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Open innovation in banking: a bibliometric study

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Abstract

- **Design/methodology/approach**: Using a set of bibliometric tools (VOSViewer and bibliometrix), we review and analyse 96 documents bibliometric items, including citations, countries, institutions, journals, authors, articles and topics. We show the co-authorship network and identify the most productive authors and countries. We also individuate research streams and future areas of research that are worth being investigated.
- **Purpose**: This paper aims to survey the literature on open innovation in banking over the period 2008-2024.
- **Findings**: Overall our results show that the two streams of literature on open innovation and innovation in banking are not fully integrated, resulting in contributions in the area of banking that present interesting case studies or discussion about open innovation in banking, but with a limited reference to the theoretical underpinnings of open innovation or to the evidence provided by the literature specialised in open innovation in the field of management and organisational studies.
- **Originality:** This bibliometric review on open innovation in banking analyses previous literature and investigates two streams of studies, i.e. banking and innovation literature to advocate interdisciplinary.

Keywords: open innovation, banking, bibliometric review

1. Introduction

Open innovation (OI) defined 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" (Chesbrough and Bogers 2014; p. 17), has recently received much attention in the banking literature and industry (Schueffel & Vadana, 2016).

The relationship between innovation and banking has its roots in the late 1950s, but it has become stronger in the last 10 years. The disruption introduced by digitalisation of financial and banking markets, i.e., fintech, has attracted much interest from academia, policymakers and the industry (Tanda and Schena, 2019; FSB,

2021). The innovative financial products and services are offered by traditional regulated financial intermediaries, new fintech companies and bigtech companies (e.g. Google and Amazon) (Locatelli & Tanda, 2021). Fintech paved the way to partnerships dedicated to shared innovation processes to improve financial products and services, in the spirit of OI. In such a cooperative environment knowledge is exchanged to improve efficiency and create value for the various actors involved (Gianiodis et al., 2014), that should operate in a flexible and open-minded environments (Dahlander & Gann, 2010; Chesbrough, 2017). This is possible when companies are willing to commit to research and development (R&D), establish business accelerators and fintech hubs, and have talented human resources.

Later, the trend of OI has been integrated into the regulatory framework through specific regulations, such as the PSD2 in Europe (Polasik et al., 2020). OI is addressed as a "vital" driver of strategic change in the financial sector: it increases market shares and addresses shareholders concerns even in times of crises (Fasnacht, 2018). OI is also considered extremely relevant when developing financial solutions addressing a social need, with the potential for the creation of new collaborations or social relationships (Altuna et al., 2015). Successful case studies envision the exploitation of innovation networks in a collaborative way not only internally, but also among external stakeholders, e.g., employees, partners or clients (Carbone et al., 2012).

Schueffel and Vadana (2015) underline that OI is potentially beneficial for the banking and financial industry, but remain scarcely applied. This topic is of interest to two main academic disciplines: on the one hand, the banking literature; on the other, the innovation literature. Nevertheless, these areas of research have continued to develop separately. Among the studies in the banking domain on these topics, Chen and Peng (2019) provide a short review and then focus on the financial performance of Taiwanese banks. Interesting case studies also emerge in the literature, not only in the academic literature, but also by policymakers and national and supranational authorities (e.g., OECD, 2023). Within the OI studies, several bibliometric reviews have been conducted in the past (e.g., Kovacs et al., 2015; Randhawa et al., 2016; Ale Ebrahim and Bong, 2017). These, however fail to address explicitly the contribution of OI to the banking sector.

However, the potential disrupting innovation of OI systems in banking is not fully investigated and understood by the more recent literature and this represents an important research gap that academics are called to fill.

To understand the state of the art of this "overlap" and provide useful hints for further research, this paper presents a bibliometric review of the literature dealing with OI in banking. Evidence shows that although the literature on OI in banking is growing, there is no established group of researchers dealing with the issue. Furthermore, an analysis of the content of the papers reveals that those dealing specifically with OI in banking are few in number and present case studies. In most cases, they fail to provide a tangible contribution to the literature on innovation. It is therefore recommended that future research overcomes these silos in the disciplines and integrates the theories of the literature on innovation with the literature on banking. This integration could be beneficial for both areas of study. The paper is structured as follows: the

second section presents the literature on OI; the third section presents the methodology; the fourth section presents the results; and the last section concludes and discusses some potential avenues for future research.

