

Open innovation, with specific reference to SMEs: a systematic review

11336022

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Abstract:

The purpose of this paper was to assess the existing body of literature on open innovation in small and medium enterprises (SMEs), to have a comprehensive position on what scholarship position on the nature of open innovation in SMEs, and the proclivity of SMEs embracing OI practices. Using a structured literature review 65 article published in peer-review journals from 2014 to 2022, themes were identified using the content analysis method. We further provided contributions with academic and practitioner implications. In conclusion, we provided suggested future research.

Keywords: Open innovation, Open innovation in SMEs, Collaboration,

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Philosophy in Evidence Based Management at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

Name & Surname

Signature

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Chapter 1: Introduction

The current business environment is very dynamic, credit to the globalised nature of our modern society (Obradović et al., 2021). Entrepreneurs must innovate and adequately manage innovations to remain competitive (Braunerhjelm et al., 2018). Therefore, organisations are in business due to some successes of current innovations. Where scholars such as (Gault, 2018) define innovations as "... the implementation of a new or significantly changed product or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations." (p. 617-618) that is seen as value-adding by the consumer. As a result, innovation is the value-creation ability of the organisation.

The closeness of the society brought about by globalisation requires companies to compete globally, increasing competitiveness (Kratzer et al., 2017). Digital technologies are becoming more prevalent, and science and innovation are becoming more open (Bogers et al., 2018), putting more pressure on companies to participate in the global movement and embrace openness and collaboration (Lopes & de Carvalho, 2018; Markovic et al., 2020) in order to generate innovations. Thus, "innovation has become more open in recent years" (Appleyard & Chesbrough, 2017), and companies have, in the last decade, started reconsidering in-house R&D as the sole mechanism to innovate (Appleyard & Chesbrough, 2017).

Entrepreneurs must innovate and adequately manage innovations to remain competitive (Autio et al., 2014; Braunerhjelm et al., 2018). According to (Gault, 2018), innovation is "...the implementation of a new or significantly changed product (good or service), or process..." (p.617). The market consumes and supports products and services that add value to them, and such is delivered by innovation (Obradović et al., 2021). Therefore, organisations are in business due to some successes of current innovations. Where innovation represents the value-creation ability of the organisation. The current marketplace is ever-changing and very competitive, which challenges entrepreneurs and businesses to develop additional innovations (Obradović et al., 2021).

Extant literature argues that in-house R&D is crucial to innovation creation (Aliasghar et al., 2020; Brunswicker & Vanhaverbeke, 2015; Vahter et al., 2014). However, the scholars further indicate that R&D can be costly, and the costs have increased significantly in recent years (Chesbrough, 2003; Kleine et al., 2022; Radicic & Pugh, 2017). Therefore, companies with scarce funding resources are disadvantaged by the increasing and high R&D funding requirements and hence do not invest in such R&D activities (Chesbrough, 2003; Kleine et al., 2022; Radicic & Pugh, 2017)., negatively impacting the innovation

process. However, companies have seemingly continued to create innovation even in the absence of these R&D investments. Companies harnessed a collaboration among stakeholders within their network and embraced some level of openness on knowledge with external partners (Chesbrough, 2003). The globalised nature of our modern society contributes to the dynamic nature of the current business environment (Obradović et al., 2021). On the other hand, digital technologies are becoming more prevalent, and science and innovation are more open (Bogers et al., 2018). Thus, “innovation has become more open in recent years” (Appleyard & Chesbrough, 2017, p.310).

It is for this that open innovation gained dominance as the approach to strengthening a company’s innovation process (Cassiman & Valentini, 2016). According to Bogers et al. (2018), “Open innovation assumes that firms can and should use external ideas as well as internal ideas, and internal as well as external paths to market, as they look to advance their innovations” (p.6). Open innovation is a broad concept involving various organisational practices and processes (Spithoven et al., 2013).

The approach of opening up and collaborating to innovate was first coined Open innovation (hereafter OI) in 2003 by Chesbrough in his book, defining the concept and later refined to “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively” (Chesbrough et al., 2006, p. 1). The definition incorporates the practice’s direct implications and is aligned with innovation strategies. The definition was later redefined by Chesbrough et al. (2013) as “a distributed innovation process based on purposively managed knowledge flows across organisational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organisation’s business model.” (p.12). The refinement emphasised the importance of business model alignment, maintaining a firm-centric view and explicitly outlining that different mechanisms or OI practices are available. The definition also emphasises that the flows can be monetary or non-monetary (Greul et al., 2018). Scholars such as (Greul et al., 2018) defined OI “as the intentional management of inbound and outbound flows of knowledge for firms to advance their innovation strategies, by which firms leverage external partners both as sources of innovation and paths for commercialising their own innovations.” (p.393). The preceding definition touches on the flow practices and is in sync with that presented by (Gassmann et al., 2010) in terms of highlighting the commercialisation aspect, but this time with an emphasis on external partner relations. Therefore, for our research project, we will adopt the definition outlined by Greul et al. (2018) as a definition for the construct of open innovation. The reason emanates from its firm-centric perspective, specifically emphasising innovation strategies and external partner relations.

Since the publication of Chesbrough's seminal book on the topic, where the practice was for the first time coined as open innovation, scholarly work has grown, and more interest has shown (Beynon et al., 2021; Colombo et al., 2014; J.-L. Hervas-Oliver et al., 2020; Popa et al., 2017). There has been considerable interest in innovation management research in the area of open innovation (OI) in recent years (Brunswicker & Vanhaverbeke, 2015; Colombo et al., 2014; Popa et al., 2017; Radziwon & Bogers, 2019). Despite the vast interest and research conducted in the past decades, academics, practitioners, and policymakers are not clear on the phenomenon of open innovation in SMEs (Brunswicker & Vanhaverbeke, 2015; Colombo et al., 2014; Pervan et al., 2015; Popa et al., 2017; Verbano et al., 2015). Moreover, it remains unclear which factors (external and internal) influence SMEs' adoption of open innovation (Jin et al., 2022; Kim & Ahn, 2020; Marzi et al., 2022; Mei et al., 2021; Pervan et al., 2015; Popa et al., 2017; Santoro et al., 2020), how partners and networks are selected, how partnerships are managed (Benhayoun et al., 2020; Benitez et al., 2022; Brink, 2018; de Marco et al., 2020; Heger & Boman, 2015; Mei et al., 2019; Radziwon & Bogers, 2019; Rigg et al., 2021; Scuotto et al., 2017; Woods et al., 2022), and what capabilities SMEs need to recoup value from their external relationships (Gentile-Lüdecke et al., 2020; Manville et al., 2019; Milici et al., 2021; Santoro et al., 2020; J. R. B. Silva et al., 2022; Singh et al., 2021). OI research is currently fragmented and poorly organized, which makes it difficult to establish an integrated theory (Bogers et al., 2018; Popa et al., 2017).

Though the open innovation field is maturing, scholars such as West & Bogers (2017) emphasised that research on moderators of the relation between open innovation and performance benefits is not fully understood and known. As a result, authors such as (Hervas-Oliver et al., 2021; Radziwon & Bogers, 2019; Spithoven et al., 2013; Tsai et al., 2022) posited that while the open innovation research field has grown exponentially ever since Henry Chesbrough published his conceptualisation in 2003, SMEs received only minimal consideration.

SMEs are crucial players in developed and developing economies, contributing significantly to economic growth and job creation (de Marco et al., 2020). Moreover, it is for this reason that governments worldwide have to increase SMEs' productivity to have sustainable economic growth (Usman et al., 2018). Many scholars have identified Open innovation as an essential innovation management strategy to mitigate the SME resource weaknesses such as funding constraints for in-house research and development (Chesbrough & Crowther, 2006) and the technical skill gaps (Greul et al., 2018).

Extant literature indicates that, in addition to SMEs, studies of low-tech industries also are very low (Bayona-Saez et al., 2017; Santamaría et al., 2009). In contrast to hi-tech, low-tech firms and many SMEs are more inclined to vertical collaborations with a few if any, horizontal collaborations to boost innovation (Bayona-Saez et al., 2017; Fernández-Olmos & Ramírez-Alesón, 2017). There is a lot more SMEs in low-tech industries than larger firms (Brink, 2017). Therefore, studying SMEs may also include low-tech industries by default.

Knowledge exchange and the relationship with external partners are at the centre and significant drivers of open innovation and performance (Tsai et al., 2022). According to Su et al. (2018), “Many companies are trying to build or join a vigorous innovation ecosystem in order to enhance their capabilities toward innovation and their market responses.” (p.126). Indicated that there are weak and healthy innovation ecosystems and the importance of belonging to a healthy innovation ecosystem.

To fully benefit from open innovation, the literature emphasises the importance of learning new skills, such as selecting innovation ecosystems and alliance partners (Aftab Alam et al., 2022; Hottenrott & Lopes-Bento, 2016; Martínez-Noya & García-Canal, 2021; Shaikh & Levina, 2019). Research conducted to investigate the moderating effect of the quality of innovation ecosystems on how open innovation impacts firm performance is in need (Gomes et al., 2018; Pustovrh et al., 2020; Su et al., 2018). As a result, “designing and managing innovation communities is going to become increasingly important to the future of open innovation.” (Chesbrough, 2015, p.26).

From this perspective, we wanted to explore open innovation (OI) within the context of small and medium enterprises (SMEs), to understand what scholarship has covered on the phenomenon. Therefore, we aim to conduct a structured literature review OI in SMEs to allow an understanding and synthesis of the extant literature on the research field of interest (Snyder, 2019). The review aims to answer the following review questions:

1. What is scholarship saying about the nature of open innovation in SMEs?
2. What is scholarship saying about the proclivity of SMEs embracing OI practices?

The following chapter will detail the methodology that was adopted in answering the above review questions.

Chapter 2: Method and analysis

The proposed structured literature review (hereafter SLR) follows a systematic approach. It aims to conduct a literature review on open OI within the context of SMEs to allow an understanding and synthesis of the extant literature on the research field of interest (Snyder, 2019). To understand the phenomenon of open innovation in small and medium enterprises (SMEs), to investigate the relationships between open innovation and SME performance and how SMEs have embraced open innovation practices over the past eight years. Considering that many literature reviews in the field were published until 2016, we decided to begin our review period in 2014. A Systematic selection and analysis of the most relevant prior literature was accomplished through a multi-step selection process. The review combined bibliometric analysis and Inductive content analysis approaches to answer the research questions comprehensively.

2.1 Database selection

We have selected several academic databases from which we will gather data for our analysis. According to the literature, Google Scholar, Scopus, and Web of Science (WoS) are the three most important databases for citations and abstracts (Mongeon & Adèle Paul-Hus, 2016). Though the scoping study was conducted on Google scholar, as detailed in subsection 2.3, for our review, we excluded Google Scholar in the second step of data sourcing because scholars such as Mongeon & Adèle Paul-Hus (2016) argue that the low quality found in Google scholar calls into question the appropriateness of research evaluation. Although Google Scholar has better coverage than other databases, the data is unreliable (Farooque et al., 2019; Mongeon & Adèle Paul-Hus, 2016). Google Scholar search results are not reproducible as the algorithm changes (Gusenbauer & Haddaway, 2020) and according to Kraus et al. (2020), "...lists too many non-academic sources, and should therefore not be used for a systematic literature review." (p.1034).

