growing literature on the drivers of firms' innovation activities. Our research extends the existing research on the connections between firms' innovation performance and knowledge diffusion. In this regard, we provide a comprehensive overview of the published articles on the linkages between the firm's innovation culture and external collaboration by analysing the main characteristics of the studies in the field: information on the time evolution and geography of the studies, the methodological profile of the articles and the main findings of the scholars. Our study also provides insights into future research avenues on the topic.

The rest of the article is structured as follows. The next section will present the methodological approach that guided the systematic selection and review of the literature on the linkages between the firm's innovation culture and external collaboration. In this respect, we will present a search strategy and a process of selecting the articles to be reviewed. In the next section, we will report the results of our analysis through descriptive and thematic analyses. The descriptive analysis includes publications over time, journals, and the geography of the articles reviewed. We also considered geographical areas, sectors of analysis, and types of research. The thematic analysis will focus on the view of the firm's innovation culture and the linkages between the firm's innovation culture and external collaboration in the reviewed articles. Next, we will describe implications for researchers and practitioners and avenues for future research. The final section will conclude the article.

MATERIAL AND METHODS

Following the research questions, we have applied a systematic literature review method to understand how the linkages between the firm's innovation culture and external cooperation have been studied in the literature. Thanks to a transparent protocol, this method allows for the identification, evaluation, and synthesis of the existing body of knowledge relevant to a particular subject (Kraus *et al*., 2020). Therefore, it allows for the identification of research trends and future research avenues (Pittaway *et al*., 2014). Notably, this method has received growing attention in the innovation literature (West & Bogers, 2013; Tian *et al*., 2018). For this article, we have adapted the systematic review protocol advanced by Tranfield *et al*. (2003) and Snyder (2019) as widely used for systematic literature reviews (Cordero & Ferreira, 2018). Accordingly, we have specified the search strategy and a selection of articles, which provide the basis for descriptive and thematic analyses of the articles selected for review, as well as for setting future research avenues. The search strategy includes the identification of databases for the articles selections, the determination of keywords to build a search string and the identification of inclusion and exclusion criteria, while the selection of articles includes the categorisation of the literature. We focused on Scopus and Web of Science as the two main scientific indexing platforms (Cordero & Ferreira, 2018). Following the relevant works in the firm's innovation culture and external cooperation, we have identified keywords to build a search string. We then sent the initial string to five leading scholars in the field of business, innovation, and entrepreneurship (Malte Brettel, Julia Olmos-Peñuela, Luke Pittaway, Joel West, and Mu Tian) with a kind request for feedback on the string and our research approach. We have received many valuable comments from Luke Pittaway, Joel West and Mu Tian, which we used to improve our original string. Hence, in relation to the firm's innovation culture, the final search includes the following keywords: 'innovat* cultur*', 'cultur* of innovat*' 'cultur* to innovat*,' 'cultur* and innovat*,' 'pro-innovat* cultur*'. With regard to external cooperation, the final search incorporates the keywords as follows: 'external* knowledge*,' 'external learning,' 'external linkage*,' 'external* environment,' 'exterior environment,' 'outer environment,' 'external relationship*,' 'external relation*,' 'external collaborat*,' 'collaborat*,' 'cooperat* with,' 'network*,' 'external partner*,' 'external expert*,' 'expert*,' 'external agent*,' 'customer*,' 'supplier*,' 'competitor*,' 'university*,' 'research institute*,' 'research organisation*,' 'research centre*'. In order to include as many studies as possible, an asterisk (*) was used. Thus, the final string was as follows:

((‘innovat cultur*’ OR ‘cultur* of innovat*’ OR ‘cultur* to innovat*’ OR ‘cultur* and innovat*’ OR ‘pro-innovat* cultur*’) AND (’external* knowledge*’ OR ‘external learning’ OR ‘external linkage*’ OR ‘external* environment’ OR ‘exterior environment’ OR ‘outer environment’ OR ‘external relationship*’ OR ‘external relation*’ OR ‘external collaborat*’ OR ‘collaborat*’ OR ‘cooperat* with’ OR ‘network*’ OR ‘external partner*’ OR ‘external expert*’ OR ‘expert*’ OR ‘external agent*’ OR ‘customer*’ OR ‘supplier*’ OR ‘competitor*’ OR ‘university*’ OR ‘research institute*’ OR ‘research organisation*’ OR ‘research centre*’)).*

We conducted the search using the titles, abstracts, and keywords to retrieve the most relevant articles. The analysis period was set from 2000 to the beginning of 2022 (when the data collection took place). We collected data collected between 4 April and 13 May 2022. Inclusion criteria included English-language peer-reviewed academic articles with full-text availability, while exclusion criteria comprised book chapters, conference articles, editorials, research notes, and commentaries. Exclusion criteria also included duplicates and articles irrelevant to the review questions

As a result of the data collection, we retrieved a total of 643 articles using the final string: 359 articles from Scopus and 284 from Web of Science. For further analysis, we exported the collected data into an Excel document. We then removed from the dataset the duplicates resulting from the interlinking of the scientific indexing platforms (196 articles). Next, we examined the titles, abstracts, and keywords of the remaining 447 articles to determine the relevance of each article to the aim of our research. To do this, we assigned values from 1 (least relevant) to 5 (most relevant). Consequently, we decided to select the articles that we gave a score of 4 and 5 for further review. Therefore, 103 articles remained in the study as potentially relevant. We gained full access to 86 of these articles, and we have consulted in-debt the content of the remaining articles to finally eliminate articles that were unrelated to the field under study. This was due to the fact that a number of abstracts did not lucidly indicate whether they met the scope of our study. For this purpose, we examined the full text of the articles, and assigned values (from 1 to 5). This process led to the exclusion of 61 articles that did not fit our analysis. Therefore, we have identified 25 eligible articles for our final sample (Figure 1. summarizes the search process). This number of relevant articles for further analysis (compared to the initial search) is consistent with other systematic literature reviews in the area of business and management including those by Sindakis *et al*. (2020), Sanni and Verdolini (2022), and Garcia-Martinez *et al*. (2023).

