

Open Innovation Strategy in Goods Manufacturing and Service Industries

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Abstract

Globalization and digitalization have increased the necessity for open innovation (OI) as a strategy for businesses to understand customers' needs better. The OI paradigm has gathered importance in academic research and industrial applications. Simultaneously, both goods manufacturing and service industries have been invested in OI in order to improve productivity and meet market demands. Considering this interest, this paper aims to synthesize findings, outline the focus application of OI within the goods manufacturing and service goods research domain, and suggest a future research agenda. Our analysis reveals that in the literature, OI in the manufacturing sector has tendencies to adopt both inbound and outbound OI in their practices. Meanwhile, service industries are inclined to adopt inbound OI than outbound OI.

Keywords: *Open innovation; manufacturing industry, service industry, systematic literature review*

INTRODUCTION

Open innovation (OI) is a type of collaborative innovation process in which external players share information and resources (H. W. Chesbrough, 2003). Outside-in activities and inside-out activities are the two forms of OI activities in general (H. Wi. Chesbrough et al., 2006). External partners, like suppliers, customers, competitors, consultants, research institutes, universities, or governments, are used to gain and explore knowledge through outside-in operations (Cheng & Huizingh, 2014). Inside-out activities include activities that include the external exploitation of internal ideas, such as licensing out, selling knowledge, and selling off pieces of a company (Lichtenthaler & Ernst, 2009). Early OI researchers such as Chesbrough focused mainly on the organizational changes and business strategy associated with 'open innovation', paying little attention to the role of new technologies in supporting OI. Meanwhile, recent authors highlighted the role of information and communication technologies in supporting the shift toward collaborative networks and more OI practices. Enabling firms to work across organizational and geographic boundaries (Aloini et al., 2020; Dodgson et al., 2006; Pavitt, 2003). Information and communication technology (ICT) as part of digital infrastructure has played a key role in enabling firms' OI activities through its ability to identify and connect potential partners, customers, and suppliers for purposes of commercial exploitation (Dodgson et al., 2006), supporting OI through data generation, data sharing, and data storage that could impact how firms manage their information or knowledge across boundaries (Aloini et al., 2020).

OI has received increasing attention in scientific research. However, it has mainly been used to conduct studies in small and medium enterprises (SMEs) as several authors have identified OI as

a crucial strategy to overcome SMEs' weaknesses such as resource (time, finance, etc.), practical constraints (complementary assets, commodity pressure, etc.), and skill gaps (Crema et al., 2014; S. Lee et al., 2010; Sikandar & Abdul Kohar, 2022; Usman et al., 2018; Vahter et al., 2015; Virlée et al., 2015b); or focus on very specific industries, for example, open-source software (Henkel, 2006) or table to role-playing games (Lecocq & Demil, 2006). The adoption of OI in the service industry (Virlée et al., 2015b) and goods manufacturing (Obradović et al., 2021) has been studied separately.

A previous study (Bogers et al., 2016) demonstrates that from several empirical findings, the effectiveness of OI in terms of its implications for innovation and firm performance varies at their respective level of analysis and is context-dependent. Given the complex nature of OI studied at the industry level, due to its higher levels of both R&D intensity and uncertainty, they are considered interesting environments for firms to experiment with OI and to share knowledge, costs, and risks of uncertain innovative projects. In industries, production systems and product design can be decomposed into separate components, which create environments where innovations can happen quasi-independently. This characteristic is called industry modularity. It creates flexibility that enables firms to use multiple inputs from different sources throughout the innovation process (Schilling, 2000). Lastly, firms in industries are characterized by broader knowledge across their boundaries, with certain industries having knowledge that is more concentrated or distributed than others (Lakhani et al., 2013). This leads to the need for research to gain a better understanding of industry-specific conditions for OI (Bogers et al., 2016). The present study addresses this gap by focusing on the industry level, dividing it into two categories: services and goods manufacturing.

It is particularly intriguing to investigate how manufacturing and service organizations adopt OI strategies and take advantage of them in different ways. By conducting this study, we aim to add to the limited body of knowledge on OI approaches at the industry level and provide insight into potential distinctions between the application of these methods in services and manufacturing. To our knowledge, this is one of the first works to specifically address the latter objective. We present a complete picture of the use of OI practices in services, as well as how OI contributes to their innovative performance. We compare the results to OI approaches in services and goods manufacturing to better understand the variations between the two industries. Separating services from manufacturing is required to uncover the differences and specific tendencies to innovate.

Studies in OI literature have found different applications and behavior patterns by firms. The approaches adopted by firms in the implementation of OI were different depending on their characteristics (S. Lee et al., 2010). However, literature on OI application in various products produced by the firms, whether they were focused on goods or services, is limited. Given that idea, this study seeks to provide light on the distinction by addressing the following research question: what are the applications of open innovation in goods manufacturing and service industries?