Furthermore, according to scholars such as Gomes & Vieira (2009), Mariani et al. (2018) and Mongeon & Adèle Paul-Hus (2016), there are two main sources of citation databases in the social sciences, Scopus and WoS. The two databases have a "... coverage mainly focuses on journals and less on other means of scientific knowledge diffusion..." (Mongeon & Adèle Paul-Hus, 2016, p.214). The limitation of what the two databases cover in terms of focusing more on academic journals and less on other publications is in line with our inclusion and exclusion criteria and therefore fits well into our planned SLR requirements.

Scholars such as Farooque et al.(2019) and Mongeon & Adèle Paul-Hus (2016) posit that the WoS database has access to old sources, and Scopus tends to have broader coverage comparatively. Since the SLR intended to capture the most recent academic discussions on OI, it further excluded the WoS database since it adds no advantage and since, according to (Mariani et al., 2018), Scopus "... is considered as one of the most comprehensive repository of the world's research output..." (p.3521). The Web of Science does not cover approximately 5% of the journals in Scopus, and the Web of Science does not cover an estimated 50% of the Scopus articles (Mongeon and Paul-Hus, 2016).

We, therefore, only used Scopus as our database source to search for our data for the review and limited our search to articles published between 2014 and 2022. Based on the above discussion and the coverage the Scopus database provides, by default of our review protocol, we will exclude full-text databases such as Taylor & Francis, Springer Elsevier, Sage, ProQuest, and EBSCO.

2.2 Data sampling

In the initial phase, to assist in defining the concepts and determining the review questions, we used the exploratory review, as Tranfield et al.(2003) suggested. The suggested scoping study was undertaken, among others, to reveal lead scholars and seminal writings (Tranfield et al., 2003) within the field of OI. A google scholar search using the keyword "open innovation" and selecting "sort by relevance", "Any time", and "Any type". Based on a scan of up to five pages of google scholar search results, the most cited work was a 2003 book by Chesbrough with 25 467 citations. We realised that sorting the search results regarding the number of citations was impossible on Google scholar. Therefore, our 5-page google search data was not random because we followed a specific order when selecting (the results deemed not relevant by google scholar had no equal chance of being selected).

Moreover, the sample size of 50 out of over 4.5 million results was too small. Therefore may not be relied upon to represent the total population. However, the scoping study assisted in building insight in terms of the leading scholars and seminal work within the field of OI.

We wanted to ensure we include high-quality data and follow or join in the current academic conversation in the field. Therefore, we deliberately excluded all papers written and published before 2015, except those from leading scholars and seminal work. As much as we wanted to join in the current scholarly discussions, we also wanted to gain a first-hand understanding of the evolution of the OI phenomenon. This is where our

scoping study helped identify, in the initial phase, the leading academic contributors in the OI field. We were then deliberate in considering some articles older than 2015 from authors considered leading scholars, such as Chesbrough (2003), Chesbrough et al., (2013) and (Gassmann et al., 2010).

We used the Scopus database as the source to search for data, guided by the findings made by Mongeon & Adèle Paul-Hus (2016) that the SCOPUS database has a wider coverage of journals from the most recent years.

2.3 Data gathering

The search for articles was based on the following terms "open innovation" OR collabot* OR "innovation collabo*" AND sme* OR small AND medium AND enterprise* OR small* OR startups* OR family*, limited to articles in journals, published between the years 2014 to 2022 and written in English. The search results using the criteria detailed yielded 306 articles. We then subjected the 306 articles to the journal criteria to only consider peer-reviewed empirical articles published in journals ranked three and above based on ABS 2021 rankings. Once again, we made an exception on the data regarding the leading scholars. We allowed some book chapters and articles published in journals ranked below our abovementioned criteria if one of the authors was a leading scholar as identified. According to the criteria for ranking journals inclusion, 243 categories of articles were removed from the initial search results since they ranked below three, according to AJG2021. The following stages we eliminated from the sample articles that did not discuss open innovation and firm performance or innovation performance to shortlist the relevant studies and eliminate the incongruent ones (Snyder, 2019). Two articles were removed based on the abstract analysis since they did not pertain to OI in SMEs. After reviewing the full text of the remaining articles, we further eliminated four articles since they did not focus on OI in SMEs. As a result, from a search of the Scopus database, 57 articles remained and were found to discuss open innovation in SMEs.(see Table 1)

Table1: Literature review search results

Description	Scopus
Articles with exact keywords	358
After removing inapplicable articles, language and the years	306
After removing inapplicable articles, journal ranking (only including AJG 3 and above)	63
After removing inapplicable articles, reading abstracts	61
After removing inapplicable articles, reading full texts	57
Articles from another search	8
Final data sample	65

Additionally, we have conducted a residual search within the Google Scholar database, using the scoping study as outlined in subsection 2.3. By doing so, we were able to gain insight into the work of the leading scholars and seminal works within the field of OI and, therefore, deliberately search for and include their work. In order to ensure that our review remains relevant to the contemporary discussion, seminal papers and the work of influential authors were included. As a result of this residual search routine, eight additional articles were found. Therefore, the final total sample of 65 articles was included.

The following is a detailed search commands and keywords used on Scopus and after excluding journals ranked below three according to AJG201 : TITLE-ABS-KEY ("open innovation" OR collabot* OR "innovation collabo* " AND sme* OR small AND medium AND enterprise* OR small* OR startups* OR family*) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014)) AND (LIMIT-TO (LANGUAGE , "english")) AND (EXCLUDE (EXACTSRCTITLE , "journal of open innovation technology market and complexity") OR EXCLUDE (EXACTSRCTITLE , "sustainability switzerland") OR EXCLUDE (EXACTSRCTITLE , "european journal of innovation management") OR

EXCLUDE (EXACTSRCTITLE , "international journal of entrepreneurship and innovation management") OR EXCLUDE (EXACTSRCTITLE , "journal of innovation management") OR EXCLUDE (EXACTSRCTITLE , "international journal of business innovation and research") OR EXCLUDE (EXACTSRCTITLE , "international journal of innovation and learning") OR EXCLUDE (EXACTSRCTITLE , "international journal of innovation science") OR EXCLUDE (EXACTSRCTITLE , "international journal of innovation and sustainable development") OR EXCLUDE (EXACTSRCTITLE , "international journal of innovation creativity and change")) AND (EXCLUDE (EXACTSRCTITLE , "international journal of globalisation and small business")) AND (EXCLUDE (EXACTSRCTITLE , "desidoc journal of library and information technology") OR EXCLUDE (EXACTSRCTITLE , "international journal of engineering and technology innovation") OR EXCLUDE (EXACTSRCTITLE , "international journal of engineering and technology uae") OR EXCLUDE (EXACTSRCTITLE , "international journal of technology") OR EXCLUDE (EXACTSRCTITLE , "international journal of technology intelligence and planning") OR EXCLUDE (EXACTSRCTITLE , "journal of technology management and innovation")) AND (EXCLUDE (EXACTSRCTITLE , "espacios") OR EXCLUDE (EXACTSRCTITLE , "journal of business strategy") OR EXCLUDE (EXACTSRCTITLE , "sage open") OR EXCLUDE (EXACTSRCTITLE , "british food journal") OR EXCLUDE (EXACTSRCTITLE , "chinese management studies") OR EXCLUDE (EXACTSRCTITLE , "cogent business and management") OR EXCLUDE (EXACTSRCTITLE , "economic research ekonomska istrazivanja") OR EXCLUDE (EXACTSRCTITLE , "european planning studies") OR EXCLUDE (EXACTSRCTITLE , "frontiers in psychology") OR EXCLUDE (EXACTSRCTITLE , "international journal of applied business and economic research") OR EXCLUDE (EXACTSRCTITLE , "international journal of business and globalisation") OR EXCLUDE (EXACTSRCTITLE , "journal of science and technology policy management") OR EXCLUDE (EXACTSRCTITLE , "south african journal of industrial engineering") OR EXCLUDE (EXACTSRCTITLE , "acta astronautica") OR EXCLUDE (EXACTSRCTITLE , "advanced science letters") OR EXCLUDE (EXACTSRCTITLE , "african journal of hospitality tourism and leisure") OR EXCLUDE (EXACTSRCTITLE , "agricultural economics czech republic") OR EXCLUDE (EXACTSRCTITLE , "asian journal of technology innovation") OR EXCLUDE (EXACTSRCTITLE , "baltic journal of management") OR EXCLUDE (EXACTSRCTITLE , "benchmarking") OR EXCLUDE (EXACTSRCTITLE , "business perspectives and research") OR EXCLUDE (EXACTSRCTITLE , "california management review") OR EXCLUDE (EXACTSRCTITLE , "clean technologies") OR EXCLUDE (EXACTSRCTITLE , "complexity") OR EXCLUDE (EXACTSRCTITLE , "direccion y organizacion") OR

EXCLUDE (EXACTSRCTITLE , "dynamic relationships management journal") OR
EXCLUDE (EXACTSRCTITLE , "emerging science journal") OR EXCLUDE (EXACTSRCTITLE , "energies") OR EXCLUDE (EXACTSRCTITLE , "euromed journal of business") OR EXCLUDE (EXACTSRCTITLE , "forest products journal") OR EXCLUDE (EXACTSRCTITLE , "global business and economics review") OR EXCLUDE (EXACTSRCTITLE , "growth and change") OR EXCLUDE (EXACTSRCTITLE , "humanities and social sciences reviews") OR EXCLUDE (EXACTSRCTITLE , "ieee access") OR EXCLUDE (EXACTSRCTITLE , "it professional")) AND (EXCLUDE (EXACTSRCTITLE , "informacijos mokslai") OR EXCLUDE (EXACTSRCTITLE , "information resources management journal") OR EXCLUDE (EXACTSRCTITLE , "innovation organization and management") OR EXCLUDE (EXACTSRCTITLE , "international entrepreneurship and management journal") OR EXCLUDE (EXACTSRCTITLE , "international journal of economics and business research") OR EXCLUDE (EXACTSRCTITLE , "international journal of educational management") OR EXCLUDE (EXACTSRCTITLE , "international journal of energy sector management") OR EXCLUDE (EXACTSRCTITLE , "international journal of intellectual property management") OR EXCLUDE (EXACTSRCTITLE , "international journal of procurement management") OR EXCLUDE (EXACTSRCTITLE , "international journal of product development") OR EXCLUDE (EXACTSRCTITLE , "international journal of social economics") OR EXCLUDE (EXACTSRCTITLE , "international journal of technological learning innovation and development") OR EXCLUDE (EXACTSRCTITLE , "journal of applied economic sciences") OR EXCLUDE (EXACTSRCTITLE , "journal of asian finance economics and business") OR EXCLUDE (EXACTSRCTITLE , "journal of family business management") OR EXCLUDE (EXACTSRCTITLE , "journal of information technology management") OR EXCLUDE (EXACTSRCTITLE , "journal of intelligence studies in business") OR EXCLUDE (EXACTSRCTITLE , "journal of library administration") OR EXCLUDE (EXACTSRCTITLE , "journal of management and business administration central europe") OR EXCLUDE (EXACTSRCTITLE , "journal of strategy and management")) AND (EXCLUDE (EXACTSRCTITLE , "journal of the southern african institute of mining and metallurgy") OR EXCLUDE (EXACTSRCTITLE , "journal of transport and supply chain management") OR EXCLUDE (EXACTSRCTITLE , "knowledge management research and practice") OR EXCLUDE (EXACTSRCTITLE , "kybernetes") OR EXCLUDE (EXACTSRCTITLE , "management france") OR EXCLUDE (EXACTSRCTITLE , "management of environmental quality an international journal") OR EXCLUDE (EXACTSRCTITLE , "measuring business excellence") OR EXCLUDE (EXACTSRCTITLE , "pacific journalism review") OR EXCLUDE (EXACTSRCTITLE ,