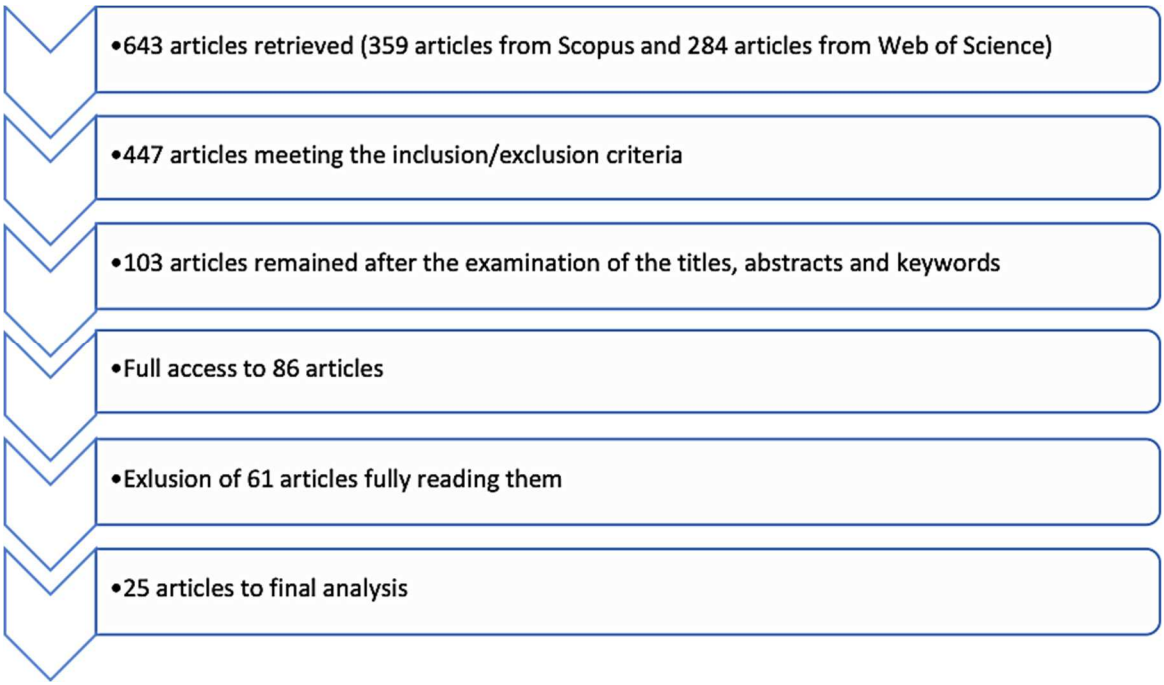

Figure 1. Overview of the search process
Source: own elaboration.

This number of articles in the final sample also confirms the findings of Tian's *et al.* (2018) that the literature on innovation and culture is still fragmented and disconnected (Tian *et al.*, 2018) as this is still a relatively new study area. Nerveless, Tian *et al.* (2018) encourage systematic literature reviews in this area to find key research and to provide future studies avenues. We then followed this approach supported by the systematic literature review by Cordero and Ferreira (2018) of 30 articles provided for a new field of study.

The identification of the final sample allowed us to extract the information from the relevant articles necessary for descriptive and thematic analyses and to indicate future research avenues. In this regard, we analysed each article to identify the study methodology, the publication over time, the journal, and the geography of the article. We also extracted geographical areas and sectors of analysis from each article. We also analysed each article to identify emerging main themes.

LITERATURE REVIEW

Following the recommendation of Tranfield *et al*. (2003) and Snyder (2019) for a systematic literature review, we will present the results of our review in two parts: a descriptive analysis and a thematic analysis. The descriptive analysis allowed us to identify an interest in the topic as a source of research. We focused on publications over time, journals, and the geography of the articles. Moreover, we have also analysed geographical areas, sectors of analysis, and types of research. We conducted the thematic analysis to provide a comprehensive view of the published articles on the linkages between the firm's innovation culture and external collaboration and to identify the emerging key themes.

Descriptive Analysis

Considering publications over time, we indicated that the linkages between the firm's innovation culture and external collaboration are a relatively new theme in the literature. As presented in Figure 2, the attention over the research interest in the field went slow but continuously grew.

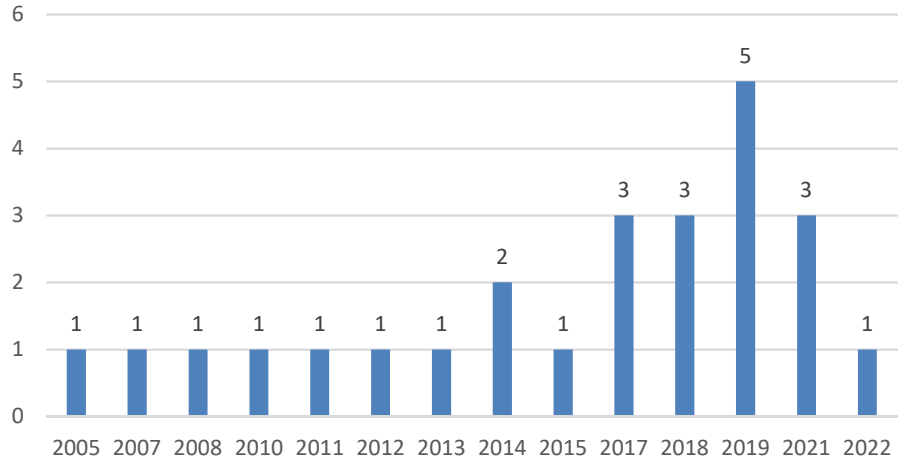

Figure 2. Distributions of publications over the timeframe between 2000 and 2022
Note: The analysis was conducted in early 2022 and did not include articles that appeared after that time.
Source: own elaboration.

From 2000 to 2016, research on the relationship between the firm's innovation culture and external collaboration was scant, with at most only one article per year, starting in 2005. A turning point, after which the number of publications increased, occurred in 2017. A closer analysis shows that in that year, Olmos-Peñuela *et al*. (2017) published an article on improving the innovation culture of small and medium-sized enterprises by collaborating with public research institutions. During the 2017-2022 period, over 60% of the articles were published, indicating that although the number of publications in the field is still relatively limited, a positive trend in publications over time is noticeable.

The articles that address this research topic were published in 23 different journals. Table 1 provides the list of journals, including the number of published articles.

Table 1. Articles distribution by journals

Article distribution by journals	Number of articles
Journal of Small Business and Enterprise Development	2
Technological Forecasting and Social Change	2
Asian Journal of Business Research	1
Creativity and Innovation Management	1
Entrepreneurship Research Journal	1
European Journal of Innovation Management	1
European Planning Studies	1
Global Journal Al-Thaqafah	1
International Journal of Engineering And Technology (Uae)	1
International Journal of Entrepreneurship And Innovation Management	1
International Journal of Innovation And Learning	1
International Small Business Journal	1
Journal of Business & Industrial Marketing	1
Journal of Business Ethics	1
Journal of Global Scholars of Marketing Science	1
Journal of Political Marketing	1
Journal of Services Marketing	1
Journal of Technology Transfer	1
Knowledge Management Research & Practice	1
Logforum	1
Management Research Review	1
Opcion	1
Technology Analysis & Strategic Management	1

Source: own study.

According to our analysis, research on the linkages between the firm's innovation culture and external cooperation has been published in journals of different fields (concerning, among others, entrepreneurship, innovation, technological forecasting, spatial development processes and policies). This may suggest the relevance of the theme and its multithreading character. We have noted that the majority of journals published only one article related to the theme, whereas only two journals published two articles on the topic (*Journal of Small Business and Enterprise Development, Technological Forecasting and Social Change*). Moreover, the review highlighted that although the number of publications related to the linkages between innovation culture and external collaboration was still relatively limited, research activity in the field was widely distributed. Scholars working on research on the topic were located in 24 countries, as illustrated in Figure 3.

A large number of the articles were written by authors from Europe (44% of the articles – especially from Germany and Spain) and Asia (40% of the articles – particularly from Malaysia). Concerning authors, only one author published three articles (in co-authorship): Hasliza Abdul Halim, and only two authors published two articles (in co-authorship): Noor Hazlina Ahmad, Dirk Meissner. In relation to the country's focus of studies, we noticed a considerable geographical dispersion, which allowed us to identify interest in the field at a global level (Table 2).

The majority of studies referred to a single country (84% of the articles). The geographical focus of the studies was: Spain (N=4), Malaysia (N=3), Canada (N=2), Germany (N=2), and Russia (N=2). The remaining articles focused on Australia, Cyprus, France, South Korea, Sri Lanka, Switzerland, Tunisia, and Turkey. As for cross-country studies, we identified four studies involving: two countries (India, United States of America), four countries (Austria, Poland, Germany, Denmark), twenty-four countries (primarily in Asia, Europe and North America) and one study that addressed several countries (from Asia, Africa, Europe, North America and South America).