2. Literature review on open innovation

The literature has deeply investigated innovation and the use of external knowledge for innovation: to perform technical innovation, information must flow between the firm and those surrounding it (Utterback, 1971), giving relevance to "lead users" in providing valuable insights for innovation (Von Hippel, 1976; 1986). External factors are found relevant for the organisation's ability to benefit from innovations (Teece, 1986) and developing an "absorptive capacity" enables organisations to recognise, assimilate and apply external knowledge (Cohen and Levinthal, 1990).

The concept of OI was introduced in 2003 by Chesbrough: companies can and should use both external and internal ideas, as well as internal and external routes to market to drive their innovation. OI has recently been redefined by Chesbrough and Bogers (2014; p. 17) as "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model".

There are three main types of OI. Inbound OI involves incorporating external knowledge and ideas into a company's innovation processes and has received significant attention in academic research and industry practice. Outbound OI involves sharing a company's innovation processes with external parties. This approach requires organisations to allow unused and underutilised knowledge and ideas to be used by others outside the organisation for their businesses and business models. Outbound OI is less explored and therefore less well understood in both academic research and practice (Bogers et al., 2018). The simultaneous use of both approaches is known as the coupled innovation process.

Considerable research has been conducted on OI exploring a wide range of issues, including the human aspect of OI, project-level attributes, platforms and ecosystems, public administration, and societal issues more broadly. Business models are used to define the requirements for these architectures and systems and thus use external and internal knowledge and ideas to create value, while establishing internal mechanisms to claim a portion of that value (Bogers et al., 2018; Bogers et al., 2019).

OI has become imperative in today's world due to the dispersion of knowledge and ideas sources and the changing geographic location of innovation (Bogers et al., 2019). Since the 1990s some companies have reduced their investment in R&D, leading to a stronger adoption of OI. This trend has been attributed to shareholder activism and short-term focus, as well as the emergence of research-intensive start-ups. However, in-house R&D and OI should be conceived as complementary approaches. Indeed, the absorptive capacity required to recognise, comprehend, and transfer advanced knowledge from external sources is

rooted in deep internal knowledge and know-how. Additionally, there is a recent trend towards digital convergence which makes OI even more imperative and digital platforms are now pervasive.

The concept of OI was initially focused more on innovating products and technologies rather than innovating services, and empirical studies on OI have primarily focused on products (West & Bogers, 2017). Service innovation can be highly challenging due to the intangible nature of services and their intrinsic involvement of customers. There is limited empirical research on the extent of OI use across service sectors and, especially, the practical challenges of managing, designing, and developing open service innovation (West & Bogers, 2017). OI works differently for service companies: often, in the case of service innovation, there is a lack of formal R&D operations and thus there is a need for customer involvement throughout the process in an iterative process that results in a customer experience (Chesbrough, 2011). In brief, Chesbrough (2011) suggests that open service innovation provides more opportunities for value creation towards a logic of customer centricity.

Banks can implement OI to integrate internal and external ideas and capabilities into organisational systems, enabling them to participate in the innovation process with third parties and stakeholders in general instead of working in silos and relying solely on internal resources and knowledge. Banks can experiment new solutions through OI, which can be launched in alternate markets in partnership with other institutions or by offering custom products that meet the requirements of niche markets.

Although in the past adoption of OI in banking has been slow, it has now become more pressing: the shift to a digital economy, the 2008 financial crisis, new technologies and techniques, such as machine learning (ML) and artificial intelligence (AI), the growth of fintech companies, and the growth in data available have all contributed to the adoption of OI in banking. The data surge from the digital business has accelerated this transition. The financial industry, and banks in particular, are prime examples of data-driven businesses (Zillner et al., 2016). Collecting customer data for business transformation, creating new revenue streams, managing risks, and improving customer loyalty (Ali et al., 2021) are all examples of how banks can use big data analytics to simplify their OI processes.