"pakistan journal of commerce and social science") OR EXCLUDE (EXACTSRCTITLE , "problems and perspectives in management") OR EXCLUDE (EXACTSRCTITLE , "quality access to success") OR EXCLUDE (EXACTSRCTITLE , "regional science policy and practice") OR EXCLUDE (EXACTSRCTITLE , "revista argentina de clinica psicologica") OR EXCLUDE (EXACTSRCTITLE , "revista de administracao mackenzie") OR EXCLUDE (EXACTSRCTITLE , "south african journal of economic and management sciences") OR EXCLUDE (EXACTSRCTITLE , "supply chain forum") OR EXCLUDE (EXACTSRCTITLE , "sustainable development") OR EXCLUDE (EXACTSRCTITLE , "tqm journal") OR EXCLUDE (EXACTSRCTITLE , "taltech journal of european studies") OR EXCLUDE (EXACTSRCTITLE , "transportation research part a policy and practice") OR EXCLUDE (EXACTSRCTITLE , "world review of entrepreneurship management and sustainable development")) AND (EXCLUDE (EXACTSRCTITLE , "international journal of innovation management") OR EXCLUDE (EXACTSRCTITLE , "journal of knowledge management") OR EXCLUDE (EXACTSRCTITLE , "technology analysis and strategic management") OR EXCLUDE (EXACTSRCTITLE , "journal of the knowledge economy") OR EXCLUDE (EXACTSRCTITLE , "business process management journal") OR EXCLUDE (EXACTSRCTITLE , "creativity and innovation management") OR EXCLUDE (EXACTSRCTITLE , "international journal of entrepreneurship and innovation") OR EXCLUDE (EXACTSRCTITLE , "science technology and society") OR EXCLUDE (EXACTSRCTITLE , "international journal of entrepreneurship and small business") OR EXCLUDE (EXACTSRCTITLE , "journal of cleaner production") OR EXCLUDE (EXACTSRCTITLE , "journal of engineering and technology management jet m") OR EXCLUDE (EXACTSRCTITLE , "journal of high technology management research") OR EXCLUDE (EXACTSRCTITLE , "management decision")) AND (EXCLUDE (EXACTSRCTITLE , "business systems research") OR EXCLUDE (EXACTSRCTITLE , "industrial management and data systems") OR EXCLUDE (EXACTSRCTITLE , "international journal of project management") OR EXCLUDE (EXACTSRCTITLE , "international journal of technology management") OR EXCLUDE (EXACTSRCTITLE , "journal of business and industrial marketing") OR EXCLUDE (EXACTSRCTITLE , "journal of evolutionary economics") OR EXCLUDE (EXACTSRCTITLE , "journal of management and organization") OR EXCLUDE (EXACTSRCTITLE , "journal of organizational change management") OR EXCLUDE (EXACTSRCTITLE , "journal of small business and enterprise development") OR EXCLUDE (EXACTSRCTITLE , "mis quarterly executive") OR EXCLUDE (EXACTSRCTITLE , "marine policy") OR EXCLUDE (EXACTSRCTITLE , "research technology management") OR EXCLUDE (EXACTSRCTITLE , "science and public policy")) AND (EXCLUDE (EXACTSRCTITLE

, "international small business journal researching entrepreneurship") OR EXCLUDE (EXACTSRCTITLE , "international journal of information management"))

2.4 Data analysis

The review advocates a qualitative data analysis, similar to content analysis (Snyder, 2019), which is more suitable for our review.

Our data abstraction included "...descriptive information such as authors, years published, topic, or type of study, or in the form of effects and findings." (Snyder, 2019, p.337). We will extract the information using a qualitative and deductive content analysis method (Gaur & Kumar, 2018). Based on the purpose of the review and the explicitly outlined review questions, the sampled articles went through a content analysis. Atlas ti software facilitated the coding of all the articles. Content analysis is able to "... capture relevant information more precisely to identify valuable topics, methods and theme ..." (Gao et al., 2020, p.3). It has been shown that content analysis allows researchers to thoroughly assess existing literature(Gaur & Kumar, 2018).

We, therefore, recorded/coded descriptive information from each paper such as journal name, year published, name of authors, applied theories, document the type of study (conceptual or empirical), industry, level of analysis, geographical area and the definitions of the phenomenon. Furthermore, having engaged the selected literature, a coding of themes ensued based on the discussions and findings of each article. Which later summarised to discuss prominent themes from the scholars. The themes included Open innovation, SMEs, open innovation in SMEs, and open innovation climate. The results of the SLR are presented in chapter three. As presented in chapter three, the results of the bibliometric analysis provide a general overview of publications relating to open innovation in SMEs. In addition, we provide a general overview of the content analysis results.

Chapter 3: Literature review

This section presents and discusses the findings of the literature review. Our synthesis of findings is primarily concerned with understanding the research landscape of open innovation in SMEs. Since the publication of Chesbrough's seminal book on the topic, where the practice was for the first time coined as open innovation, scholarly work has grown, and more interest has shown (Beynon et al., 2021; Colombo et al., 2014; J.-L. Hervas-Oliver et al., 2020; Popa et al., 2017). There has been considerable interest in innovation management research in the area of open innovation (OI) in recent years (Brunswicker & Vanhaverbeke, 2015; Colombo et al., 2014; Popa et al., 2017; Radziwon & Bogers, 2019). Despite the vast interest and research conducted in the past decades, academics, practitioners, and policymakers are not clear on the phenomenon of open innovation in SMEs (Brunswicker & Vanhaverbeke, 2015; Colombo et al., 2014; Pervan et al., 2015; Popa et al., 2017; Verbano et al., 2015). Moreover, it remains unclear which factors (external and internal) influence SMEs' adoption of open innovation (Jin et al., 2022; Kim & Ahn, 2020; Marzi et al., 2022; Mei et al., 2021; Pervan et al., 2015; Popa et al., 2017; Santoro et al., 2020), how partners and networks are selected, how partnerships are managed (Benhayoun et al., 2020; Benitez et al., 2022; Brink, 2018; de Marco et al., 2020; Heger & Boman, 2015; Mei et al., 2019; Radziwon & Bogers, 2019; Rigg et al., 2021; Scuotto et al., 2017; Woods et al., 2022), and what capabilities SMEs need to recoup value from their external relationships (Gentile-Lüdecke et al., 2020; Manville et al., 2019; Milici et al., 2021; Santoro et al., 2020; J. R. B. Silva et al., 2022; Singh et al., 2021). In the following sections, the findings from the sampled literature are presented.

3.1 Sampled articles Overview: Descriptive results

The final sample for our review consisted of 65 articles published in peer-reviewed journals ranked three or higher according to AJG2021, with publication dates ranging from 2014 to 2022. As shown in Fig.1, the distribution of articles is based on the year of publication. Within the time frame of our review, 2014 to 2022, the number of publications on open innovation in SMEs (also referred to as the topic) has grown and continues to grow. Notably, the number of publications increased significantly in 2020 compared to 2019, equating to an increase of 100%. The growth may be a response to calls made in prior literature regarding the importance of open innovation in SME research gaps (Hervas-Oliver et al., 2021; Greul et al., 2018; Popa et al., 2017; Radziwon & Bogers, 2019).

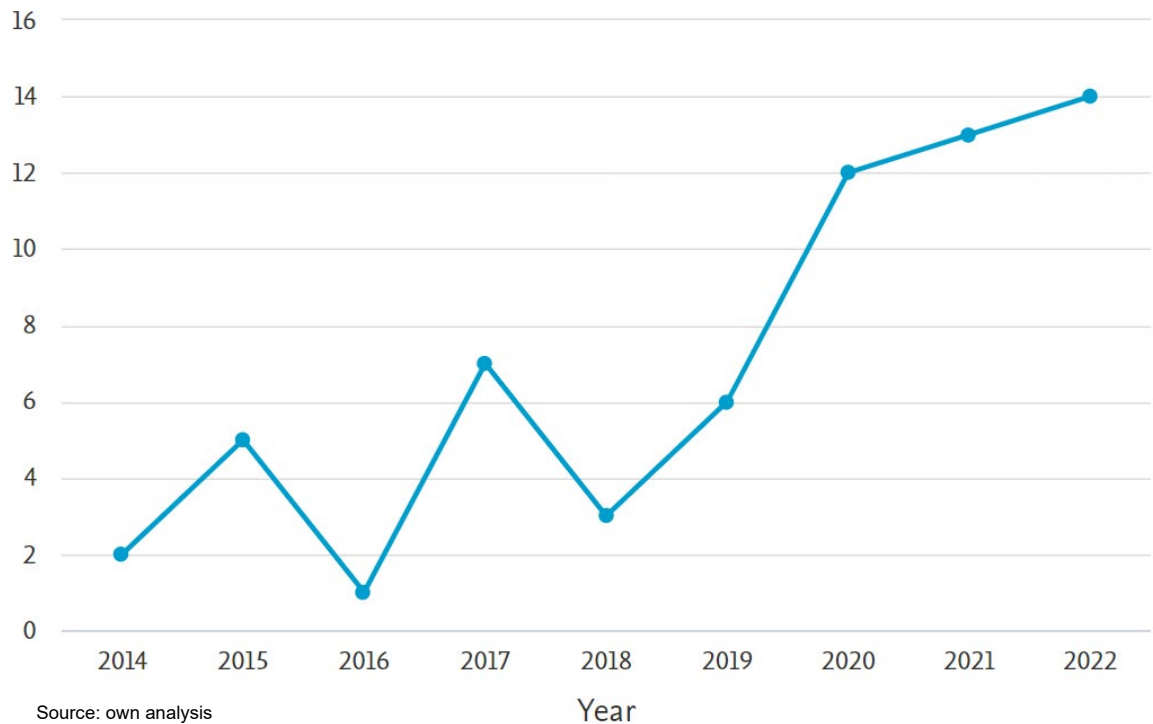


Fig.1. Number of publications by year

Since the significant increase in 2020 publications, as shown in Figure 1, scholarly work on open innovation in SMEs has maintained a high number and continued to show a positive trajectory until 2022. Using the selected sample, the topic of interest was covered in 18 highly ranked journals, as shown in Fig.2. In addition, three (17%) of these journals ranked four and above, with the rest published in journals ranked 3, according to AJG2021. However, in the final sample, those ranked four and above only accounted for five (8%) of the 65. The main channel for research on open innovation in SMEs is the Technological Forecasting and Social Change Journal recorded the highest number of articles in the sample at 14 (22%). Despite this, research in this field is spread across various journals (19); the spread of data samples indicates that open innovation has

become an increasingly popular topic among SMEs.

List of Journals from final sample



Fig. 2. number of articles per journal

Region of Study

Regarding the region of analysis, the majority (66%) of studies are conducted in the European environment. Although trends show that since 2014, studies in other regions, such as Asia (17%), Middle-east (5%) and Africa (3%), have been conducted, it is still minimal. If the analysis is done from the economies, developed economies (combining North America and Europe) are still in the majority at approximately 70,8% (46 of the 65 articles). It has been observed that studies concerning emerging economies, including Asia, Middle-East, South America and Africa, remain largely lacking, which is in line with existing literature findings (Jin et al., 2022; Markovic et al., 2021; Zahoor et al., 2022). The study based on region analysis is illustrated in Fig. 3.