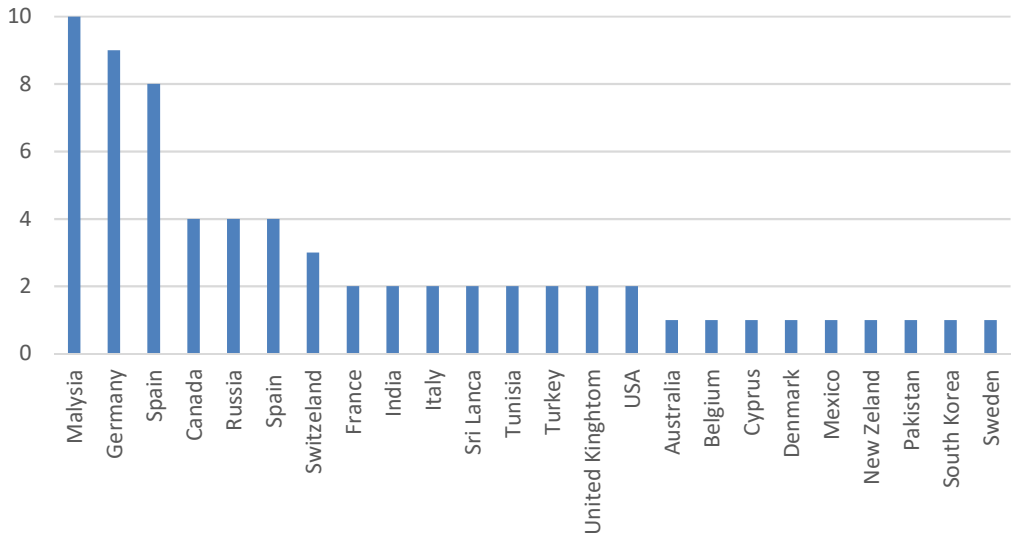

Figure 3. Authors' location
Source: own elaboration.

Table 2. Country of analysis

Country of analysis	Author(s)
Australia	Hyland & Beckett (2005)
Canada	Dobni (2008), Bourdeau *et al.* (2021)
Cyprus	Hadjimanolis (2010)
France	Jouny-Rivier *et al.* (2017)
Germany	Brettel & Cleven (2011), Nestle *et al.* (2019)
Malaysia	Abdul Halim *et al.* (2019a), Abdul Halim *et al*. (2019b), Hanifah *et al*. (2022)
Russia	Kratzer *et al*. (2017), Meissner & Shmatko (2019)
South Korea	Lee (2018)
Spain	Morcillo *et al.* (2007), Santos-Vijande *et al*. (2013), Olmos-Peñuela *et al*. (2017), Martínez-Costa *et al*. (2018)
Sri Lanka	Raisal *et al*. (2019)
Switzerland	Wolf *et al*. (2012)
Tunisia	El Harbi *et al*. (2014)
Turkey	Duygulu *et al.* (2015)
India, United States	Sai Manohar & Pandit (2014)
Austria, Poland, Germany, Denmark	Batz *et al.* (2018)
24 countries	Raajpoot & Sharma (2021)
Various countries	Bashir & Malik (2021)

Source: own study.

Considering the sector of analysis, we noticed a predominance of studies relating to a single sector (52%), as illustrated in Table 3.

The outcome of the review indicates research interest in manufacturing (28%) and services (24%), with a particular focus on highly innovative firms. Empirical investigations also cover two or more sectors (manufacturing, services, agriculture, mining and construction). We also identified studies for sectors described as public and private and several research without clearly stated analysis sectors. Most of the studies involved small and medium-sized enterprises.

Regarding the type of research adopted by scholars dealing with the linkages between the firm's innovation culture and external cooperation, we observed only empirical studies in our final sample (Table 4).

Table 3. Sector of analysis

Sector of analysis	Author(s)
manufacturing	Brettel & Cleven (2011), Kratzer *et al.* (2017), Olmos-Peñuela *et al.* (2017), Martínez-Costa *et al*. (2018), Meissner & Shmatko (2019), Nestle *et al.* (2019), Bashir & Malik (2021)
service	Dobni (2008), Santos-Vijande *et al*. (2013), El Harbi *et al*. (2014), Jouny-Rivier *et al.* (2017), Lee (2018), Raajpoot & Sharma (2021)
service, manufacturing	Hyland & Beckett (2005), Wolf *et al.* (2012)
service, manufacturing, agriculture	Abdul Halim *et al.* (2019a), Abdul Halim *et al.* (2019b)
service, manufacturing, mining and construction	Hanifah *et al*. (2022)
variety of sectors	Sai Manohar & Pandit (2014), Duygulu *et al.* (2015)
not specified	Morcillo *et al.* (2007), Hadjimanolis (2010), Batz *et al.* (2018), Raisal *et al.* (2019), Bourdeau *et al*. (2021)

Source: own study.

Table 4. Type of research

Study method	Author(s)
Qualitative study	Hyland & Beckett (2005), Wolf *et al.* (2012), El Harbi *et al*. (2014), Duygulu *et al*. (2015), Bashir & Malik (2021)
Quantitative study	Morcillo *et al.* (2007), Dobni (2008), Hadjimanolis (2010), Brettel & Cleven (2011), Santos-Vijande *et al.* (2013), Sai Manohar & Pandit (2014), Jouny-Rivier *et al.* (2017), Kratzer *et al.* (2017), Olmos-Peñuela *et al.* (2017), Batz *et al*. (2018), Lee (2018), Martínez-Costa *et al.* (2018), Abdul Halim *et al.* (2019a), Abdul Halim *et al.* (2019b), Meissner & Shmatko (2019), Nestle *et al.* (2019), Raisal *et al.* (2019), Bourdeau *et al*. (2021), Raajpoot & Sharma (2021), Hanifah *et al.* (2022)

Source: own study.

The review's outcome reveals that the authors mostly employed quantitative studies (76%) using questionnaire surveys with multi-item scales (*e.g.* Jouny-Rivier *et al*., 2017; Abdul Halim *et al*., 2019). We found that four of them additionally used the structural equation model to analyse structural relationships over the research interest in the field (Santos-Vijande *et al*., 2013; Nestle *et al*., 2019; Raisal *et al*., 2019; Raajpoot & Sharma, 2021). As for qualitative studies, we noticed that this type of research is less commonly used in the studied publications. We indicated four research designs entailing interviews (Wolf *et al*., 2012; Duygulu *et al*., 2015; Meissner & Shmatko, 2019; Bashir & Malik, 2021), two studies applying case studies (Hyland & Beckett, 2005; El Harbi *et al*., 2014) and one study using the process of observation (Hadjimanolis, 2010). To sum up, the application of different research types suggests that although the linkages between the firm's innovation culture and external collaboration are a relatively new theme in literature, the authors apply various research methods to investigate processes in the field from different perspectives. We found 92% of cross-sectional studies (23 articles) among the final sample. Only two articles adopted a longitudinal research design (Wolf *et al*., 2012; Olmos-Peñuela *et al*., 2017). This may indicate that research in the field is developing, and a rise of articles that cover multiple time periods is desirable.