An OI approach helps traditional banks collaborate with fintech firms to co-innovate and meet rapidly changing customer needs. It facilitates the exchange of ideas, technical expertise, experience, and data between banks and fintech firms, often involving an extended network of partners. Banks need to manage investments and partnerships by deciding whether to invest internally in fintech projects and compete with fintech start-ups / firms, or to invest directly in them, including through mergers and acquisitions (Lee and Shin, 2018; Cappa et al., 2022), although further research is needed on the ‘cost-benefit ratio’ of such operations from an economic, strategic and organisational perspective.

Further strategies may also be possible. For example, Stefanelli and Manta (2023) reported that banks may choose to partner with external fintech companies that offer ready-made white-labelled solutions. In this case, the bank purchases a pre-made solution from a fintech and implements it under its own brand with the

advantage of reducing time-to-market. Another possible collaboration model is to integrate new in-house solutions or to adopt software-as-a-service solutions. Lee and Shin (2018) argue that banks must manage their increasingly digital and demanding customers, and, thirdly, must face high costs in managing regulations and integrating new technology with existing legacy banking information systems. However, these steps are essential for providing a consistent consumer experience across different channels, as well as ensuring the security and management of sensitive customer data. According to Stefanelli and Manta (2023), to maintain their leadership, established companies should adopt the right combination of an internal technology structure based on an API (or Application Programming Interface)-driven platform and a portfolio of partnerships with innovative external partners that ensure the development of new products or services with greater value for the end customer, towards a logic of customer centricity. Furthermore, the emergence of the Open Banking model and relevant regulations such as PSD2 have compelled banks to reassess their business models and pursue collaborative strategies with various players in the digital financial ecosystem.

In brief, key drivers of openness in financial services include open banking regulations requiring data sharing, open architecture models using third-party products/services, open platforms and marketplaces, open APIs enabling third-party access, and new open business models like banking-as-a-service. OI allows banks to gain speed-to-market advantage by leveraging diverse capabilities while focusing on core competencies. Effective implementation requires fully integrating the inbound flow of external ideas, outbound flow of underutilised internal ideas, and coupled processes combining internal and external knowledge. Banks can white-label fintech solutions and leverage open banking APIs to share data and develop innovative services with partners. OI innovation promotes agility, continuous learning, accelerated growth and an enhanced customer experience for banks.

3. Methodology

The topic of interest of this paper lies in the intersection of two very established streams of studies: banking and innovation. To select the most appropriate and relevant studies to be reviewed in this paper, we perform a search on Scopus at the end of March 2024 using the following search query “open innovation*” AND (“bank*” OR “financial institut*” OR “financial intermed*” OR “financial serv*”). This yields 147 papers. excluding disciplines such as medicine or nursing[1]. The search had no filter according to year or type of publication (book chapters, book reviews, or conference proceedings), but we limited the search to papers written in English. We removed any irrelevant studies remaining. The results yielded 96 documents (Figure 1).

[1] The search string is as follows: TITLE-ABS-KEY("open innovation*" AND "bank*") AND (EXCLUDE (SUBJAREA,"ARTS") OR EXCLUDE (SUBJAREA,"EART") OR EXCLUDE (SUBJAREA,"MATE") OR EXCLUDE (SUBJAREA,"NURS") OR EXCLUDE (SUBJAREA,"BIOC") OR EXCLUDE (SUBJAREA,"CENG") OR EXCLUDE (SUBJAREA,"MATH") OR EXCLUDE (SUBJAREA,"AGRI") OR EXCLUDE (SUBJAREA,"ENER") OR EXCLUDE (SUBJAREA,"MEDI") OR EXCLUDE (SUBJAREA,"ENVI")).

Scopus is selected as it has wider coverage than Web of Science and is commonly used in bibliometric studies (e.g. De Giuli et al., 2024).