The structure of the paper is as follows. We address the theoretical features of OI in Chapter 1 regarding the function of industry types. The literature review is discussed in Chapter 2, followed by the methodology of the research as described in Chapter 3. Then, Chapter 4 presents the findings of the bibliography technique and how the results relate to the theoretical context. The conclusions and directions for future study are presented in Section 5. At the same time, limitations are stated in Chapter 6.

LITERATURE REVIEW

2.1 Product: goods and services

While most people intuitively know the difference between a product and a service, the term 'goods' and 'products' appear to be used interchangeably in many works of literature. Goods have exchangeable value (Smith, 1791), and one of the characteristics of a good is that its ownership rights may be formed and transferred. Goods are material objects, which means they are substantial and have physical dimensions. While the definition of "goods" was established, the definition of service has never reached a consensus (Parry et al., 2011). Hence, it is hard to obtain full acceptance of the clear distinction between goods and services from literature. Service is defined in business as an aggregation of involvement with one or more service actions between two or more service systems that result in service outcomes. In economics, service means the non-material equivalent of good in economics and marketing within a service-product continuum. To fit in this literature review context, we used the term explained (McConnell et al., 2010): "*a service is an intangible act or use for which a customer, firm, or government is willing to pay.*"

The term 'Product/Service-System' or PSS has gotten popular and is still considered a growing field of research and industry practice, with the intentional and designed combination of products and services at its core. Given the history of the field, many researchers have tried to define PSS. A prior study by Haase et al. (2017) with the aim to characterize PSS from its 52 different definitions and associated concepts identified from 47 of the most prominent papers in the PSS literature resulted in a conclusion: no universal PSS definition has yet been agreed upon within the field. But the authors suggested that there are two characteristics that are glued to the PSS definition: the element of 1) product and services and 2) satisfaction of consumer needs. They also stated that further study to understand the associated PSS terms on an individual basis is needed to enable a more detailed conclusion. While PSS is interesting to study because of its growing relevancy that has become important with the growth of innovation and business competition, a study to gain a deeper understanding of what are the drivers of focus in OI practices of the service industry and goods manufacturing stand-alone is needed to fill the gap and enrich the findings in the research field.

2.2 Open innovation paradigm

The strategic management and innovation literature traditionally approached new product development as an inherently closed process (Schumpeter & Stiglitz, 1942). However, many business scholars recognized that valuable ideas and technologies might originate outside large firms' boundaries and reside within research institutions (Y. S. Lee, 1996), business clients or end-users (Hippel, 1988), and even in smaller firms (Zoltan J. Acs & David B. Audretsch, 1988). Chesbrough (2003) then observed that large technology firms source their external environment for emerging ideas or technologies, as well as for external opportunities to enhance their own knowledge through "purposive inflows and outflows of knowledge" to accelerate internal innovation and expand the market for external use of innovation. This interaction with external parties in the innovation process coined the term 'open innovation' or OI, which contradicts the traditional 'closed' view elaborated earlier (H. W. Chesbrough, 2003; Gassmann, 2006). Since Chesbrough's (2003) seminal work, interest and awareness of OI topic have increased exponentially.

Firms adopt the OI methods to establish successful innovation strategies (Zhu et al., 2019). It has become an integral part of firms' business models in recent years due to several circumstances, such as the reduction of the product life cycle, the rising cost of research and development (R&D), and the intensification of global competition (Crema et al., 2014). Firms require external help (West & Bogers, 2014), critical knowledge, and the discovery of new ways to get and/or produce knowledge in the conception, construction, and implementation of innovative ideas (H. Chesbrough & Bogers, 2014; Gatzweiler et al., 2017) (Gatzweiler et al., 2017; Bogers et al., 2016). According to Chesbrough and Bogers (2014), organizations must be open to and eager to embrace external knowledge in order to be truly innovative.