Overall, the descriptive analysis shows that although studies relevant to the area of investigation are still relatively limited, the importance of the theme is noticeable.

Thematic Analysis

The in-depth analysis of our final sample reveals considerable differences in the scope of the articles. This corresponds to the fact that the linkages between the firm's innovation culture and external collaboration are a relatively new topic in the literature. Despite the limited comparability of the previously published studies, we tried to identify the emerging main themes. In this context, we followed the approach of Kraus *et al*. (2005) for a literature review with insufficiently differentiated research and we identified

interesting partial results. Thus, the following key themes were defined, in line with the stated research questions: the view of the firm's innovation culture, the focus on one or more specific external partners for collaboration, the support of the linkages between the firm's innovation culture and external cooperation, innovation under consideration, and the firm's size. The first of them arises from a noticeable lack of a unified approach to describing the firm's innovation culture, while the others originate from the need to understand how the firm's innovation culture is linked to external collaboration. Table 5 presents the main findings of 25 empirical studies that address this research topic.

Table 5. The main findings of the reviewed articles

Number	Author(s)	Main findings
1.	Hyland & Beckett (2005)	Harvest Company cooperates with suppliers, independent experts and universities to improve knowledge flow to foster the firm's innovation culture. Broens Industries, for enhancing the firm's innovation culture, cooperates with the university and customers.
2.	Morcillo *et al.* (2007)	Government technological policy support is needed for the innovation culture of the firm.
3.	Dobni (2008)	The firm's proactive interactions with others in the value chain (retailers, distributors, suppliers) and co-defining value with customers are important for firm's innovation culture.
4.	Hadjimanolis (2010)	Political marketing promotes and strengthens the firm's innovation culture through cooperation between the public and private sectors.
5.	Brettel & Cleven (2011)	A positive connection with the firm's orientation towards technological innovation and the firm's cooperation with universities, independent experts and customers (negative relationship for competitors and suppliers). A positive association between the learning orientation and the predisposition to take risks by the firm in cooperation with independent experts and customers (negative association with suppliers, universities, and competitors). A positive association between the firm's orientation towards the future market and cooperation with universities, independent experts and suppliers (negative for customers and competitors.
6.	Wolf *et al.* (2012)	Collaboration with external partners differs in SMEs with a distinct innovation culture. While SMEs with an innovation culture concentrate on network base profit from external collaboration but innovate incrementally, SMEs with an innovation culture with a holistic innovation profile for long-term cooperation are careful in their choice of excellent international partners. Moreover, SMEs featuring innovation culture with a do-it-yourself innovation profile are more likely to reject external collaboration but do not lose their innovativeness
7.	Santos-Vijande *et al.* (2013)	The firm's innovation culture strongly determines cooperation with customers in new services co-creation.
8.	El Harbi *et al.* (2014)	The innovation culture of the firm suffers from a lack of developed cooperation with universities, technology parks, and competitors. This can affect firm's isolation.
9.	Sai Manohar & Pandit (2014)	Highly innovative firms are distinguished by an innovation culture that focuses on effective collaboration with external R&D centres for the development of new technologies, services, and products to respond quickly to environmental changes.
10.	Duygulu *et al.* (2015)	Firms with R&D employees strengthen their innovation culture by cooperating with universities, R&D centres, and competitors. Collaboration with universities may face problems due to a mismatch of expectations between both parties.
11.	Jouny-Rivier *et al.* (2017)	Firms distinguished by the strong culture of innovation are not concerned about cooperating with customers due to owning the essential resources and capacities for innovation.
12.	Kratzer *et al.* (2017)	As an essential feature of proactive innovation, the firm's innovation culture increases external openness through external collaboration.
13.	Olmos-Peñuela *et al.* (2017)	There are differences in the capacity of SMEs to foster a culture of innovation through cooperation with research organisations. SMEs with formal innovation plans distinguish the greater ability to enhance their innovation culture by coop-

Number	Author(s)	Main findings
		erating with research organisations. Search strategy indirectly strengthens collaboration with research organisations. Innovation culture of smaller SMEs benefits more from collaboration with research organisations.
14.	Batz *et al.* (2018)	Insufficient cooperation between firms and clusters for innovation does not facilitate the firm's innovation culture due to communication problems. Cluster organisations are unable to provide accurate offers to change innovation culture of the firm.
15.	Lee (2018)	External technology cooperation positively affects the firm's innovation culture.
16.	Martínez-Costa *et al.* (2018)	A positive link between a firm's innovation culture and inter-organisational collaboration.
17.	Abdul Halim *et al.* (2019a)	Competitor orientation (cooperation with competitors) positively impacts the firm's innovation culture, while customer orientation (customers' commitment to value creation) does not.
18.	Abdul Halim e*t al.* (2019b)	No positive effect of customer orientation (customer commitment in value creation) on the firm's innovation culture as the effect of lack of priority assessment on the demand of SMEs' customers. Competitor orientation (cooperation with competitors) supports the firm's innovation culture.
19.	Meissner & Shmatko (2019)	Firms rarely pay attention to the skills of young researchers and engineers in interacting with external cooperation. This can hamper firm's innovation culture.
20.	Nestle *et al.* (2019)	Information asymmetries reduce the ability of clustered firms to foster their innovation culture. Agglomeration effect and trust positively impact the intensity of cooperation between cluster members and encourage their innovation culture.
21.	Raisal *et al*. (2019)	The firm's innovation culture is treated as a mediator between cooperation with customers, suppliers, competitors, and product innovation.
22.	Bashir & Malik (2021)	Using social media to collaborate on external knowledge fosters the firm's innovation culture.
23.	Bourdeau *et al*. (2021)	Externally focused information technology together with innovation culture can help employees transfer knowledge and learn from external collaboration with customers and suppliers.
24.	Raajpoot & Sharma (2021)	External collaboration is essential for new services success but does not influence the firm's innovation culture.
25.	Hanifah *et al.* (2022)	The mediating role of government support between a firm's innovation culture and innovation activities.

Source: own study.

The View of the Firm's Innovation Culture

The reviewed literature has demonstrated a substantial interest in the firm's innovation culture, its definition and operationalisations, discussing the number, type of dimensions and content of the dimensions. In this context, many studies in our final sample indicate that the firm's innovation culture as an intangible resource leads to an increase in the firm's innovativeness while indicating difficulties in defining its dimensions (Hadjimanolis, 2010; El Harbi *et al*., 2014). We found that several authors propose their own approach to identify the dimensions of the firm's innovation culture, while others rely on previously developed approaches. In this vein, Hadjimanolis (2010) identifies numerous dimensions of the firm's innovation culture that express creativity, knowledge sharing, and openness to change. For instance, attitudes towards change, learning, risk, and creativity. Jouny-Rivier *et al*. (2017) use two dimensions to describe the firms' innovation culture (organisational innovativeness, and organisational perception orientations toward change), while Meissner and Shmatko (2019) focus on dimensions, which reflect employees' 'soft' skills (*e.g.* communication skills, social skills). For Duygulu *et al*. (2015), the firm's innovation culture is expressed by eight dimensions. Among them, it can be indicated knowledge sharing and open communication, learning and development, social networks and external cooperation, free time allocation, tolerance of mistakes, and reward and incentive systems. On the other hand, Batz *et al*. (2018) highlight the following issues related to innovation culture: the benefits of innovation processes knowledge acquisition, knowledge transformation and work organisation. Sai Manohar and Pandit

(2014) highlight six dimensions of the firm's innovation culture such as organisational climate, customer focus, leadership, creativity, envisioning the future, and core values. El Harbi *et al*. (2014) focus on the knowledge exchange processes, leadership, and working climate for employees and relationships, while Santos-Vijande *et al*. (2013) emphasise market-oriented behaviour, openness to new ideas and front-line employees' behaviour towards innovation. For Wolf *et al*. (2012) the dimensions of the firm's innovation culture express holistic innovation, network-based innovation, 'do-it-yourself' innovation and innovation resistance. Meanwhile, Olmos-Peñuela *et al*. (2017) present another approach to the firm's innovation culture. They highlight the collaborative aspects. In this context, the innovation culture of the firm is regarded as a potential benefits of collaborating with public research organisations.