The study involving multiple regions and interaction among authors from different regions is taking place. In addition, as shown in Fig.4, most studies are undertaken by scholars based in the United Kingdom, followed by the United States, Italy, Spain and recently, China. The network analysis depicts a lot of interaction between European and Asian authors on the topic, and the collaborations between the regions are also more recent

China dominates Asian region participation in the collaborations dating back from 2017. The absence of African author participation is loud and evident in Fig.4.

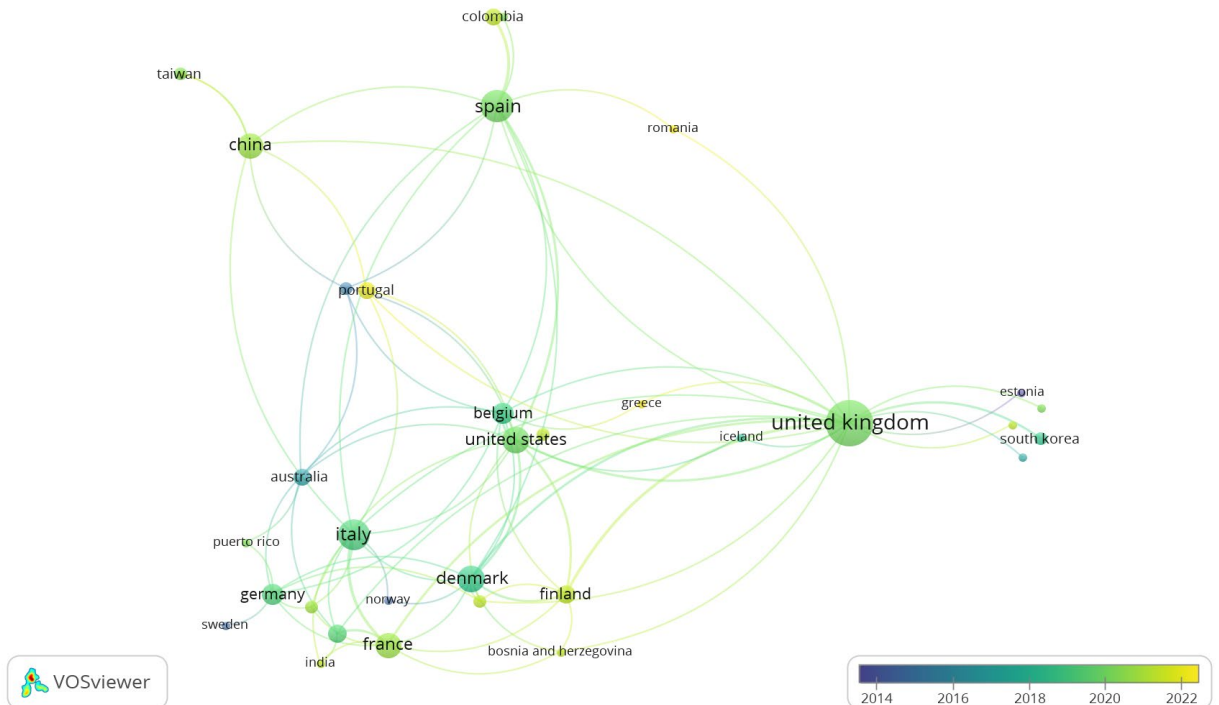
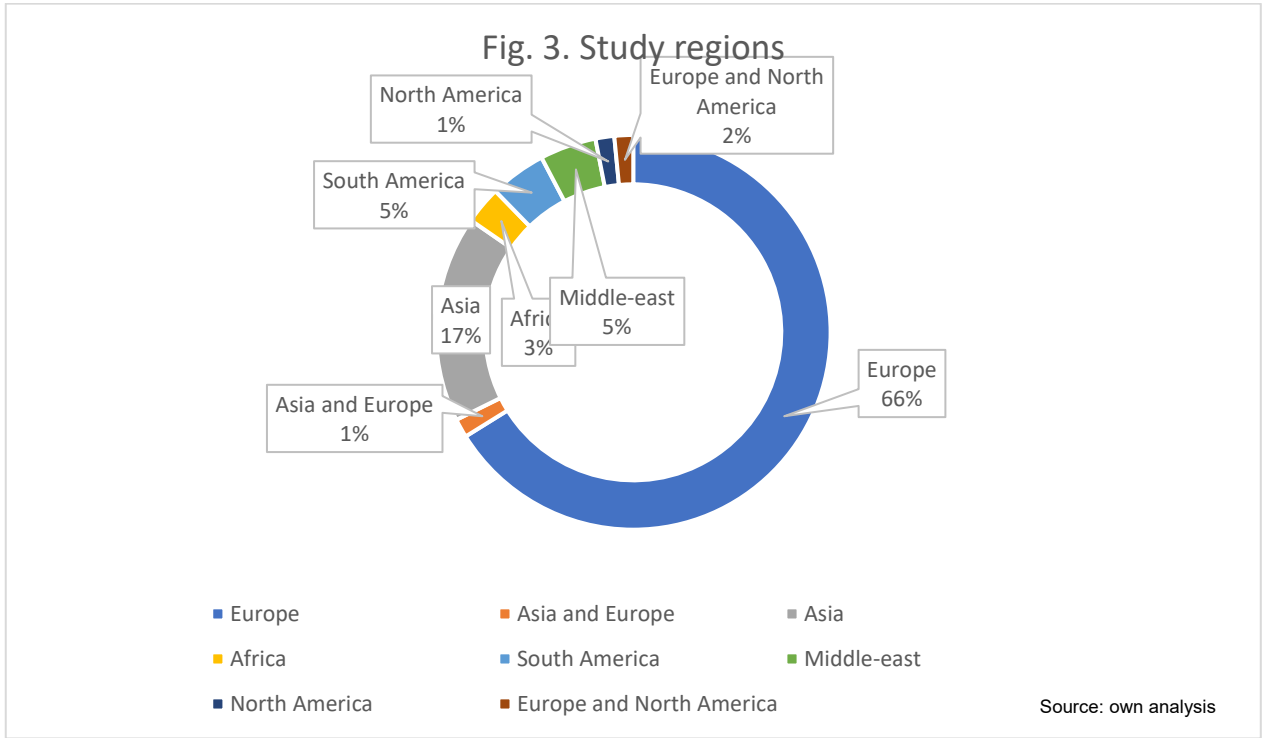


Fig. 4. An evolution of author interaction by region

3.1.1 Industry Sectors

The open innovation in SME was studied in more than one industry sector, and the diversity of industries is continuing to grow, as shown in Fig.5. In the period 2014 –2022, sectors such as manufacturing and IT were explored more than any other sectors. Studies of other sectors were included in multi-industry studies, but not with the same degree of attention given to manufacturing and IT. Furthermore, the multi-industry category is dominated by a combination of manufacturing and services, followed by manufacturing and other industries such as retail, agriculture, tourism, and services. The analysis of the industry sectors is shown in Fig. 5.

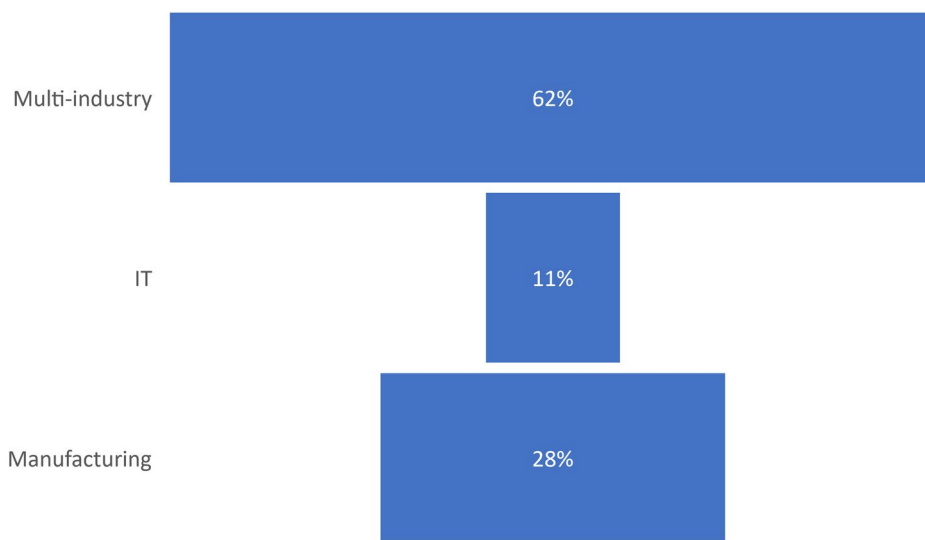
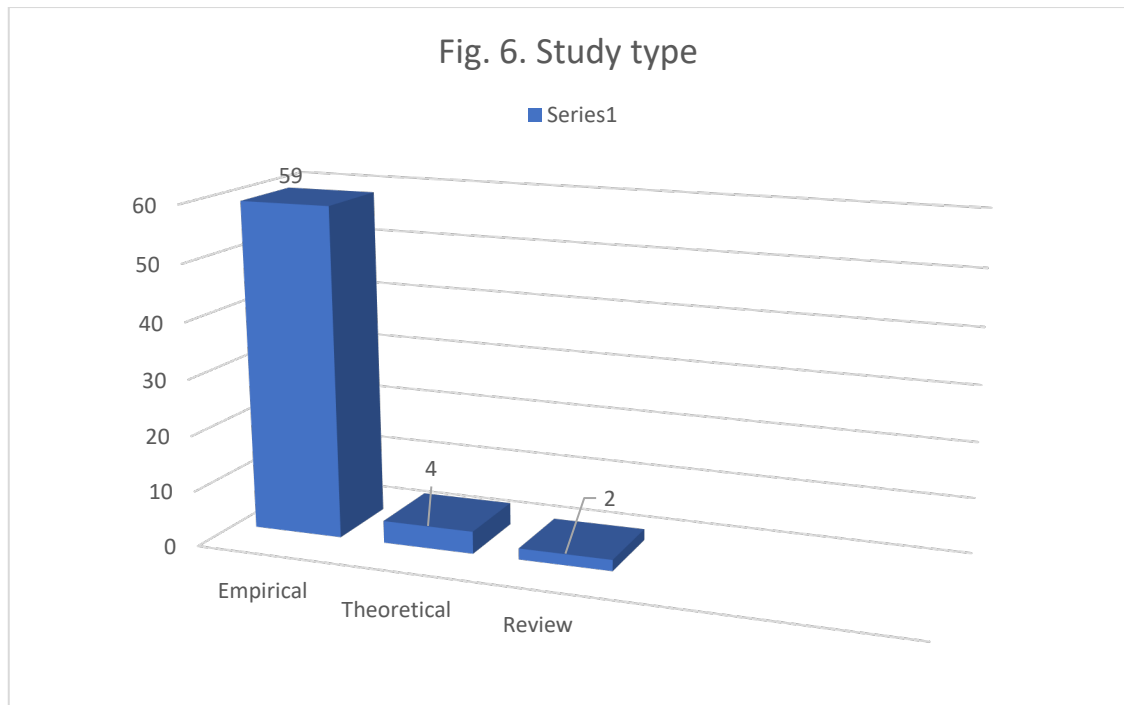


Fig. 5. Industry sector studied

The extant literature highlights the dominance of studies involving high-tech enterprises/industries (Albats et al., 2020; Arias-Perez et al., 2022; J.-L. Hervas-Oliver et al., 2020; Popa et al., 2017; Radziwon & Bogers, 2019). Despite the high-tech dominance, only 10 (equivalent to 15%) of the sampled articles deliberately studied only low and medium-tech companies or industries. Instead, 13 articles conducted multi studies involving both low- and high-tech companies and the bulk (25 articles) were not specific and did not have sufficient information to facilitate the classification into either low- or high-tech companies.