2.3 Inbound and outbound open innovation

Implementation of OI practices can be divided into inbound and outbound open innovation (H. Wi. Chesbrough et al., 2006; Oliver Gassmann & Ellen Enkel, 2004). Inbound OI is linked to exploring and integrating external resources for internal development through networking, inter-firm collaboration, licensing, and customer involvement (H. Wi. Chesbrough et al., 2006; Parida et al., 2012). Firms can obtain access to complementary or unique resources needed but can be expensive because it requires time, money, and the ability to effectively utilize external resources (Bapuji et al., 2011; Oliver Gassmann & Ellen Enkel, 2004). On the other hand, outbound OI refers to the process of internal development by using an external path to market (H. Wi. Chesbrough et al., 2006; Parida et al., 2012) and possesses either monetary, strategic, or both (Lichtenthaler & Ernst, 2007). This process can be risky because it involves disclosing a firm's expertise to a partner, which could strengthen a competitor's market position (Rivette & Kline, 2000). It is reported that firms more frequently adopt inbound OI than outbound OI (Van Der Meer, 2007; Virleée et al., 2015b). Some firms implemented both simultaneously (Virleée et al., 2015b). The chosen OI practices' determinants are important to be studied because the context can influence a firm's decision (Gardet & Fraiha, 2012). Prior studies focused more on the type of partners involved rather than how these practices were adopted. Furthermore, this study attempts to understand why some practices are adopted by service industries or goods manufacturing and others are not.

The literature review represents the theoretical core of an article. The purpose of a literature review is to "look again" what other researchers have done regarding a specific topic. A literature review is a means to an end, namely, to provide background to and serve as motivation for the objectives and hypotheses that guide one's own research. A good literature review should not merely provide a summary of previous relevant research; the researcher is also expected to critically evaluate, re-organize, and synthesize the work of others.

RESEARCH METHOD

This study used Denyer and Tranfield (2009)'s five-step process, which included a pilot search in the first phase to obtain a better grasp of the present literature, develop criteria for literature selection, and derive the research question and future steps. As a result, the five phases of the systematic review that we used are depicted in Figure 1.

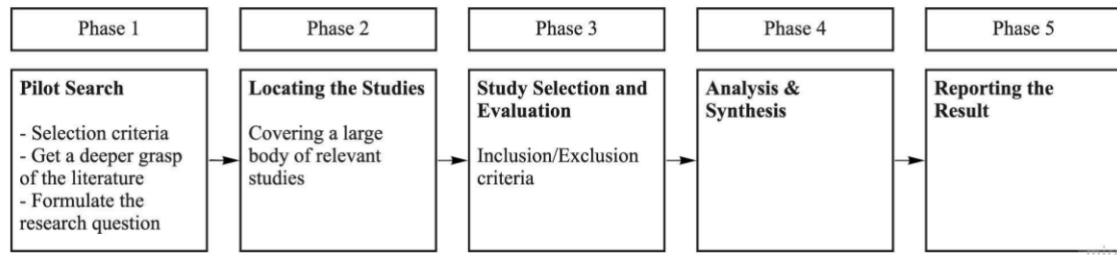


Figure 1. Research Process of Literature Review

3.1 Search strategy

We conducted a literature review to gather all relevant studies that met the pre-specified eligibility criteria in answering the research questions. As part of the first step, a pilot search was done to grasp the field and the current literature better. We found the literature sources by looking at the results of a specific search query with focused keywords such as “open innovation” as the first string, and “services” or “manufacturing” on the second search string.

3.2 Locating the studies

The next step was to locate the publications and conduct a practical screening. We chose the search engine(s) and search strings to find the relevant studies. Given that we needed databases that provided broad access to a considerable amount of relevant literature during a given time, we chose one database with extensive coverage of the peer-reviewed literature relevant to our research question: Scopus. This database was searched using search terms that particularly sought contributions related to the topic.

3.3 Study selection and evaluation

In this systematic literature review, only research articles were included, while conference papers, proceedings, books, company reports, and news articles were excluded. This ensured that only peer-reviewed publications were considered. Moreover, we excluded studies that were not in English, and not in the Business & Management field. Finally, we analyzed research articles that provided open access and were published between 2012-2022 for novelty reasons. This resulted in the identification of 34 papers consisted of publications in the service industries (Table 1) and goods manufacturing (Table 2). The flow of articles selection conducted is presented in Figure 2.