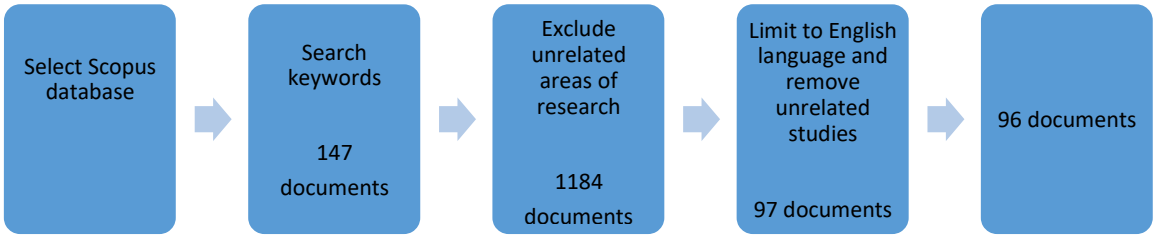

Figure 1: process of sample construction. Source: authors' elaboration

After identifying the sample, we analyse the key figures, most relevant journals and leading institutions within the sample. We then describe the conceptual and intellectual framework of the research area using methods such as co-citation analysis, bibliographic coupling and analysis of keywords, employing by the Bibliometrix package in R and the software VOSviewer.

Furthermore, we select the main articles based on their cumulative number of citations to delineate the different research streams and potential research gaps that remain uncovered by the literature.

4. Results

4.1. Bibliometric citation analysis

The studies included in the analysis have been published in journals between 2008 and 2024 (Table 1).

Description	**Results**
DOCUMENTS	
Timespan	2008-2024
Sources (Journals, Books, etc)	67
Documents	96
Annual Growth Rate %	2.57
Document Average Age	6.26
Average citations per doc	11.17
References	4599
AUTHORS	
Authors	242
Authors of single-authored docs	11
AUTHORS COLLABORATION	

Single-authored docs	17
Co-Authors per Doc	2.78
International co-authorships %	15.62

Table 1: key information on the documents in the sample. Source: Bibliometrix output.

Figure 2 shows the number of articles per year and the cumulative number of documents in the sample. The figure highlights the rising academic attention given to the subject. A total of 242 authors published 96 documents in 67 different sources (81% of contributions are published as articles in journals). They received 11.17 citations on average and have overall more than 4,500 references. Moreover 15.62% of the papers are published by authors cooperating internationally and 17.7% of the studies are single-authored.

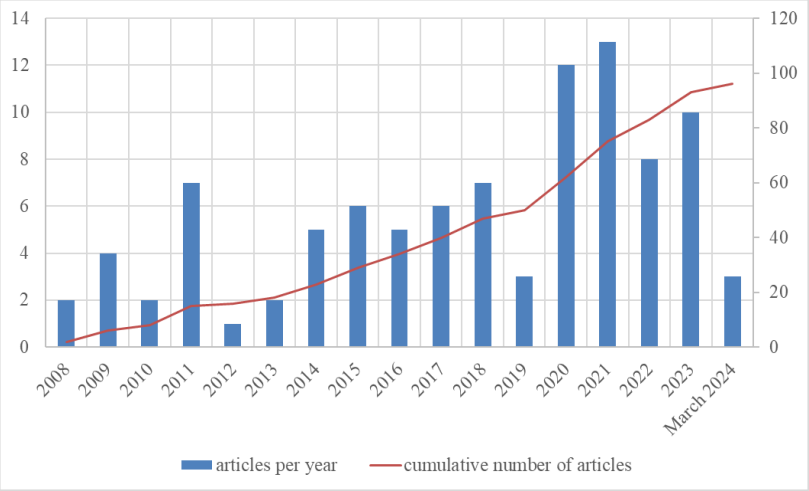

Figure 2: distribution of articles per year and cumulative growth. Source: authors' elaboration.

The most influential authors, journals and institutions in the field are identified through bibliometric citation analysis. Table 2 shows the top-5 authors per document published. We limit to 5 authors because, based on the evidence on the sample, most of the authors are present with 1 or 2 publications.

Author	Number of documents	Total citations
Fasnacht D	5	66
Mention A-L	4	38
Cooke P	3	31
Martovoy A	3	25
Torkkeli M	3	25

Table 2: most productive authors. Source: authors' elaboration

Figure 3 shows the most relevant sources in terms of total publications (left axis) and citations (right axis) on the topic of open innovation in banking. Except the *Journal of open innovation: technology, market, and complexity* that has 17 total documents and more than 300 citations, the rest of the journals have 4 or fewer documents and a lower number of total citations.