3.1.2 Keywords Analysis

A bibliographic analysis was conducted to plot the topics covered in the articles. A visualisation of the co-occurrence of keywords in author keywords was created based on the number of keywords used in the articles. We do not discuss keywords that are most likely to have emerged as a result of the search criteria (such as “open innovation” or “SMEs”). The result is shown in Figure 5.

3.1.2 Research methodologies

Regarding the research approach, the sampled articles were categorised based on the methodological and analytical approaches used. In the sample, 63% (41) of studies employed quantitative methodologies ranging from descriptive statistics to structural equation modelling and other regression methods. In contrast, 31% (20) of the studies used a qualitative method, mainly through a case study approach, and 6% (four) used a mixed method approach. (See Fig.8)

To unpack the complex phenomenon of open innovation in SMEs, we first explain the key conceptual components shaping it: open innovation and SME based on the sampled literature.

3.2 Open innovation

Studies have shown that the practice of open innovation (OI) provides a mechanism for entrepreneurs and companies to create and commercialise innovations (Greul et al., 2018). Hence scholars such as Hervas-Oliver et al. (2020) and Bogers et al. (2017) agree that open innovation has become an important discussion point in innovation management. As a result, OI has attracted much attention over the past decades from academics and practitioners (Chaudhary et al., 2022; Saura et al., 2022; Hervas-Oliver et al., 2020). Open innovation enables the flow of ideas from beyond company boundaries, interacting with external partners, and also embraces the exploitation of internal knowledge by external partners (Chesbrough et al., 2014; Gentile-Lüdecke et al., 2020; Jasimuddin & Naqshbandi, 2019; Rosa et al., 2020), as illustrated in Fig.9. A new external market for internally generated knowledge is established, at the same time benefiting from a supplementary external source of ideas, technologies and expertise to be used internally (Gimenez-Fernandez et al., 2020; J.-L. Hervas-Oliver et al., 2021; Leckel et al., 2020; Popa et al., 2017; Radicic & Pugh, 2017; Radziwon & Bogers, 2019; Vahter et al., 2014).

The open innovation paradigm emphasises the importance of using different sources and external ideas in the innovation process (Brunswicker & Vanhaverbeke, 2015; Santoro et al., 2020). The literature overwhelmingly supports the notion that companies interacting with external actors, agents or innovation networks are likely to have exceedingly performed superior to those that do not (Brink, 2017; Brunswicker & Vanhaverbeke, 2015; Candi et al., 2018; Mawson & Brown, 2017; Santoro et al., 2020; Teirlinck, 2017).

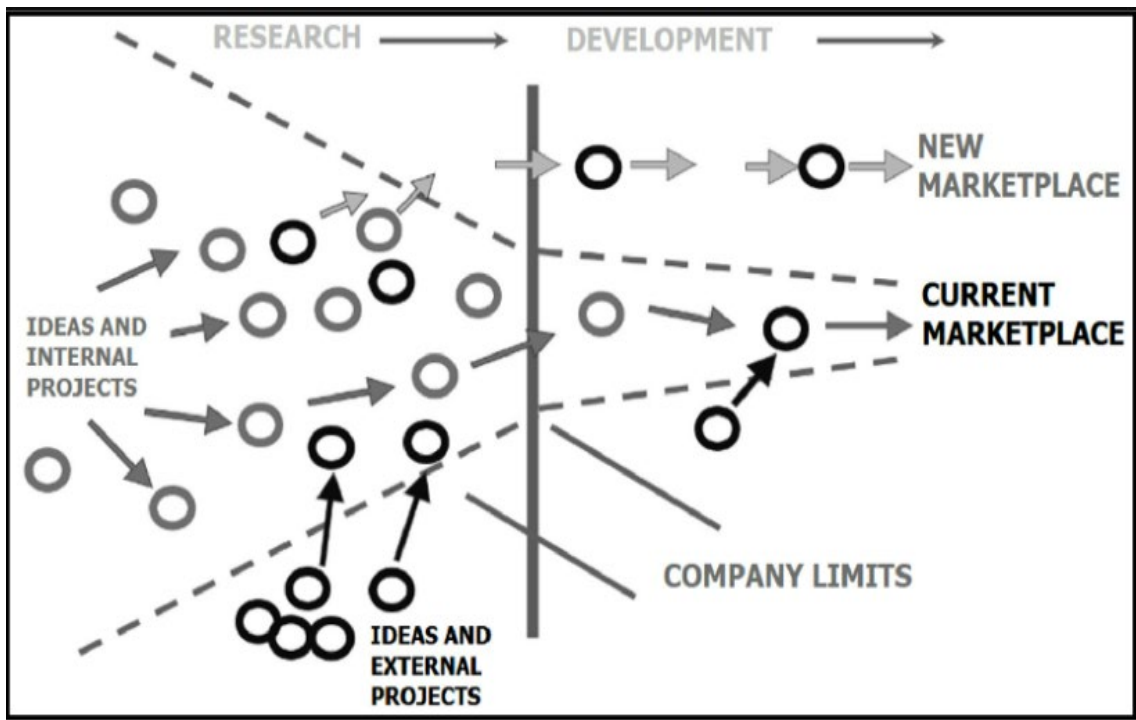


Fig. 9. Flow of ideas in (OI) process. Source: adapted from [Chesbrough \(2006\)](#).

The literature captures three OI practices, inbound, outbound, and coupled OI (Ahn et al., 2017; Cassiman & Valentini, 2016; Chesbrough et al., 2013; Hottenrott & Lopes-Bento, 2016; Popa et al., 2017; Xia & Roper, 2016; Zobel, 2017). Inbound OI refers to the use of external knowledge internally (purposive inflows), and outbound OI (purposive outflows) refers to the transmission of internal knowledge or technologies to an external environment (Bogers et al., 2018; Gentile-Lüdecke et al., 2020; Jasimuddin & Naqshbandi, 2019; Kleine et al., 2022; Popa et al., 2017; Radziwon & Bogers, 2019) and coupled OI suggest a practice that adopts both inbound and outbound OI. Many factors influence the choice of an OI practice to adopt, which is very complex (Xia & Roper, 2016; Popa et al., 2017; Hottenrott & Lopes-Bento, 2016). Gassmann et al. (2010) defined outbound as external paths to commercialise internal innovations that are not used. In comparison, inbound is described as strategies to search for external information to be used in conjunction with in-house R&D and competencies (Cassiman & Valentini, 2016; Gassmann et al., 2010; Gentile-Lüdecke et al., 2020; Markovic et al., 2020; Popa et al., 2017).

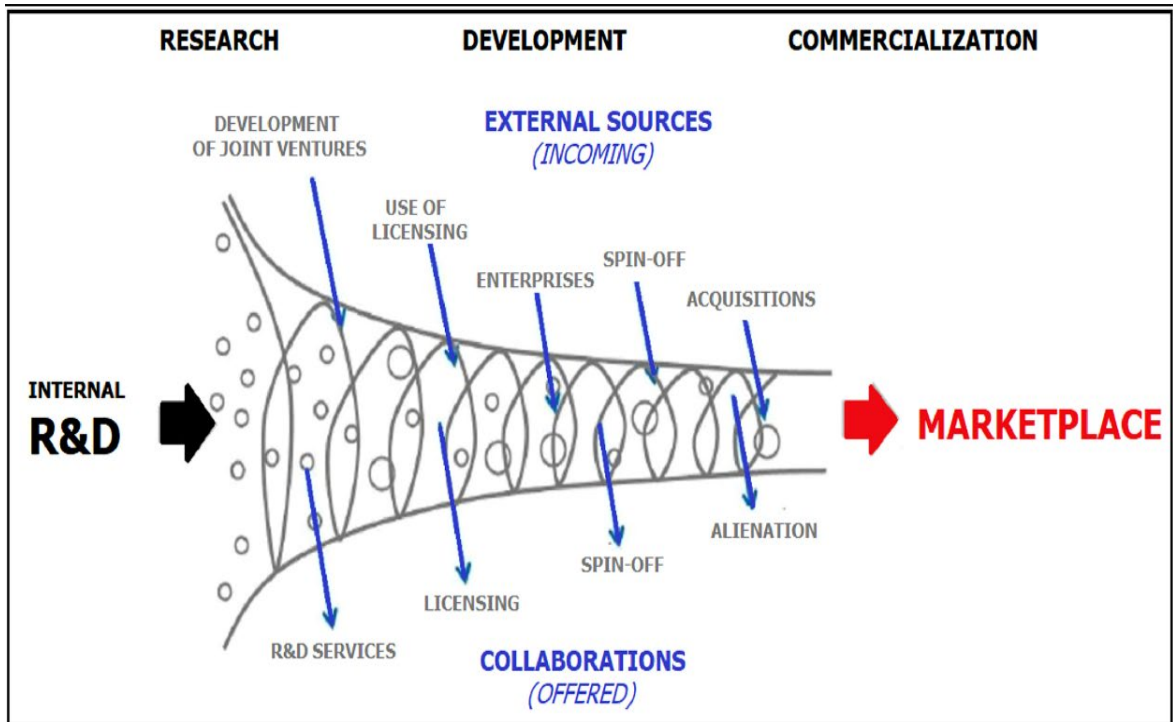


Fig. 10. Inbound and outbound (OI). Source: adapted from [Chesbrough \(2006\)](#).

The knowledge transfer and interaction between the organisation and its external environment are shown in Fig.10. The OI process embraces and values company interaction with the external environment, with actors such as customers, suppliers, the institution of higher learning, research centres, innovation networks and business partners (Benhayoun et al., 2020; Benitez et al., 2022; Brink, 2018; García-Muiña et al., 2019; Heger & Boman, 2015; Rigg et al., 2021; Scuotto et al., 2017; Woods et al., 2022).

For scholars such as Rosa et al. (2020), more companies in the last decade have shifted from relying only on in-house knowledge generated to complementing their internal innovation process by collaborating for external sources with the external environment (Aliasghar et al., 2020; David et al., 2021; J.-L. Hervás-Oliver et al., 2021; Kim & Ahn, 2020; Mei et al., 2021). Moreover, since its conceptualisation, OI studies in smaller firms have not received the same attention as larger companies (Popa et al., 2017; West & Bogers, 2017).

3.3 SMEs and Open Innovation

Small and medium-sized enterprises (SMEs) are defined differently across the literature and depend on the context (region) in which they are studied. In all studies size of the company was determined using the number of employees. Studies in the European region adopted the European Union’s definition of SMEs with the following criteria:

Micro enterprises (1-9 employees), small enterprises (10 – 49 employees) and medium-sized enterprises (50 – 250 employees) (Aslesen & Harirchi, 2015; Bertello et al., 2022; Brink, 2017; Edeh et al., 2020; Gimenez-Fernandez et al., 2020; J.-L. Hervas-Oliver et al., 2020; Jasimuddin & Naqshbandi, 2019; Kleine et al., 2022; Mawson & Brown, 2017; Rigg et al., 2021; Scuotto et al., 2017; Verbano et al., 2015; Zahoor et al., 2022).