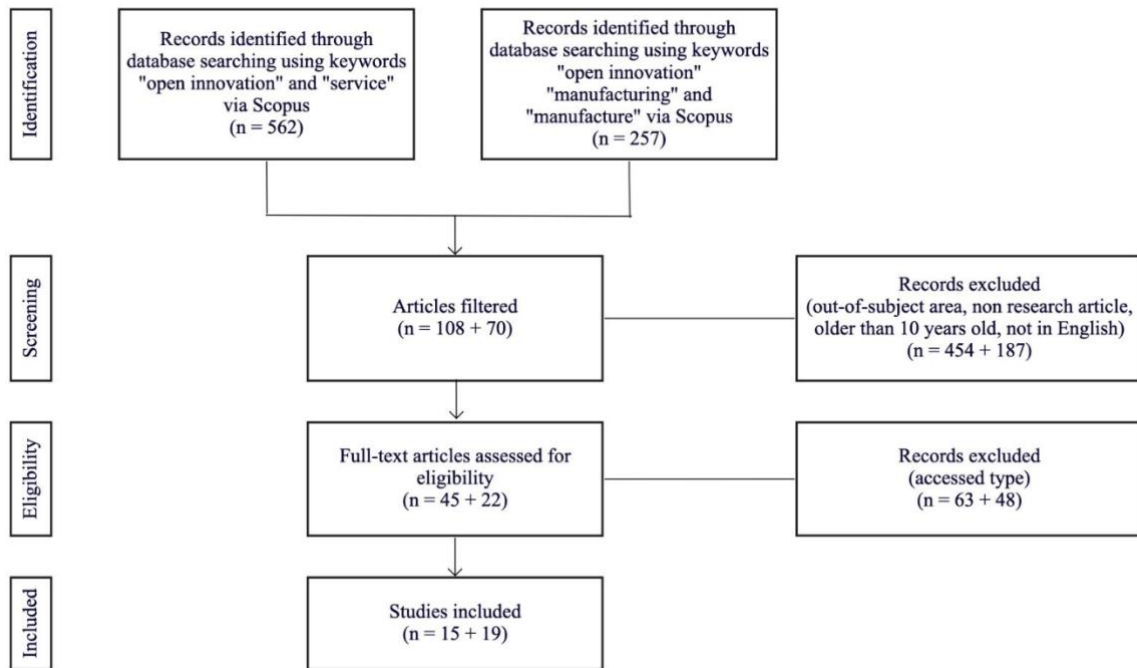


Figure 2. Diagram Flow of Studies Included in the Systematic Literature Review

3.4 Analysis and synthesis

All articles that were studied relevant were subjected to descriptive and thematic analysis. A deductive strategy was used in the descriptive analysis, which focused on categorizing papers by year of publication, journal of publication, methodology used, region, and industry addressed (if any). The theme analysis, on the other hand, was aimed to characterize the phenomena of OI and was more inductive in nature. Our objectives were to explore the use of OI in the services and manufacturing company and to identify the research gap that can be further investigated in the future avenue.

3.5 Reporting the result

The findings of this study are presented in the form of tabulations, data, and comments with an academic audience in mind. The findings and discussion section includes summaries of the reviewed literature (Denyer & Tranfield, 2009), highlighting what is known and what is unknown regarding the application of OI in the company.

FINDINGS AND DISCUSSION

4.1 Descriptive results

After compiling a selection of relevant publications, the data analysis and synthesis process begins. The final database includes information such as the author, year of publication, journal, applied methodology, and region. The database of the results allowed the extrapolation of some interesting information, even at a general level. First, the annual distribution of articles reveals that the subject was of less importance before 2020, with only 15 articles obtained, and the article frequency peaked at 19 articles from 2020 to 2022, as shown in Figure 3. The growing number of

articles published in recent years shows that OI topics are becoming an interest among researchers. Secondly, services engage in more OI practices than goods manufacturers (Mina et al., 2014). However, our study found the opposite result, as there were more articles studying OI practices in goods manufacturing than services in 2012-2022.

Table 1. Review of Publications in Service Company

No	Author, Year	Journal	Methodology	Region
1.	(Patroni et al., 2022)	Information and Management	Qualitative	Australia
2.	(Fuglsang & Hansen, 2022)	Research Policy	Qualitative	Europe
3.	(Vincenzi & Cunha, 2021)	Innovation and Management Review	Qualitative	Brazil
4.	(Adikari et al., 2021)	International Journal of Information Management Data Insights	Qualitative	Australia
5.	(Lakomaa & Sanandaji, 2021)	Research Policy	Quantitative	Europe
6.	(Ovuakporie et al., 2021)	Research Policy	Quantitative	Europe
7.	(Lütjen et al., 2019)	Journal of Business Research	Mixed-Methods	Europe
8.	(Iglesias-Sánchez et al., 2017)	Tourism Planning and Development	Quantitative	Europe
9.	(Gómez-Limón & Sanchez-Fernandez, 2010)	Technology in Society	Qualitative	Europe
10.	(Virlée et al., 2015a)	Journal of Innovation Management	Qualitative	Europe
11.	(Liedtke et al., 2015)	Journal of Cleaner Production	Qualitative	Europe
12.	(Martovoy et al., 2015)	Journal of Technology Management and Innovation	Quantitative	Europe
13.	(Sato, 2014)	Journal of Technology Management and Innovation	Qualitative	Europe
14.	(Mina et al., 2014)	Research Policy	Quantitative	Europe
15.	(Battisti, 2012)	International Journal of Services, Technology, and Management	Qualitative	Brazil