Regarding previously developed approaches to the firm's innovation culture, the reviewed literature shows that, for example, Martínez-Costa *et al*. (2018) follow the approach developed by Cameron and Quinn (1999), which includes an adhocracy culture oriented towards communication and collaboration between firms. On the other hand, Hanifah *et al*. (2022) apply the approach of Kim and Yoon (2015), specifying four items of the firm's innovation culture. These relate to being innovative and the ability to take risks, seize opportunities quickly, and take individual responsibility. A number of the reviewed articles apply Dobni's (2008) approach to define the firm's innovation culture (Abdul Halim *et al*., 2019a; Abdul Halim *et al*., 2019b; Raajpoot & Sharma, 2021). In this vein, the innovation culture of the firm is regarded as a multidimensional construct with four dimensions (Dobni, 2008): intention for innovation, infrastructure for innovation, the influence of market orientation for innovation, and innovation implementation. Following this approach, the firm's innovation culture comprises innovation readiness, organisational constituency, organisational learning, creativity and empowerment, market and value orientation, and implementation context (Dobni, 2008). The use of such an approach is based on incorporating multi-faced aspects of firms' innovation culture. Bourdeau *et al*. (2021) followed Brettel and Cleven's (2011) understanding of the firm's innovation culture, which identifies four dimensions of the firm's innovation culture with an emphasis on continuous learning and knowledge development to detect and fill discrepancies between market needs and the firm's offering. Thus, according to Brettel and Cleven (2011), the dimensions of the firm's innovation culture include a focus on technological innovation, learning orientation, risk-taking, and future market orientation. Nevertheless, in their empirical research, Bourdeau *et al*. (2021) applied two dimensions of the firm's innovation culture, identified as 'key dimensions,' which are being collaborative and entrepreneurial. In this context, the collaborative dimension refers to the collaborative working environment that requires collaboration between stakeholders, while the entrepreneurial dimension is associated with entrepreneurial behaviour and attitudes.

We have also noticed that some studies from our final sample emphasise the view of the firm's innovation culture as openness to employees' attitudes in the field of innovation and openness to external relationships to increase firms' innovation activities (Kratzer *et al*., 2017; Nestle *et al*., 2019). Here, the term 'open innovation culture of the firm' is proposed to emphasise the leveraging effect of external knowledge on the firm's innovativeness. Following this knowledge, Kratzer *et al*. (2017) address five dimensions of innovation culture, which are related to internal innovation capabilities, knowledge providers, outsourcing innovation capabilities, extramural innovation and internal and external openness. Thus, substantial attention is paid to proactive innovation behaviour. We notice the same feature in Lee's (2018) study, which indicates the following approach to the firm's open innovation culture: continuous communication with the outside, procedures and systems for external cooperation, and usage of external and internal technology for technology development. In their view of the firm's innovation culture, Bashir and Malik (2021) also stress the use of external technology to enhance firms' innovativeness. On the other hand, Nestle *et al*. (2019) emphasise the dimensions of open innovation culture developed by Herzog and Leker (2010). They paid attention to the not-invented-here syndrome, risk-taking, and management support (Herzog & Leker, 2010).

These results indicate heterogeneous views of the firm's innovation culture, which may be due to the intangible nature of the firm's innovation culture. Heterogeneous views of the firm's innovation culture may also be due to research in a different context, including differences in sector or country focus. It may also be due to the consideration of different types of innovation and relationships with a

particular external partner or partners. For this reason, our review revealed that the view and dimensions of the firm's innovation culture call for further development.

External Partner(s) for Collaboration

Our study revealed that the final articles highlight research topics involving different external partners demonstrating the importance of incorporating collaboration with different knowledge providers into the firm's innovation culture. Most of the reviewed articles focused on one or more specific external partners. However, we also identified articles that refer generally to 'external cooperation' or 'external partners,' without specifying a particular one. This suggests that although the linkages between the firm's innovation culture and external collaborations are a relatively new topic in the literature, there is particular interest in identifying and aligning relationships with a specific external partner or partners. In this respect, we noted the focus of the reviewed articles on such external partners as customers, competitors, suppliers, clusters, retailers, distributors, research organisations, and government institutions. Such a differentiation of the external partners studied illustrates the need for research to examine different aspects of the links between the firm's innovation culture and external collaboration. Noteworthy, although the number of publications in the field is still relatively limited, they do consider all external partners associated with triple helix.

In our final sample, the greatest number of the reviewed articles examine aspects related to the links between the firm's innovation culture and collaboration with customers. This is crucial, because customers play a key role in enhancing firms' innovation activities (Santos-Vijande *et al*., 2013) by providing knowledge about customers' attitudes towards changes in the environment. This has implications for the resources and capabilities required by the firm to innovate. Significantly, we may observe ambiguous results in this area. Five studies report a positive association between the firm's innovation culture and collaboration with customers (Hyland & Beckett, 2005; Dobni, 2008; Brettel & Cleven, 2011; Santos-Vijande *et al*., 2013; Raisal *et al*., 2019), while four provide the opposite results (Brettel & Cleven, 2011; Jouny-Rivier *et al*., 2017; Abdul Halim *et al*., 2019a; Abdul Halim *et al*., 2019b). For instance, Dobni (2008) provides evidence of the linkages between the firm's innovation culture and customers, emphasising the co-definition of value with customers. On the contrary, the study by Jouny-Rivier *et al*. (2017) suggests that firms with a strong innovation culture are not interested in cooperating with customers, because they possess the necessary resources and capabilities to innovate.

Moreover, extant studies found cooperation with competitors to be crucial for the continuous development of ideas, products, and services, leading to the improvement of firms' innovation activities. In this regard, five studies reported a positive relationship between the firm's innovation culture and collaboration with competitors (El Harbi, 2014; Duygulu *et al*., 2015; Abdul Halim *et al*., 2019a; Abdul Halim *et al*., 2019b; Raisal *et al*., 2019). In line with this, Abdul Halim *et al*. (2019a) argue that collaboration with competitors supports the firm's innovation culture by 'actively monitoring' existing and potential competitors, thus ensuring increased competitiveness. Another study by Abdul Halim *et al*. (2019b) also provides evidence that such linkages are crucial for enhancing the firms' innovation activities, especially in an unstable market. In contrast, one study highlights the negative relationship between the firm's innovation culture and cooperation with competitors. Here, Brettel and Cleven (2011) provide evidence of the negative impact of cooperation with competitors.