According to studies conducted in the United States of America, companies with up to 500 employees are classified as small and medium-sized enterprises (SMEs)(Benitez et al., 2022; Gentile-Lüdecke et al., 2020; Lin et al., 2022). Comparatively, Chinese studies consider companies with up to 2000 employees to be SMEs (Gentile-Lüdecke et al., 2020; Lin et al., 2022; Mei et al., 2019). On the other hand, the Vietnamese consider small businesses with up to 300 employees to be SMEs (F.-S. Tsai et al., 2022). There is, however, one study that classified SMEs with 1-9 employees as small businesses; In the same survey, SMEs were defined as those with fewer than 200 employees(Pervan et al., 2015).

In their study, Albats et al.(2021) concluded that “The SMEs differed in size, age, region, industry, tech intensity, and development stage.” (p.10). This indicates the complexity of what is referred to as small and medium-sized enterprises (SMEs).

In the literature reviewed, SMEs are regarded as crucial players in developed and developing economies, contributing significantly to economic growth and job creation (Albats et al., 2021; Benhayoun et al., 2020; de Marco et al., 2020; del Giudice et al., 2021; J.-L. Hervas-Oliver et al., 2020, 2021; Jin et al., 2022; Livieratos et al., 2022; Mawson & Brown, 2017; Pervan et al., 2015; Popa et al., 2017; Radziwon & Bogers, 2019; Santoro et al., 2020; A. R. D. Silva et al., 2021; F.-S. Tsai et al., 2022). Moreover, it is for this reason that governments worldwide have to increase SMEs’ productivity to have sustainable economic growth (Dabić et al., 2020; Usman et al., 2018). Many scholars have identified Open innovation as an essential innovation management strategy to mitigate the SME resource weaknesses such as funding constraints for in-house research and development (Bogers et al., 2018; Chesbrough & Crowther, 2006; J.-L. Hervas-Oliver et al., 2020) and the technical skill gaps (Brink, 2018).

Accordingly, “A more detailed understanding of the exact conditions under which SMEs can successfully implement an open approach to innovation, therefore, remains lacking.” (Radziwon & Bogers, 2019, p.57)

The study of Open innovation with SMEs has not advanced much compared to larger firms (Colombo et al., 2014; de Marco et al., 2020; Gentile-Lüdecke et al., 2020; Gimenez-

Fernandez et al., 2020; J.-L. Hervas-Oliver et al., 2020, 2021; Kim & Ahn, 2020; Matsuzaki et al., 2021; Mei et al., 2019; F.-S. Tsai et al., 2022). Only recently and in 2009, SME open innovation was published and has since drawn the attention of scholars. Studies have found that the benefits of open innovation to SMEs differ from those of large enterprises (Brink, 2017; Radicic & Pugh, 2017; Radziwon & Bogers, 2019).

SME contexts are unique, considering their resource allocations, internal capabilities, the inseparable link between the entrepreneur and the open innovation strategy of the entity, etc.(Dabić et al., 2020; Hervas-Oliver et al., 2021; Tsai et al., 2022). Therefore, a deliberate and explicit focus on the distinct features brought about by the SME context when examining these entities is needed (Dabić et al., 2020; de Marco et al., 2020; Gentile-Lüdecke et al., 2020; Usman et al., 2018).

The SME context has benefits; for example, scholars have pointed out that due to its flexibility relative to the larger firms, it has an advantage for cultivating successful OI practices (J. L. Hervas-Oliver et al., 2020; Radziwon & Bogers, 2019; Spithoven et al., 2013). Therefore an effective adoption of open innovation is highly likely (Usman et al., 2018). This is further echoed by Gentile-Lüdecke et al. (2020) and Usman et al. (2018) in pointing out that the flexibility of SMEs' organisational structures and the ability to change their strategic direction are essential drivers of OI.

In addition to the above, OI research is dominated by studies in hi-tech firms (Rosa et al., 2020) and predominately from developed countries which agree with our review results. Scholars have highlighted that more studies of SMEs in low-tech industries would be ideal as future research in OI (Albats et al., 2021; Bayona-Saez et al., 2017; Spithoven et al., 2013; Usman et al., 2018; Vanhaverbeke et al., 2012), indicating that how SMEs manage the whole process of open innovation and managing the innovation ecosystems is not the same for large companies and hi-tech SMEs (Benitez et al., 2022; Chesbrough, 2003; Heger & Boman, 2015; Jin et al., 2022; Mei et al., 2019; Radziwon & Bogers, 2019; Spithoven et al., 2013)(Chesbrough, 2003; Spithoven et al., 2013).

The literature reviewed indicates that, in addition to SMEs, studies of low-tech industries are also very low (Fernández-Olmos & Ramírez-Alesón, 2017). In contrast to hi-tech, low-tech firms and many SMEs are more inclined to vertical collaborations with a few, if any, horizontal collaborations to boost innovation (Fernández-Olmos & Ramírez-Alesón, 2017; Gimenez-Fernandez et al., 2020; J.-L. Hervas-Oliver et al., 2020).

Open innovation in SME low-tech industries relies on personal relations by the SME managers/ entrepreneurs (de Marco et al., 2020; Usman et al., 2018); in many cases,

this is due to a lack of resources to can have an open innovation network and monitor external partners (Ahn et al., 2017; Brink, 2018; Rigg et al., 2021; F.-S. Tsai et al., 2022; Usman et al., 2018). Accordingly, Usman et al. (2018) and Albats et al. (2021) posit that the phenomenon of open innovation occurs as a direct result of the innovations in business models initiated by the entrepreneur(s).

The extensive and "... rich body of literature assumes that at the core of open innovation is the ability to create an open innovation ecosystem" (Aftab Alam et al., 2022, p. 435). Knowledge exchange and the relationship with external partners are at the centre and significant drivers of open innovation and performance (Tsai et al., 2022). According to Su et al. (2018), "Many companies are trying to build or join a vigorous innovation ecosystem in order to enhance their capabilities toward innovation and their market responses." (p.126). Indicated that there are weak and healthy innovation ecosystems and the importance of belonging to a healthy innovation ecosystem.

To fully benefit from open innovation, the literature emphasises the importance of learning new skills, such as selecting innovation ecosystems and alliance partners (Aftab Alam et al., 2022; Hottenrott & Lopes-Bento, 2016; Martínez-Noya & García-Canal, 2021; Shaikh & Levina, 2019). Research conducted to investigate the moderating effect of the quality of innovation ecosystems on how open innovation impacts firm performance is in need (L. A. de V. Gomes et al., 2018; Pustovrh et al., 2020; Su et al., 2018). As a result, "designing and managing innovation communities is going to become increasingly important to the future of open innovation." (Chesbrough, 2015, p.26).

The analysis of the review, following the coding, captured themes covering the open innovation climate. The external and internal factors/environments that enable a successful and positive innovation performance (Rumanti et al., 2022). Performance in innovation is dependent on the innovation climate (Kim & Ahn, 2020; Popa et al., 2017; Rumanti et al., 2022). According to (Rumanti et al. (2022), "Open innovation climate is a condition under which open innovation in an organisation is facilitated so that internal and external flows of innovation occur." (p. 2). The literature describes open innovation climate dimensions as innovative and flexible, outward-focused and reflexive (Rumanti et al., 2022). The following sections will discuss the findings from the review.

Theme 1: Innovation networks/ecosystems

In the OI literature, networks have often been instrumental to innovation processes' success (Brink, 2018; Mei et al., 2019; Radziwon & Bogers, 2019; Rigg et al., 2021). They have been considered instrumental either in acquiring resources (e.g. knowledge or financing)

(Benitez et al., 2022; Jin et al., 2022; Mawson & Brown, 2017) or in introducing new products in the market (Brink, 2017; Jin et al., 2022; Markovic et al., 2021). For startup companies and other actors involved in innovation processes, it is important to understand how the structure and processes of the network affect their processes and outcomes

An innovation ecosystem is activated when SMEs and external stakeholders form a network to collaborate (Radziwon & Bogers, 2019), “making knowledge exchange between the SME and stakeholders the same as knowledge sharing within the organisation itself.” (Tsai et al., 2022, p.435). Nambisan & Baron (2013) suggested the types of innovation ecosystems, such as “hub-based ecosystem, open source community, research and development (R&D) consortium, crowdsourcing ecosystem” (p.1074). (Nambisan & Baron, 2013) further argued that “a hub-based innovation ecosystem that involves a single firm assuming the ecosystem leadership (setting the goals and defining the innovation platform) and exercising considerable influence over the strategies and fortunes of all other members” (p.1072). According to Woods et al.(2022), “Social network theory espouses that firm outcomes and future performance depend, in part, on the network position it occupies.” (p.353). Based on the social network theory, Woods et al.(2022) further suggest that organisations’ innovation performance is affected by the position of the organisation within the innovation network/ecosystem.

For instance, SMEs are likely to collaborate with institutions such as universities and research institutes (J. L. Hervas-Oliver et al., 2020). While on the other hand, Tsai et al. (2022) noted scholars who “considered business partners and universities to be critical actors that positively affect product innovativeness” (p.435). However, according to a study in the UK, rural SMEs are less inclined to collaborate with universities compared to SMEs based in urban areas. (Johnston & Prokop, 2021).

SMEs have a propensity to network; for instance, SMEs are also likely to network with institutions such as universities and research institutes (J. L. Hervas-Oliver et al., 2020). Furthermore, Hervas-Oliver et al. (2020) point out that SMEs still prefer a networking process that follows a vertical collaboration, networking with suppliers and are limited to the supply chain (Spithoven et al., 2013) and; therefore, suppliers are the essential source for SME innovation (Heidenreich, 2009; J. L. Hervas-Oliver et al., 2020). As such, in agreement with other scholars, Hervas-Oliver et al. (2020) suggest that “In general, SMEs engage in cooperation agreements with actors in the supply chain (industry-based actors), such as suppliers or customers, relatively more intensively than they do with scientific-based agents (universities, technology and research transfer offices, and so

forth) (for example, Corsten, 1987; Hervas-Oliver, Albors-Garrigos, & Gil-Pechuan, 2011; Zeng, Xie, & Tam, 2010), a fact that is also confirmed for the case of process-oriented SMEs (Hervas-Oliver et al., 2011, 2014).” (p.413). There is consensus among scholars arguing that customers and suppliers provide valuable knowledge to enable new product development and innovation process (Albats et al., 2021; Arias-Perez et al., 2022; Benitez et al., 2022; J.-L. Hervas-Oliver et al., 2020; Jin et al., 2022). It is emphasised that “The reason for that pattern is based on the fact that process-oriented innovation goals include primarily cost reduction, an increase of productivity, flexibility and capacity, as well as reverse engineering, imitation, or incremental changes.” (Hervas-Oliver et al., 2020, p.415).

As such, “An important consideration for ecosystem firms should be to regularly examine the degree regulatory body in the cluster significantly influences the emergence of both inbound and outbound open innovation activities by member firms in the cluster initiative through increased effects of trust and information asymmetries strategy, and rapidly (re)configure to adapt to changing needs” (Aftab Alam et al., 2022, p.435). Nestle et al. (2019) also provide support for this conclusion, stating that cluster initiatives have been shown to result in a higher number of firms participating in open innovation activities if regulatory bodies are present in cluster initiatives due to an increase in trust and information asymmetries.