Table 2. Review of Publications in Manufacturing Company

No	Author	Journal	Methodology	Region
1.	(Visnjic Kastalli & Van Looy, 2013)	Journal of Operations Management	Quantitative	Europe
2.	(Love et al., 2014a)	Strategic Management Journal	Quantitative	Europe
3.	(Visnjic et al., 2018)	Technovation	Qualitative	n/a
4.	(Love et al., 2014b)	Research Policy	Quantitative	Europe
5.	(Roper et al., 2013)	Research Policy	Quantitative	Europe
6.	(Beltagui et al., 2020)	International Journal of Production Economics	Qualitative	Europe
7.	(Vahter et al., 2015)	Industry and Innovation	Quantitative	Europe

8.	(Zhang et al., 2018)	Journal of Engineering and Technology Management	Quantitative	China
9.	(Bagherzadeh et al., 2020)	IEEE Transactions on Engineering Management	Quantitative	US & Europe
10.	(Magistretti et al., 2019)	Industry and Innovation	Qualitative	Europe
11.	(Li-Ying et al., 2018)	Technological Forecasting and Social Change	Quantitative	Europe
12.	(Aryan et al., 2021)	Creativity and Innovation Management	Qualitative	Europe
13.	(Wang & Islam, 2017)	Frontiers of Business Research in China	Qualitative	Europe
14.	(Woods et al., 2022)	IEEE Transactions on Engineering Management	Mixed methods	Europe
15.	(Bocquet & Dubouloz, 2020)	Journal of Innovation Economics and Management	Quantitative	Europe
16.	(Stanisławski, 2021)	International Journal of Innovation and Learning	Quantitative	Europe
17.	(Tani et al., 2022)	European Journal of Innovation Management	Qualitative	Europe
18.	(Rintala, 2021)	International Journal of Business Innovation and Research	Quantitative	n/a
19.	(Vlasova & Roud, 2020)	Foresight and STI Governance	Quantitative	Europe

The analysis showed that 52.9% are quantitative in nature, 44.1% of the articles are in the qualitative form, and the rest is in mixed methods. The articles were created in various geographical regions. As shown in Figure 5, 27 of the articles (79.4%) were from Europe, 2 papers (5.89%) were from Australia, 2 papers (5.9%) were from America, 1 paper (2.9%) was from Asia, and the remaining 2 (5.9%) were not identified. The highest proportion is from Europe. This may be connected to the Innovation Union Flagship Initiative of the Europe 2020 Strategy (European Commission, 2007), which encourages the adoption of OI practices by EU businesses for them to play a significant role in the present Global Networks of Innovation. This also explains why most of the studies were conducted during and after 2020. Embracing an OI culture in Europe has had tangible benefits, including accelerated rates of collaboration between businesses and research institutions in close-to-market innovation processes, the adoption of intellectual property rights for their full exploitation through technology markets, and the inclusion of consumers and citizens in the process of knowledge creation.