The articles from our final sample also paid substantial attention to the linkages between the firm's innovation culture and collaboration with research organisations as providers of knowledge, skills, and technology. We noted that researchers pay particular attention to collaboration with universities, independent researchers, technology parks and external research and development (R&D) centres. Regarding these external partners, the results are also ambiguous. Among four studies in this area, most of them claim that collaboration with research organisations ensures that the innovation culture of the firm is strengthened (Hyland & Beckett, 2005; Brettel & Cleven, 2011; Duygulu *et al*., 2015; Olmos-Peñuela *et al*., 2017). For example, Hyland and Beckett (2005) analyse two firms: Harvest Company and Broens Industries, stressing the importance of collaborating with the university and independent experts to improve the flow of knowledge to support the innovation culture of the firm. On the other hand, Brettel and Cleven (2011), find not only a positive relationship between the firm's orientation

towards technological innovation and the future market and collaboration with universities and independent experts as key sources of information but also a negative association between the firm's learning orientation and risk-taking and collaboration with universities. This points to the important implication that relationships within the same partner can be considered at different levels and produce different results in terms of links to the firm's innovation culture.

Four articles from our final sample raise the issue of the linkages between the firm's innovation culture and cooperation with suppliers (Dobni, 2008; Brettel & Cleven, 2011; Raisal *et al*., 2019; Bourdeau *et al*., 2021), as they are familiar with the firm's requirements and support the firm's development of new products. Among them, only one reported a negative relationship between the firm's innovation culture and collaboration with suppliers. In this regard, Brettel and Cleven (2011) found that such a negative relationship occurs with respect to the firm's risk-taking and learning orientation as well as with respect to the firm's orientation towards technological innovation. This argument is supported by the view of suppliers as information providers rather than contributors to innovation processes (Brettel & Cleven, 2011).

Three studies from our final sample examine the links between the firm's innovation culture and cooperation with government institutions (Morcillo *et al*., 2007; Hadjimanolis, 2010; Hanifah *et al*., 2022). Such cooperation appears to be crucial, as government institutions contribute to the promotion of innovation activities of firms and thus to the development of regions and countries. Significantly, all three articles point to the importance of cooperation with government institutions for the innovation culture of the firm. As reported by Hadjimanolis (2010), this is linked to cooperation between the public and private sectors.

In our final sample, only two articles referred to the interactions between the firm's innovation culture and clusters (Batz *et al*., 2018; Nestle *et al*., 2019). We noted that although only two articles addressed clusters in the context of the firm's innovation culture, there was a lack of consistent findings. In this sense, Batz *et al*. (2018) provide evidence about positive linkages in this area, while Nestle *et al*. (2019) provide opposite results. Considering the links between the firm's innovation culture and cooperation with retailers and distributors, from our final sample, only Dobni (2008) addresses this issue, suggesting that the firm's proactive interactions with retailers and distributors are important for the firm's innovation culture.

Regarding the reviewed articles that refer to 'external cooperation' or 'external partners' without specifying a particular one, we identified seven such articles. Four of them highlight a positive relationship between the firm's innovation culture and external collaboration (Kratzer *et al*., 2017; Lee, 2018; Martínez-Costa *et al*., 2018; Bashir & Malik, 2021), while the remaining articles point to opposite results (Wolf *et al*., 2012; Meissner & Shmatko, 2019; Raajpoot & Sharma, 2021). For example, Kratzer *et al*. (2017) report that the firm's innovation culture, as a core feature of proactive innovation, increases external openness through external collaboration. On the other hand, Raajpoot and Sharma (2021) show that cooperation with external partners affects the firm's innovativeness but does not affect the firm's innovation culture.

Our review shows heterogeneous results when examining the firm's innovation culture and cooperation with external partners. This may stem from the focus on, among others, the different aspects of this collaboration or the type of innovation. Such a differentiation of results indicates the diversity of research topics in this area and encourages further research.

Supporting the Linkages between the Firm's Innovation Culture and External Cooperation

The existing studies from our final sample highlight how to support the links to the firm's innovation culture and cooperation with external partners. We found that studies undertaken in this area are very diverse and cover a wide range of topics. This suggests that although the linkages between the firm's innovation culture and external collaborations are a relatively new topic in the literature, interest in the field is multifaceted. A substantial number of the articles reviewed raise the issue from the internal perspective of the firm. We also noted articles that consider how to support the link between the firm's innovation culture and cooperation with external partners from the firm's external perspective.

Focusing on the firm's internal perspective, we noted that researchers pay particular attention to technological support, the capabilities of the firm's human resources, and the firm's attitude towards innovation and external collaboration. Two of the reviewed studies address the issue of technology as a tool to support the links between the firm's innovation culture and cooperation with customers. In this respect, Bourdeau *et al*. (2021) show that externally focused information technology together with the firm's innovation culture can help employees transfer knowledge and learn from external collaboration with customers. In a similar vein, focusing on internet-based applications, Bashir and Malik (2021) suggest that the firm's innovation culture favours the use of social media for external collaboration. In our final sample, four articles raise the issue of the capabilities of the firm's human resources as supportive of the relationship between the firm's innovation culture and collaboration with external partners. Here, Meissner and Shmatko (2019) provide evidence that firms rarely pay attention to the skills of young researchers and engineers when dealing with external collaboration. In particular, such a characteristic may inhibit the firm's innovation culture (Meissner & Shmatko, 2019). Another study draws attention to the firm's R&D employees, suggesting that such employees strengthen the firm's innovation culture by collaborating with universities, external R&D centres and competitors, which contributes to innovation development (Duygulu *et al*., 2015). Santos-Vijande *et al*. (2013) emphasize first-line employees and suggest that the willingness to involve first-line employees and customers is crucial for the co-creation of new services. An interesting finding in this area is the one by Dobni (2008), who indicates that proactive interactions with suppliers, retailers, and distributors are important for the firm's innovation culture. We also found that the reviewed articles deal with the issue of the firm's attitude towards innovation and external collaboration as support for the link between the firm's innovation culture and external collaborations. In this regard, Olmos-Peñuela *et al*. (2017) suggest that firms with a formal innovation plan distinguish a more remarkable ability to improve innovation culture as an effect of collaboration with research organisations. They also find that the search strategy indirectly strengthens collaboration with research organisations (Olmos-Peñuela *et al*., 2017). Another study draws attention to the need for developed cooperation, indicating that the firm's innovation culture suffers from a lack of developed cooperation with competitors, which can lead to the isolation of the firm (El Harbi *et al*., 2014). In this vein, the study by Batz *et al*. (2018) also provides important evidence that insufficient cooperation between firms and clusters for innovation does not promote the innovation culture of the firm due to communication problems.

Regarding the firm's external perspective, we found that the reviewed articles mainly focus in this area on the relationships between the firm's innovation culture and cooperation with clusters and government institutions. In this regard, Batz *et al*. (2018) provide evidence that clusters are not able to provide precise offers to change the firm's innovation culture. In particular, information asymmetries, defined as hidden information and characteristics, reduce the promotion of the firm's innovation culture in a cluster (Nestle *et al*., 2019). On the other hand, Nestle *et al*. (2019) provide evidence that the agglomeration effect and trust positively influence the intensity of cooperation among cluster members and foster their innovation culture. Meanwhile, Hadjimanolis (2010) indicates the need for policy marketing to promote and enhance the innovation culture of the firm through, among other things, research subsidies, support for technological upgrading and competitive research. Morcillo *et al*. (2007) also provide evidence that government technological policy support is needed for the firm's innovation culture. Such support should lead to the strengthening of firms' innovation activities. Similarly, Hanifah *et al*. (2022) underline the mediating role of government support between the firm's innovation culture and firms' innovation activities. In this regard, Hanifah *et al*. (2022) particularly emphasise cooperation towards the firm's entrepreneurial attitude.