The success of these partnerships was found to require “mutual trust, and honest and open communication between SMEs and their stakeholders may improve the influence of absorptive capacity on knowledge sharing” (Tsai et al., 2022, p.435). This may lead us to conclude that the quality of innovation ecosystems can moderate the relationship between OI activities and SME performance. In addition, network partnerships were found to be more successful when member firms were in close proximity. (Albats et al., 2021; García-Muiña et al., 2019; Johnston, 2022; Johnston & Prokop, 2021).

3.4 Innovation climate: Proximity

Johnston (2022) posit that “Proximities capture the closeness of partners across several dimensions including physical distance or location (spatial proximity), network membership (social proximity), cognitive understanding (technological proximity), and similarity or working culture (organisational proximity) (Boschma 2005; Aguilera, Lethiais, and Rallet 2012; Balland, BelsoMartínez, and Morrison 2016).” (p.313).

According to García-Muiña et al.(2019), physical proximity enables face-to-face relationships, which, despite the onslaught of ICTs, are still indispensable for building partnership trust and commitment. The physical closeness allows member firms to

observe their effectiveness and organisational routines and trust building (Johnston, 2022; Leckel et al., 2020). A favourable cluster effect may result in the local employment market and have spillover effects among the cluster's members and cost-saving opportunities in local industries and products. (Aslesen & Harirchi, 2015; Kleine et al., 2022; Marzi et al., 2022; Nestle et al., 2019). In separate studies, Johnston (2022) and Johnston & Prokop (2021) found that SMEs located closer to a university were more likely to collaborate with the institution.

In contrast, other authors warn of limitations of too much physical proximity, which risk being “ed in” in local areas (Albats et al., 2020; Aslesen & Harirchi, 2015; Brink, 2018). Furthermore, alternatives were suggested. A longitudinal study carried out by Albats et al.(2020) suggests that virtual proximity is becoming increasingly important, which will reduce the importance of geographical proximity and even emphasise that geographical proximity can have a detrimental effect on causing too much lock-in within the local area.

3.5 Innovation climate: SME capabilities to capture value

Based on a study conducted on high-tech SMEs in emerging economies (China), Jin et al. (2022) find that SMEs adopt dynamic and flexible OI practices at different stages of new product development with various partners. The practice adopted varies with each stage and external partners involved. In addition, Jin et al. (2022) findings indicated that “... at the ideation stage, high-tech SMEs only adopt inbound open innovation with research institutes, universities, and customers for external basic research and innovative ideas, while at the manufacturing and commercialisation stages, SMEs adopt both inbound and outbound open innovation to speed up the NPD process, secure the market demand, and explore new markets.” (p.335).

Lin et al. (2022) found a positive correlation between competitor intelligence and product innovation for high-tech SMEs in emerging economies. In addition, it was found that the organisation's culture and its open-mindedness to external knowledge sources of information mediate the relationship between competitor intelligence and product innovation (Lin et al., 2022). As a result, it supports the assertion that organisational culture has a significant impact on open innovation adoption and success (Ahn et al., 2017; Jasimuddin & Naqshbandi, 2019; Mei et al., 2019; Milici et al., 2021; Nestle et al., 2019; Popa et al., 2017; Rosa et al., 2020; J. R. B. Silva et al., 2022; F.-S. Tsai et al., 2022; Zahoor et al., 2022). According to Rumanti et al. (2022), “... the acceptance level of new ideas within an organisation...” (p.03) is one of the tools that can be used to measure innovation and reflexivity. Due to the fact that innovation and reflexivity are dimensions of the innovation

climate, open-mindedness contributes to the improvement of the open innovation climate (Rumanti et al., 2022).

In another study by Arias-Perez et al.(2022), the authors found that the emotional capabilities of the organisation play an essential role in the success of the open innovation process. This is due to the higher levels of uncertainty involved, the volumes of information dealings and the level of risk assumed when opening up to the external environment (Arias-Perez et al., 2022; Bertello et al., 2022). A high level of emotional intelligence facilitates seamless interaction with external agents and alleviates the pressure of the process (Arias-Perez et al., 2022; Bertello et al., 2022).

3.6 Absorptive capacity

A company's absorption capacity is known as its ability to absorb new, external knowledge, integrate it, and use it in its operations for profitable objectives (Ahn et al., 2017; Aslesen & Harirchi, 2015; Gimenez-Fernandez et al., 2020; Heger & Boman, 2015; J.-L. Hervas-Oliver et al., 2021; Ho et al., 2016; Kleine et al., 2022; Manville et al., 2019; Radicic & Pugh, 2017; F.-S. Tsai et al., 2022; Vahter et al., 2014; Woods et al., 2022). A high level of absorptive capacity in SMEs promotes the adoption of open innovation (Aslesen & Harirchi, 2015; Candi et al., 2018; Gentile-Lüdecke et al., 2020; Heger & Boman, 2015; Jasimuddin & Naqshbandi, 2019; Marzi et al., 2022; Mei et al., 2019; Radicic & Pugh, 2017; Teirlinck, 2017; Vahter et al., 2014; Woods et al., 2022) and improves the position within the innovation network (Heger & Boman, 2015; Ho et al., 2016; Woods et al., 2022).

Having high academic qualifications among employees and managers improves the company's absorptive capacity (Ahn et al., 2017; de Marco et al., 2020; Edeh et al., 2020; Markovic et al., 2021; Mei et al., 2019; Santoro et al., 2020; Teirlinck, 2017).

Due to their small size, SMEs are predominantly managed by their owners(Santoro et al., 2020), and therefore the open innovation climate is directly affected by the experience (Ahn et al., 2017; Mawson & Brown, 2017), character, culture, behaviour and attitude of the CEO or top management (Ahn et al., 2017; Gentile-Lüdecke et al., 2020; Kim & Ahn, 2020; Santoro et al., 2020; Woods et al., 2022) Furthermore, these factors impact the company's network position (Woods et al., 2022).

According to A. R. D. Silva et al.(2021), leadership, planning, and processes were the key factors influencing SMEs' likelihood to participate in OI. It is important to note that these results are in agreement with the conclusions of earlier studies conducted b (Ahn et al., 2017) and (Santoro et al., 2020).

3.7 Innovation climate: SME support

It is crucial that governments encourage open innovation in SMEs through support, such as financial and legal assistance (Benhayoun et al., 2020; Benitez et al., 2022; Brink, 2017; de Marco et al., 2020; Edeh et al., 2020; Gentile-Lüdecke et al., 2020; Gimenez-Fernandez et al., 2020; Ho et al., 2016; Markovic et al., 2021; Pervan et al., 2015; Rumanti et al., 2022). Government support through policy intervention and financial aid can assist SMEs in overcoming some of the challenges associated with open innovation and be in a position to realise the benefits of open innovation (Gentile-Lüdecke et al., 2020; Gimenez-Fernandez et al., 2020; Ho et al., 2016; Pervan et al., 2015; Rumanti et al., 2022; Usman et al., 2018). With several studies point to the significant governmental role of assisting SMEs in narrowing the skill and knowledge gaps by aligning them with research centres and other key stakeholder partners' assistance (Benhayoun et al., 2020; Benitez et al., 2022; Brink, 2017; de Marco et al., 2020; Edeh et al., 2020; Gentile-Lüdecke et al., 2020; Gimenez-Fernandez et al., 2020; Ho et al., 2016; Markovic et al., 2021; Pervan et al., 2015; Rumanti et al., 2022), which will equip SMEs to take on essential roles within the innovation ecosystems (Pervan et al., 2015; Usman et al., 2018).

In this context, governments can provide publicly funded research centres and universities suited for equipping SMEs in bridging research and skills gaps (Usman et al., 2018).” As such, by providing SMEs with access to core knowledge relevant to their fields of business, helping them to digest this knowledge, and by educating them with respect to how to integrate this know-how into their innovation processes, governments help small firms build up their absorptive capacity, which is crucial for successful OI” (Usman et al., 2018,p.23).

Johnston & Prokop (2021) suggest that higher numbers of employees and export revenues positively influence the propensity to collaborate with a university. In addition, “collaborating with organisations such as private laboratories and public sector research institutes increases the propensity to engage in university collaboration.”(Johnston & Prokop, 2021, p. 298). However, the issue of proximity was raised as an impediment by Johnston (2022) in a separate study, which demonstrated that a successful SME-university collaboration requires” ... both access (through social proximity) and understand (through technological and organisational proximity) their university partners”. (p. 310).

In contrast to the government financial support suggested by other scholars, Pervan et al. (2015) found that financial support from the government did not significantly impact the innovation process of SMEs based in Dubai. Furthermore, in the same study, Pervan et al.(2015) research results indicated that SME-university collaborations did not significantly impact SMEs and their innovation process, contradicting extant literature.

In another study by de Marco et al.(2020), it was found that “SMEs awarded the grants are less engaged in the challenging dimensions of Open Innovation than companies that did not receive any funding.” (p.1). Additionally, a separate study undertaken by Kleine et al.(2022) found that the impact of the innovation voucher program is short-lived and temporary and described the intervention as “... an immediate, short-term impact on the execution of these innovation projects with positive effects...” (p.1). Kleine et al.(2022) further suggest that in the long-term, the impact of innovation vouchers loses its influence and strength and within two years after the intervention, their results also would agree with de Marco et al.(2020).

While other studies have emphasised the liaising role of governments where SMEs are assisted in identifying and connecting with the right partners by setting up hub-based innovation ecosystems (Gentile-Lüdecke et al., 2020; Usman et al., 2018) and ensuring these ecosystems are healthy.

Chapter 4: Discussion of literature review

This study shows that open innovation in SMEs has received vast empirical attention in the last decade. The studies are concentrated and not scattered across geographical areas, and there is limited focus on emerging economies and low-tech industries (Albats et al., 2021; Bayona-Saez et al., 2017; Spithoven et al., 2013; Usman et al., 2018; Vanhaverbeke et al., 2012).

Small and medium enterprises (SMEs) and open innovation are two concepts that contribute to the phenomenon of open innovation in SMEs. The concept of open innovation is the primary construct, and SMEs were viewed as an appropriate context for the review. Consequently, our approach was to examine the literature separately on the two constructs. Throughout our review, we captured definitions and criteria used to identify each construct based on literature, including historical trends and significant discoveries where possible. Initially, each construct was discussed independently, allowing the richness of literature to be appreciated and given the importance it deserves as a phenomenon. As described in the methodology section, we have identified only papers published in journals ranked three and above, according to the Academic Journal Guide (AJG2021). This protocol has been selected in order to guarantee that we have a high-quality sample of data, thus ensuring the credibility of the source data.

Essentially, the plan was to include the construct as it was conceptualised initially, the current and most recent developments, and the futurist advancements on open innovation. For this reason, the selected articles are meant to best capture the three stages to get a sense of the chronology of open innovation and the anticipated developmental trajectory of the phenomenon. This was our first research focus to understand better what has been done in the open innovation research field.

It was also important to keep parts of one of the most influential textbooks in the field since it is seminal and contains the earliest definition of the construct in its original form, and it is cited by most of the articles I have engaged. By engaging with literature, we could identify that the open innovation practice existed before Chesbrough first coined the term in 2003 (Popa et al., 2017).