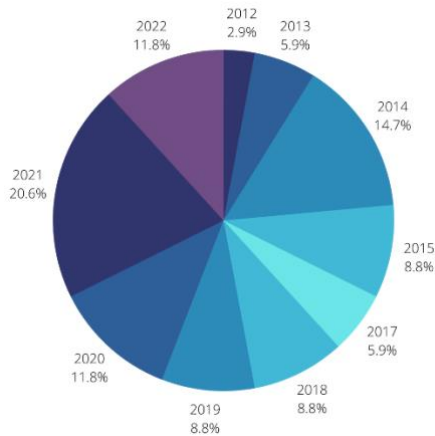


Figure 3. Year of Publication

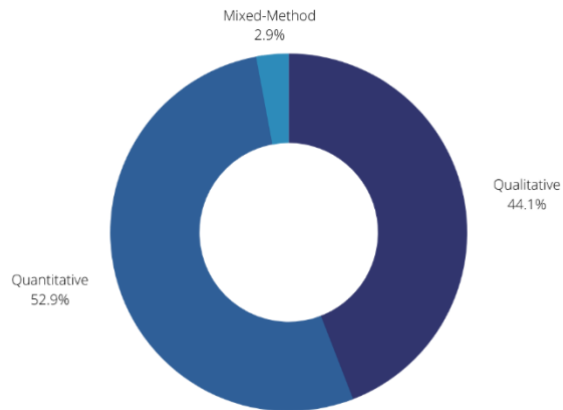


Figure 4. Research Methodology Used

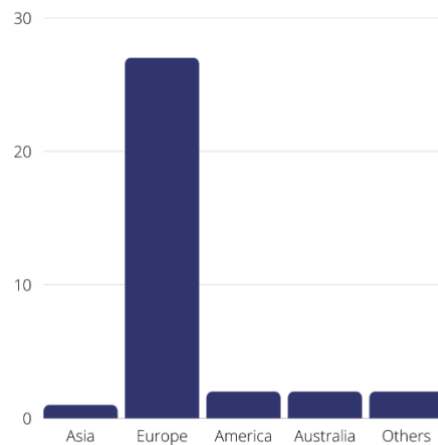


Fig 5. Region of Publication

4.2 Open innovation practices

In order to synthesize OI practices in the services and goods manufacturing fields, the descriptors are arranged into two major categories: inbound and outbound OI (H. Wi. Chesbrough et al., 2006; Oliver Gassmann & Ellen Enkel, 2004). The descriptors' categorization facilitates a better understanding of OI in the intellectual structure of services (Virlee et al., 2015b) and goods manufacturing (Obradović et al., 2021) fields as it follows the practices of previous literature reviews. The literature has diverging findings on the focus and application of OI in the goods manufacturing and service industries.

Table 3. The Use of OI in Manufacturing and Service Company

Type of Industry	OI practices	OI activities	Studies
Goods Manufacturing	Inbound	<ul style="list-style-type: none"> Value creation Integration of service to the core product offering Managerial innovation Vertical cooperation Supply chain innovation 	Visnjic et al., 2013 Visnjic et al., 2018 Bocquet & Dubouloz, 2020 Vlasova & Roud, 2020 Rintala, 2021 Woods et al., 2022

			Tani et al., 2022
	Outbound	<ul style="list-style-type: none"> • External collaboration • External innovation • Knowledge exchange • Technology acquisition • Community-driven innovation • Vertical cooperation • Open-source design (3D printing) 	Roper et al., 2013 Love et al., 2014 Love et al., 2014 Vahter et al., 2015 Wang & Islam, 2017 Zhang et al., 2018 Li-Ying et al., 2018 Magistretti et al., 2019 Bagherzadeh et al., 2020 Beltagui et al., 2020 Vlasova & Roud, 2020 Aryan et al., 2021 Stanislawski, 2021
Service Industry	Inbound	<ul style="list-style-type: none"> • Customer Insight • Value co-creation • Ideation • Firm Performance • Business Capability • Problem Solving 	Patroni et al., 2022 Adikari et al., 2021 Lütjen et al., 2019 Battisti, 2012 Liedtke et al., 2015 Fuglsang & Hansen, 2022 Fernandes et al., 2017 Vincenzi & da Cunha, 2021 Ovuakporie et al., 2021 Sato, 2014 Iglesias-Sánchez et al., 2019 Lakomaa & Sanandaji, 2021 Martovoy et al., 2015 Virlée et al., 2015 Mina et al., 2014
	Outbound	N/A	N/A

Service businesses, as opposed to manufacturers, are more likely to employ inbound OI techniques (Table 3). We argue that some fundamental service delivery aspects may help explain some of these preferences. For instance, formal protection of services is challenging due to their intangibility, whereas patent utilization is often connected with outbound activity (Harhoff et al., 2003). Heterogeneity makes it more difficult to cult to provide the same service value, making it tough to go outbound by forming spin-offs or selling to other businesses (Dahlander & Gann, 2010). It is difficult for service firms to engage in outbound OI activities since there is a greater requirement to be customer-centric. For example, consumer conversations can provide an important impetus for organizational innovation and potentially lead to a continuous dialog between consumers and firms throughout the entire innovation process (Patroni et al., 2022).

4.2.1. Open innovation activities in goods manufacturing

From our findings, the goods manufacturing studies focused on using OI to increase firm performance, innovation performance, and sustainability through value creation, managerial innovation, supply chain innovation, external collaboration, and knowledge exchange. Firms' engagement in OI practices increases with their size and R&D expenditure. OI activities adopted by

goods manufacturing were not concentrated in one trend, as we found a fair amount of both inbound and outbound OI practices from the literature. This shows that in this increasingly dynamic business environment, opening boundaries and exchanging resources is important to keep up with the market.