Innovation under Consideration

A relatively small number of the reviewed articles examine aspects related to the links between the firm's innovation culture and external collaboration from the perspective of innovation under consideration. We found that among the reviewed articles that address this issue, the greatest emphasis was on innovation related to technology and product development. In this context, Hyland and Beckett (2005) highlight the role of collaboration with customers in enhancing the innovation culture of the

firm, which scholars see as a 'meditative role' between external collaboration and product development success (Raisal *et al*., 2019). Lee (2018) also focuses on external technology collaboration, highlighting that such collaboration has a positive impact on the firm's innovation culture. Brettel and Cleven (2011) highlight the positive effect of cooperation with customers by referring to aspects of the firm's innovation culture, such as openness to the technological development of products. This study also shows that collaboration with universities and independent experts (as key sources of information) positively relates to the firm's orientation towards technological innovation (Brettel & Cleven, 2011). Furthermore, Brettel and Cleven (2011) provide evidence of the negative impact of cooperation with competitors on the firm's technological innovation orientation.

In our final sample, we noted two articles that refer to innovation related to service. In this regard, Santos-Vijande *et al*. (2013) found that collaboration with customers in the co-creation of new services is strongly determined by the firm's innovation culture. Another study, by Raajpoot and Sharma (2021) discusses the relationship between the firm's innovation culture and external collaboration in the success of new services, showing that such collaboration contributes to the success of new services but does not affect the firm's innovation culture.

We also noted a single study that focuses on the links between the firm's innovation culture and external collaboration through different innovation profiles. In this respect, Wolf *et al*. (2012) found that the firm with a network-centric innovation culture benefits from external collaboration but innovates incrementally. They also found that a firm with an innovation culture with a holistic innovation profile tends to select excellent international partners for long-term cooperation rather carefully (Wolf *et al*., 2012). Moreover, they highlight that a firm with an innovation culture with a do-it-yourself innovation profile tends to reject external cooperation but is no less innovative (Wolf *et al*., 2012).

These results indicate that there is relatively little interest among the reviewed articles in the topic of specific innovation. This may be due to the fact that the literature on the linkages between the firm's innovation culture and external collaboration is still fragmented and developing. Nevertheless, the heterogeneous results obtained so far encourage further research.

Firm Size

The analysis of our final sample provides evidence for the lack of a specified firm size in most of the reviewed studies on the relationship between the firm's innovation culture and external collaboration. Among those with a specified firm size, small and medium-sized enterprises predominate. Significantly, these studies report heterogeneous results indicating multidimensional aspects of the link on the firm's innovation culture and external collaboration. For example, Raisal *et al.* (2019) found that the SME's innovation culture is treated as a mediator between cooperation with customers, suppliers, competitors, and product innovation. In this vein, Martínez-Costa *et al.* (2018) provide evidence of a positive relationship between the innovation culture of the SMEs and inter-organisational collaboration. On the other hand, Abdul Halim *et al.* (2019a) and Abdul Halim *et al.* (2019b) show a negative effect of customer engagement in value creation on the firm's innovation culture as a result of the lack of prioritisation of the demand of SME's customers. Abdul Halim *et al.* (2019a) and Abdul Halim *et al.* (2019b) also report a positive effect of cooperation with competitors on the SME's innovation culture. Another study from our final sample focusing on SMEs suggests that there are differences in the SMEs' ability to foster a culture of innovation through cooperation with research organisations (Olmos-Peñuela *et al.*, 2017). In this context, SMEs with formal innovation plans distinguish the greater ability to enhance their innovation culture by cooperating with research organisations, while search strategy indirectly strengthens collaboration with research organisations (Olmos-Peñuela *et al.*, 2017). Batz *et al.* (2018) also focus on SMEs and provide evidence that insufficient cooperation between SMEs and clusters for innovation does not facilitate the SME's innovation culture due to communication problems. Another study, by Wolf *et al.* (2012), points to differences in collaboration with external partners in SMEs with a distinct innovation culture. In this context, SMEs with an innovation culture concentrated on network base profit from external collaboration but innovate incrementally, while SMEs with innovation culture with a holistic innovation profile for long-term cooperation are careful in their choice of excellent international partners (Wolf *et al.*, 2012).

Among the other studies from our final sample that specify the firm size, we noted that researchers pay attention also to micro and small firms. In this respect, analysing together micro, small, medium, and large firms, Jouny-Rivier *et al.* (2017) show that firms distinguished by a strong culture of innovation are not concerned with cooperating with customers due to owning the essential resources and capacities for innovation. On the other hand, analysing SMEs and large firms together, Brettel and Cleven (2011) provide evidence of a positive connection between the firm's orientation towards technological innovation and the firm's cooperation with universities, independent experts and customers (negative relationship for competitors and suppliers). They also suggest a positive association between the learning orientation and the predisposition to take risks by the firm in cooperation with independent experts and customers (negative association with suppliers, universities, and competitors (Brettel & Cleven, 2011).

These results point to the need for greater association of the link between the firm's innovation culture and external collaboration with the firm size. This could lead to the further development of the research results obtained so far and to better knowledge in the research area.

DISCUSSION

This study provides theoretical implications in the area of the drivers of firms' innovation activities by providing a comprehensive review of the existing research on the linkages between the firm's innovation culture and external collaboration. We contribute to the encouragement of Tian's *et al.* (2018) to provide systematic literature reviews on the connections between innovation and culture to find key research and to provide avenues for future studies. Our review revealed the growing interest in understanding how the firm's innovation culture is linked to external collaboration. We found that the link between the firm's innovation culture and external collaboration is a relatively new theme in the literature, but the interest in this research area is growing. We also found that although the studies relevant to the area of investigation are still relatively limited, many topics and research directions have emerged. In this context, our findings provide more insight into this relatively new theme in the literature. Our analysis revealed that the issues related to the relationship between the firm's innovation culture and external collaboration have been examined in various ways. The results show that the view of the firm's innovation culture and its dimension are important for understanding cooperation with external knowledge providers. However, the results suggest a heterogeneous view of the firm's innovation culture which may be due to the intangible nature of the firm's innovation culture or the specificity of the relationship with a particular external partner or partners. Our review provides also evidence of heterogeneous results on the link between the firm's innovation culture and cooperation with external partner or partners. It may vary according to the different aspects of this collaboration or the innovation type. It could also relate to the focus on different sectors of analysis or the firm size. We also noticed heterogeneous results from the perspective of innovation considered, although most of the studies do not consider a specific innovation. This may be due to the fact that the literature on the linkages between the firm's innovation culture and external collaboration is still fragmented and developing. The review also indicates heterogeneous results for the association of the link between the firm's innovation culture and external collaboration with the size of the firm, with a particular focus on SMEs. However, most of the studies do not consider a specific firm size in the research in this area. Our study also reviewed how to support the links to the firm's innovation culture and cooperation with external partners. The results reveal that researchers pay particular attention to, among others, technological support, the capabilities of the firm's human resources, and the firm's attitude towards innovation and external collaboration. Our findings show heterogeneous results in this area. This indicates that although the linkages between the firm's innovation culture and external collaborations are a relatively new topic in the literature, the interest in the field is diverse.