As the second research focus, we examined the SME context. One of the findings was literature indicating that different regions use different criteria for determining the size of SMEs, and among other things, the concept has many complexities (Albats et al., 2021). As a result, caution should be exercised when generalising a particular study's results to all regions.

On our third research focus, we then examined open innovation within the context of SMEs. The discussion was now restricted to the open innovation benefits and challenges faced by SMEs and examining the existing literature on open innovation in small and medium enterprises (SMEs).

Further engaging the literature from our sample suggested that OI provides a mechanism for entrepreneurs and SMEs to create and commercialise innovations (Albats et al., 2021; Brink, 2017; Gentile-Lüdecke et al., 2020; Gimenez-Fernandez et al., 2020; J.-L. Hervas-Oliver et al., 2020, 2021; Kim & Ahn, 2020; Livieratos et al., 2022; Mawson & Brown, 2017; Mei et al., 2019; Pervan et al., 2015; Popa et al., 2017; Radziwon & Bogers, 2019). Research on the OI phenomenon has grown and developed over the years innovations (Albats et al., 2021; Brink, 2017; Gentile-Lüdecke et al., 2020; Gimenez-Fernandez et al., 2020; J.-L. Hervas-Oliver et al., 2020, 2021; Kim & Ahn, 2020; Livieratos et al., 2022; Mawson & Brown, 2017; Mei et al., 2019; Pervan et al., 2015; Popa et al., 2017; Radziwon & Bogers, 2019). It further provides antecedents and research gaps that need further research (West & Bogers, 2017). There is a knowledge gap in understanding the relationship between IO and performance (Popa et al., 2017; Radziwon & Bogers, 2019)

Only recently has SME OI received attention from scholars to fill the research gap, but other aspects are still veiled (Hervas-Oliver et al., 2021; Popa et al., 2017; Radziwon & Bogers, 2019). However, according to Popa et al. (2017), "... an increasing number of firms, especially SMEs, are relying more on external information and research collaborations in order to innovate and gain competitive advantage" (p.134). Additionally, little attention has been paid to the relationship between OI and performance in SMEs (Popa et al., 2017). Furthermore, research on the factors that motivate or deter SMEs from pursuing OI practices is also lacking (Popa et al., 2017). Therefore, further OI and SME studies are necessary (Hervas-Oliver et al., 2021).

In the fourth research focus, we brought forward a debate and discussions that have been addressed and investigated in our sampled articles. Due to research on open innovation in SMEs having started in the past decade (J.-L. Hervas-Oliver et al., 2021; Popa et al., 2017; Radziwon & Bogers, 2019), the discussion is still around the innovation climate conducive to innovation performance. Our fourth research focus therefore examined and analysed the innovation climate. Following engagements with literature, a discussion of those factors that are external and internal were addressed and investigated by scholars. As a result, the fourth research focus was divided further into subsections, following the factors literature covered on the innovation climate.

The research focus was in line with our research objectives. The review aimed to answer the following review questions:

1. What is scholarship saying about the nature of open innovation in SMEs?
2. What is scholarship saying about the proclivity of SMEs embracing OI practices?

Our research focuses examined and analysed the selected literature to ensure that the research questions are as detailed as possible. The innovation climate is an overarching topic that covers all factors that promote and discourage the adoption of the open innovation process.

Our research focuses one, two and three covered the first research question of examining the current and most recent literature on open innovation in SMEs. In addition, research focus four supplemented the interrogation of the nature of open innovation in SMEs by providing salient features that affect the nature of the phenomenon under review.

Our second review question looked at the level of SMEs embracing open innovation as an innovation management tool and the factors affecting their choice to adopt or not. Research focus four provided the most in terms of information gathering and responding to the second review question. However, research focuses one, two and three also provided supplementary information.

The findings from our review provided a guide for the position of research within the OI field and have assisted us in refining the review questions (Snyder, 2019). It provided a thorough scan of the OI research landscape and ensured that our research project remains part of an ongoing discussion within the field (Snyder, 2019).

4.1 Contributions

The structured literature review provides an overview of the literature in the specific context of SMEs, which contributes to the theory by providing an in-depth understanding of open innovation. The review identifies areas that need further research, providing a birds-eye view of the field for future research. In addition, the article outline a potential framework that other academics may use as a guide when adding to the theory on open innovation or searching for areas of research that need to be explored. The results of the study may contribute to practitioners' decisions when selecting OI strategies and practices. Practitioners are provided with a number of options that can assist when considering and implementing open innovation, and what could be the outcome when this approach is adopted.

The location of where the current research phenomenon is still concentrated within Europe, see Fig.3. The research needs to be extended to other geographical regions to ensure

Also apparent was that previous studies have focused on companies in developed countries; this was also well captured by some of the literature review articles that were part of the sample. OI research is dominated by studies in innovative firms (Rosa et al., 2020) and predominately from developed countries. On the other hand, firms operating in emerging economies have a relatively harsher business environment, often lacking support infrastructure (Barnard et al., 2017). Therefore, a study of OI in SMEs within emerging economies context would shed some light on the nuances, around the mixed results on the open innovation outcomes and the open innovation practice, given the different setup it presents.

Our keyword search and strings. When looking at the three review questions, our sample contained more articles discussing OI and performance than the other two review questions. Furthermore, all the articles engaged have their research conducted within developed countries with minimal constraints relative to the context of what our main research project would be looking at. From the scoping study that we conducted using Google Scholar, out of interest, we extended our google search term to “open innovation in Africa”. The google scholar search results were astonishingly above 2.8 million, none of which was part of the current sample. The realisation of such made us contemplate a revision of our review protocol.

The command to limit the search results to include finding within SMEs, though it has assisted in narrowing our search, may have denied us the opportunity to be exposed to literature discussing open innovation and firm or innovation performance for larger firms. The discussion may be valuable, especially considering that open innovation research in the context of SMEs is lagging behind and relatively not given much attention in the past (Radziwon & Bogers, 2019).

Our focus on one database, Scopus, for data sourcing proved to work to our advantage at this stage. The decision has helped us to deal with a manageable sample size of high-quality data. It saved time from having to check for data duplications where more than one database is used. We are mindful of the probable exclusion of valuable data from other databases, but we were able to have a final sample greater than 50.

Overall the review conducted was beneficial to our study. However, our other concern is whether the results reached as far as the leading scholar would the replicated given the

data analysis method conducted from the scoping study conducted at the initial stage. The open innovation research field is very broad, as shown by the more than 4.5 million search results on Google Scholar. Without putting a lot of limitations on the search commands, there may be many data to work with and, therefore, risk of being unable to manage it.

Chapter 5: Conclusion

The review's objective was to examine the body of literature seeking to understand the scholarship position on the open innovation (OI) research field and narrow it within the context of small and medium enterprises (SMEs). Hence our goal in this review is to map and synthesise the field of OI, to eventually have a comprehensive position on what scholarship position on the nature of open innovation in SMEs, open innovation and firm or innovation performance and the proclivity of SMEs embracing OI practices.

Regarding the theory applied to anchor studies conducted, resource-based views (RBV) and absorptive capacity appear to be more prevalent than the other theories in the dataset. The RBV theory has been used as a lens for the study in approximately 18 articles, while the absorptive capacity theory has been employed in seven articles. In order to have a well-rounded theory of open innovation, a broader range of available scientific theories must be used in various studies. This will also assist the maturity of the OI theory.

Open innovation as a practice existence depends on collaborations with external partners and the availability of an innovation network or ecosystem. OI practice involves human interaction between internal and external parties. The OI process requires relationship management and human resource management. It is, therefore imperative that future research be more engaged with network, clan, and cluster theory. In order to refine the interactions within innovation networks. As highlighted during the review, issues of trust and regulation signalled that more should be done in future research. Our study highlights the need for future studies to focus on the impact of formal regulations within the innovation network or ecosystems. SMEs, because of a lack of resources and absorptive capacity it becomes difficult to secure a favourable position within innovation networks (Woods et al., 2022). There is a real need to assure trust and reliability among network members, and the results will inform policymakers and therefore alleviate the challenge for SMEs of investing in resources to evaluate innovation networks prior to engagement. The result would also add to the existing body of knowledge that looked at government support in the open innovation context.

Additionally, the literature reviewed does not discuss the strength/health of innovation networks or ecosystems. In particular, proximity to network members implies a lock-in risk, which could result in a burden and loss of resources to SMEs (Albats et al., 2021; Aslesen & Harirchi, 2015; Brink, 2018). The study aims to contribute to practitioners in different OI dimensions. Future studies should focus on determinants of healthy innovation networks or ecosystems. In addition, the impact of the strength/health of the

innovation ecosystem on the relationship between open innovation practices and firm performance should be examined. The information will assist practitioners in crafting open innovation strategies when selecting and evaluating innovation ecosystems and ensuring eventual choices results in favourable firm performance. Managers will have relevant insights into selecting a healthy innovation network or ecosystem.

Furthermore, how the health of the innovation ecosystem impacts the relationship between the open innovation practices, decomposed into when accessing external knowledge (inbound) or commercialising the internal technologies (outbound), and overall profitability. The findings will shed light on national/ governmental policy drafting regarding the support and strategy around the innovation communities if their intervention is required. Empirically, the findings will first provide a clear framework and model for healthy innovation networks or ecosystems. In addition, gather information about the antecedents and moderators of a healthy innovation network, thus adding to the body of literature. Moreover, outline the benefits of belonging to a quality (healthy) innovation ecosystem for SMEs.

The innovation process is riddled with uncertainties; therefore, those involved at any level are affected mentally and emotionally as they participate in the process (Arias-Perez et al., 2022; Bertello et al., 2022; Marzi et al., 2022). Further research on using Daniel Goleman's emotional intelligence theory to look into the impact of emotional intelligence on innovation performance. It would also add value to exploring the mediation of variables such as emotional intelligence intervention in the relationship between OI and SMEs' innovation performance. The use of other theories outside organisational theory will further ground the open innovation theory, widening its reach. The practitioners will be provided with practical information and tools to manage the innovation process within the open innovation context.

Our review found contradicting findings on government support in the form of financial assistance and its impact on the innovation process of SMEs(de Marco et al., 2020; Kleine et al., 2022; Pervan et al., 2015). The study should be revisited further to examine the determinants and moderators of the relationship between financial assistance for innovation and innovation performance within SMEs. It may also require similar research in a different regional setting since the three studies were undertaken in the Middle-east and Europe. Governments are eager to support and promote their SMEs, and grants and vouchers are a common form of support. Therefore the confirmation of a solid scientific theory on the impact of such support will assist in policy-making and also inform SME strategic planning. The contradictions in academic results that cannot be explained

suggest that more research is required and that the existing literature is not mature enough. Therefore, there is a need to further contribute academically to the phenomenon.

Lastly, in response to the literature reviewed. Future research should focus on unravelling “the different innovative strategies based on a distinct mixture of external sources to innovate and also show how open innovation is linked to SME performance”(Hervas-Oliver et al., 2020, p.411). As a means of providing additional information on the different dimensions of open innovation in SMEs that are still lacking (for example, Bogers et al., 2017; Brunswicker & Vanhaverbeke, 2015; Radziwon & Bogers, 2018). Dimensions include low-tech industries, studies at a level of analysis other than the firm level, studies extended to other regional settings and more studies within emerging economies context. Overall, the study must present new in-depth insights on the impact of moderators that, based on our knowledge, have not been tested empirically, extending knowledge on SME open innovation.

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