Inbound OI. Firms need to readjust their strategy to face challenges and changes in the market. A study by Crema et al. (2014) found that firms that choose a diversification strategy are likely to use OI, while firms focused on a strategy of efficiency are inclined toward OI practices. The adoption of integrated business models, the implementation of practices that generate customer proximity, and the enactment of economies of scale and learning effects were suggested to achieve long-term profitability (Visnjic et al., 2018; Wang & Islam, 2017). Vertical collaboration, as an example of integrated business models, or including customers and suppliers in the process of developing new ideas, is the most popular type of cooperative strategy (Vlasova & Roud, 2020). In manufacturing firms, OI practices are associated with the adoption of service business models in manufacturing firms, also known as Product-Service Systems (PSS), a field which gained interest from academics and practitioners in the last decades. The integration of services made goods manufacturing firms shift to more informal knowledge-exchange activities (Mina et al., 2014). The aim of PSS strategy adoption is to decouple business success and economic growth from pure goods sales (Finken et al., 2013), similar to the motivation why most firms adopt OI. The most impactful advantages of inbound OI are new skilled employees; access to ideas, knowledge, and expertise; new technologies; decreased costs; and finding a new approach to solve a problem (Martovoy et al., 2015). However, this form of innovation has a major drawback: intellectual property issues or worry about one's own intangible resources (knowledge). Protecting innovators' rights are significant concerns that made goods manufacturing firms hesitant to engage with OI initiatives (Rahmanzadeh et al., 2019; Stanisławski, 2021). In small cases, forming a long-term partnership or vertical collaboration with academia in terms of the development and distribution of intellectual property could solve the problem (Vlasova & Roud, 2020).

Outbound OI. Not all firms have resource abundance, whether they are large firms or SMEs. SMEs are known to have limited resources for scanning and monitoring the technological environment. Additionally, they lack the capabilities in manufacturing, marketing, and distribution needed to introduce innovation effectively in the market. Hence, openness, to some degree, is needed to boost product sales (Lichtenthaler & Ernst, 2009). Firms seek to collaborate with external partners mostly to gain additional resources, such as knowledge (Lai-Yin Cheah et al., 2021), funds (Markovic et al., 2021), and technologies (Zoltan J. Acs & David B. Audretsch, 1988). Managers who intend to establish OI should prepare internally by developing an innovation strategy and knowledge-sharing process to truly boost innovation performance as a firm's absorptive capacity positively influence innovation adoption intensity (Bagherzadeh et al., 2020; Bocquet & Dubouloz, 2020). The degree of openness to external knowledge during new product creation involves a set of processes from engagement to information processing. Firms with more experience in external collaboration derive more innovation output (Magistretti et al., 2019; Roper et al., 2013) and private returns (Roper et al., 2013; Zhang et al., 2018) from this strategy, which is the benefit of spillover effect. Such efforts are likely to be subject to a learning process as businesses discover which information sources, collaboration links, and partnerships are most effective at achieving innovative performance for their specific needs.

The use of an open source to acquire new designs in developing new products is also one of many reasons why manufacturing firms adopt OI. The advancement of three-dimensional (3D) printing technologies in several industries influences strategic decisions on how to utilize them (Weller et al., 2015). For example, open source is adopted to innovate the supply chain in health-related crises (Tani et al., 2022) and utilization of 3D design sharing (Rintala, 2021). Sharing of 3D design files without monetary gains for others to use is an example of community-driven innovation (Aryan et al., 2021). In other cases, the open design of 3D-printed mobile phone accessories helped overcome size-related resource constraints faced by small firms, resulting in market growth. This socially sustainable supply chain innovation can support market success. Not only for design purposes, but 3D printing technologies are also highly flexible. They offer many opportunities in supply chain management (SCM) by minimizing material waste, reducing SCM complexity through design consolidation (Beltagui et al., 2020), and cost-effective low-volume production (Chekurov et al., 2018).

4.2.2. Open innovation activities in the service industry

Service businesses are more active open innovators than manufacturers; they are more engaged in informal relative to formal OI practices than manufacturers; and they attach more importance to scientific and technical knowledge than to market knowledge compared to manufacturing firms (Mina et al., 2014). OI has different uses in the service industry, such as obtaining customer insight, value co-creation, ideation, firm performance, business capability, and problem-solving, as explained in the next paragraphs. These activities are categorized as inbound OI. Service firms are different with regard to OI adoption because of their service-related characteristics and underlining organizational structures, such as intangibility and close customer involvement (Virlée et al., 2015b).

Customer Insight. The social media-driven innovation capability results from interactions between social media managers who use digital technologies to extract insights from consumer dialogues and business stakeholders who act on this knowledge. This, in turn, promotes innovation at the organizational level (Patroni et al., 2022). Social media insights are a possible source of consumer knowledge that may be included in open-service innovation techniques within enterprises. The information about client conversations, opinions, and feelings that was retrieved from the insights will allow for careful observation of the customers' views and for the near-real-time identification of service problems.

Value Co-creation. Continuous customer interaction will lead to a value co-creation process that is gradual and iterative, which will eventually be beneficial for innovation capabilities. More precisely, because firms could adapt and enhance service based on continuous and nearly real-time customer input, this iterative value co-creation would encourage the adoption of agile innovation approaches (Adikari et al., 2021). As shown in Patroni et al. (2022), interactions between social media managers who leverage digital technologies to extract knowledge from consumer conversations and business stakeholders who act on this knowledge give rise to the social media-driven innovation capability, which, in turn, fosters innovation at the organizational level.