Considering the above, our review suggests that results related to the linkages between the firm's innovation culture and external collaborations are predominantly heterogeneous. We also found that many of the issues in the field remain fragmented and considerably unexplored. This provides an opportunity to pose several questions as future research avenues. Firstly, future re-

search might focus much more on cross-sectoral and cross-countries analysis to better capture different aspects of the linkages between the firm's innovation culture and external collaboration. Furthermore, as little is known about the association between the firm's size with occurrences related to the firm's innovation culture and external cooperation, it will be worth exploring the role of firm size more deeply. Future research could also provide more insights by investigating drivers and conditions that lead to the fruitful relationship between the firm's innovation culture and external collaboration. Furthermore, it would be valuable to shed more light on these issues concerning market stability, *i.e.* to reveal differences between stable and unstable markets. It would also be useful to extend the research in the area to consider the global economic situation and the ability of the firm to withstand changes in its environment. It would also be interesting to explore in more detail the relevance of the linkages between the firm's innovation culture and cooperation with external partners concerning the effects on the firm's innovativeness.

Hence, based on our results, we posed the following potential future research questions:

- How do sectors (manufacturing, services, agriculture, mining and construction) differ in the links between the firm's innovation culture and external cooperation? Which sectors are especially prone to the impact of collaboration with external partners on the firm's innovation culture?
- Do highly innovative sectors/firms benefit more than other sectors/firms from the linkages between the firm's innovation culture and collaboration with external partners?
- How does the innovativeness of countries/regions affect the establishment of a relationship between the innovation culture of the firm and external collaboration? Do firms from countries/regions with high innovation performance have more developed associations of innovation culture and better cooperation with external partners?
- How does firm size affect the linkages between the firm's innovation culture and external collaboration? Which firm size benefits more from such linkages? What is the difference between SMEs and large firms in this framework?
- What drivers lead to a fruitful relationship between the firm's innovation culture and external collaboration? Which of them should be considered as the key drivers? What is the role of firm's attitudes and human resources in creating an innovation culture focused on external cooperation? What conditions provoke the choice of cooperation with a particular external partner to foster the innovation culture of the firm? What is the role of external partners in these processes?
- How to reduce the potential mismatch of expectations in the linkages between the firm's innovation culture and collaboration with external partners?
- What is the difference between the innovativeness of firms with established linkages between innovation culture and cooperation with external partners concerning firms without innovation culture?
- What determines that some firms foster their innovation activities through the effective connection with the firm's innovation culture and external collaboration, and some do not, even if their innovation culture is oriented toward cooperation with external partners?
- What is the difference in the association between the firm's innovation culture with external cooperation in a stable and unstable market?

It would also be valuable to increase the number of longitudinal studies as most of the reviewed articles included cross-sectional studies (little is known about the long-term effects and maintenance of established relationships). Given the complexity of the firm's innovation culture and its dimensions, future studies should also include methodological considerations and working definitions. For example, it might be interesting to further develop the view of the firm's innovation culture, especially with regard to its particular dimensions. Furthermore, it would be interesting to conduct more research on open innovation culture and external collaboration to further exploit the effects of external knowledge on the firm's innovativeness. It also seems important to include eco-innovation issues in research in this area, as they are becoming increasingly important in enhancing the firms' innovative capacity.

This study is also relevant to practitioners by expanding the knowledge about the drivers of firms' innovation activities. Knowing that innovation culture is seen as a driver of firms' innovation performance, which is oriented towards the acquisition, transformation and use of knowledge for

innovation processes, can provide an increase in the firm's competitive advantage. In this context, our review provides a synthesis of research on the relationship between the firm's innovation culture and external collaboration that can be valuable to practitioners in strengthening the firm's internal capabilities for innovation processes. Firms should encourage external partners to contribute to innovation processes. Firms should also communicate their needs for external collaboration and create internal conditions to support the link between the firm's innovation culture and external collaboration. In this context, our study provides insight into technological support, the capabilities of the firm's human resources and the firm's attitude towards innovation and external collaboration, which can be implemented in the firm's policies. In this regard, the review provides evidence that practitioners should particularly consider externally focused information technology, the skills of the firm's human resources when dealing with external collaboration, the existence of a formal innovation plan and a framework for developed cooperation with external partners.

CONCLUSIONS

We analysed the existing literature on the drivers of firms' innovation activities. We drew research attention to the firm's innovation culture as an intangible resource that leads to an increase in firms' innovation performance. We were interested in the linkages between the firm's innovation culture and external cooperation as a developing area of research on the connections between knowledge diffusion and innovation processes. This is because innovation culture is regarded as a driver of firms' innovation performance, which is oriented towards the acquisition, transformation and use of knowledge for innovation processes and can lead to an increase in the firm's competitiveness. Nevertheless, this field suffers from a lack of comprehensive examinations of previously published articles. Considering the above, our study contributes to the field by providing a systematic review that gives attention to the relationship between the firm's innovation culture and external collaboration. We explored research articles from 2000 to 2022, and we provided a review of 25 articles selected from the Scopus Web of Science databases. We summarised systematic information on the time evolution and geography of the studies, the methodological profile of the articles and the main findings of the scholars. The review provides evidence that the literature on the linkages between the firm's innovation culture and external cooperation is still relatively limited, but the interest in the field is growing. Moreover, our review suggests that the research on this topic is not homogeneous, and varies in scope, focus, and findings, which may provide further research avenues. In this regard, our findings suggest a heterogeneous view of the firm's innovation culture. We also found heterogeneous results on the link between the firm's innovation culture and cooperation with external partner or partners. The review also provides evidence that through technological support, the capabilities of the firm's human resources, and the attitude towards innovation and external collaboration, firms can support the relationship between its innovation culture and external cooperation.

The present review provides implications for scholars and practitioners. Although researchers have shed some light on the topic, there remains a need for an in-depth understanding of the relationship between the firm's innovation culture and external cooperation. This study raises several questions that we may regard as propositions for future research. We would also suggest more longitudinal studies to increase the number of repeated observations in the field. Furthermore, along with the focus on small and medium-sized enterprises, we would suggest more research on large firms to compare whether the obtained results also fit this size of firms. Considering the implications for practitioners, the review suggests that firms should foster the linkages between the firm's innovation culture and collaboration with external partners to provide conditions for enhancing firms' innovation activities. The findings also point to the need to promote the strengthening of the firm's innovation culture and reduce the potential mismatch of expectations between the innovation culture of the firm and collaboration with external partners.

This study also provides implications for policymakers. The findings suggest that the support of government institutions is needed to promote the linkages between the firm's innovation culture and external collaboration. This is because such a link can lead to the improvement of firms' competitive-

ness and, consequently, to the improvement of the competitive advantages of regions and countries. In this regard, our study points to the need for further development of a favourable environment for firms' innovativeness by providing support for technological upgrading and research subsidies.

This study is not free of limitations, which are related to the methodology applied in our systematic literature review. We may see these limitations as opportunities for future systematic literature reviews on the linkages between the firm's innovation culture and external collaboration. Firstly, our review was limited to the articles from the Scopus and Web of Science databases. Another limitation was that the review did not consider book chapters and conference proceedings. Furthermore, many full-text articles written in English were not accessible. Despite this, we believe that our review offers an interesting set of results, which may direct future empirical research.

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Conflict of Interest

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