Ideation. Communities and social entrepreneurs, for example, can contribute to the public sphere by developing ideas and innovations that may eventually be accepted by the public sector

(Fuglsang & Hansen, 2022). Fernandes et al. (2017) discovered that the P&G case (Procter & Gamble) began the 'connect & develop' program meant to employ OI to boost innovation results. They drastically lowered R&D spending by eliminating initiatives that were not producing the desired results. The next stage was to get additional ideas out into the world with the proper partners, moving into the 'fit for purpose' phase. P&G improved the execution of concepts and learned how to better utilize its resources. Then, it improved its idea selection process, and its innovation competence took a jump forward.

Firm Performance. Organizations that establish OI processes generate superior outcomes; they also show that a higher degree of originality in inventions has a good influence on service companies' financial success (Vincenzi & Cunha, 2021). As service organizations broaden their internal knowledge base to allow for the influx of ideas from external sources and external partnerships, they broaden their pool of innovation prospects, resulting in improved innovation performance. This supports Chesbrough's (2003) thesis that the knowledge sources needed to increase innovation results may be obtained beyond the firm's boundaries, and organizations that are too inwardly oriented may miss out on innovation prospects (Ovuakporie et al., 2021).

Business Capability. Involving outside partners in the innovation process is crucial for navigating volatile social, economic, and political changes in the environment. The concept aims to create competitive and sustainable innovation for addressing societal problems and assists businesses in the effective growth of the innovation process by embracing ICT as a key component of change (Battisti, 2012). Another study indicates that firms with high service-innovation intensity possess significantly stronger ecosystem-related capabilities than firms with lower service-innovation intensity. Those firms also seem to sense and seize external opportunities and resources to a greater extent in order to reconfigure their service-related ecosystems. The findings also show that successful service innovators consider not only value-adding partnerships, such as suppliers and customers, to be relevant for service innovation but also relationships with non-direct value-adding ecosystem stakeholders (e.g., governments, communities, legislators) (Lütjen et al., 2019).

Problem Solving. By interpreting the relationship and goals of the external parties, companies could better understand the nature of the social problems in emerging economies, which might present profound social challenges. Collaborative innovation managed by knowledge-intensive companies could readily represent a suitable way the development of social innovation (Battisti, 2012). For example, in Adikari et al. (2021), insights generated via social media can be integrated into organizations' open-service innovation practices as a potential asset of consumer knowledge. The extracted insights contain information about consumers' discussions, views, and emotions which will provide an opportunity to closely observe the perceptions of the consumers.

CONCLUSION

Goods manufacturing and service businesses have different uses of OI. This is understandable since the nature of their businesses is also contradictory. Businesses that follow a diversification strategy should use the OI model to close any gaps in resources and knowledge needed to approach a new market. This could be accomplished by putting in place the proper procedures for managing relationships with external partners, such as tools, formal analyses and assessments of various partners, goals, and relationship risks, the creation of the proper kind of collaborative organization, and formal evaluations of the collaborations' success or failure. Only if

the business develops the necessary internal skills to fully utilize the acquired external resources can the OI model be effectively used to pursue an innovation strategy.

Through a thorough, in-depth study of the present literature, this paper analyzes the use of OI as an information source for a corporation, revealing various relevant research routes in the process. Considering our findings and the rapid evolution of OI, we propose that academicians and managers collaborate more closely as complementary avenues for input and understanding rapidly changing practices. This collaboration can assist researchers in crossing barriers by providing practical insights for future research initiatives, as well as providing managers with new models and ways to implement them in their organizations.

LIMITATIONS & FURTHER RESEARCH

Despite the thoroughness with which we conducted our systematic study, there are still significant limitations. We attempted to include all relevant studies in the corpus, but because we only focused on high-ranking, peer-reviewed publications, some new research may have been overlooked. Other factors that have yet to be investigated could bring new study opportunities.

Apart from the gaps and future avenues of research that emerged from answering the previous research questions, some other areas in the OI strategy domain are of particular interest from a management point of view. In manufacturing, future research should investigate deeper the success of OI adoption in an industry that is secretive in nature (sensitive to intellectual property rights). Thus, this nature acts as a barrier to the implementation of such an innovation strategy. Other than that, investigating the role of OI in PSS firms also possess an interesting character due to its concept of integrating services to the goods manufacturing to create new value for the customers. While in service, future research can investigate the correlation of OI use with the tendency of service industries to launch a market pull strategy. As can be seen from the result, service businesses use inbound OI that focuses on customers' needs to improve their service quality.

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