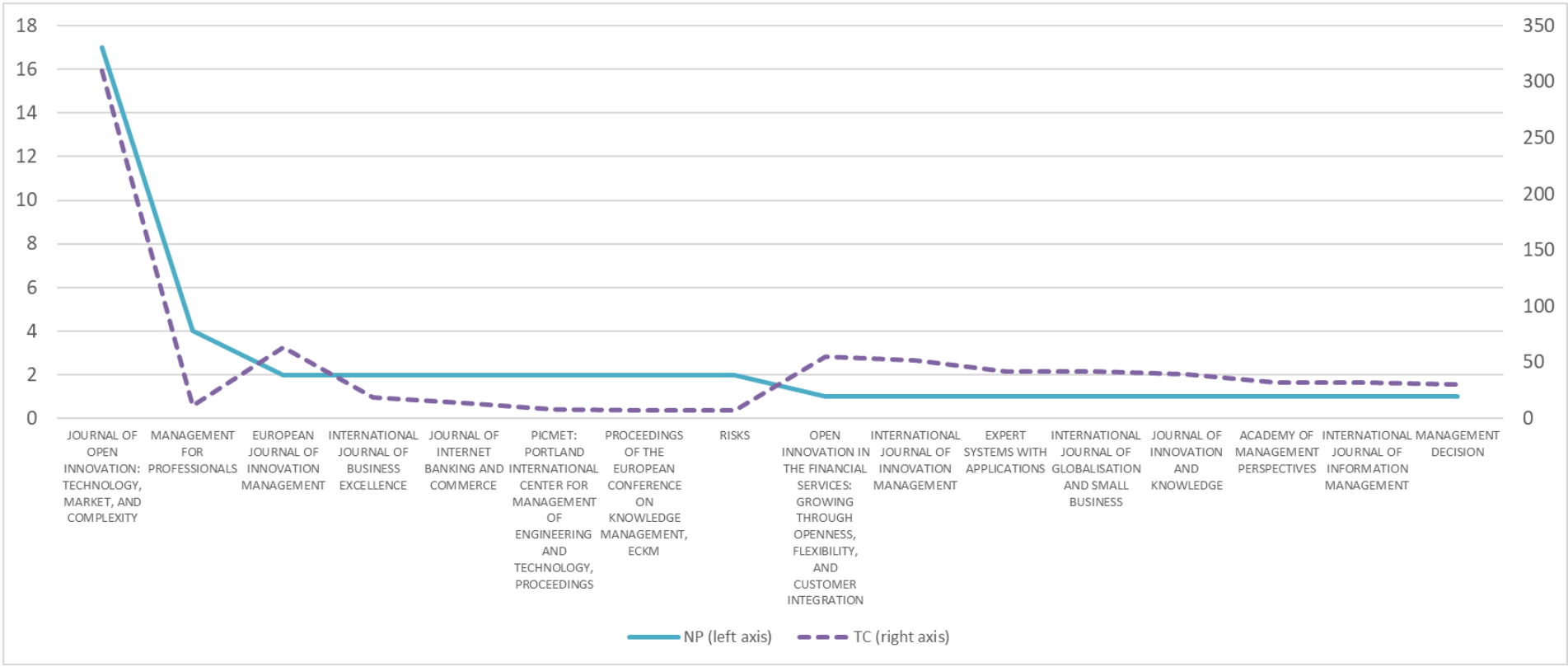

Figure 3: sources number of publications (left axis) and total citations (right axis). Source: authors' elaboration on Bibliometrix output.

The countries with the most significant scientific production are Italy (24 publications), Indonesia (21 publications) and Switzerland (20 publications). USA and China follow respectively with 17 and 16 documents. Indonesia has experienced a strong growth in the last years (Figure 4). In terms of citations, the countries most cited are Italy (115 citations, 19.2 average article citations), Switzerland (107 citations, 35.7 average article citations), Spain (91 citations, 30.3 average article citations).

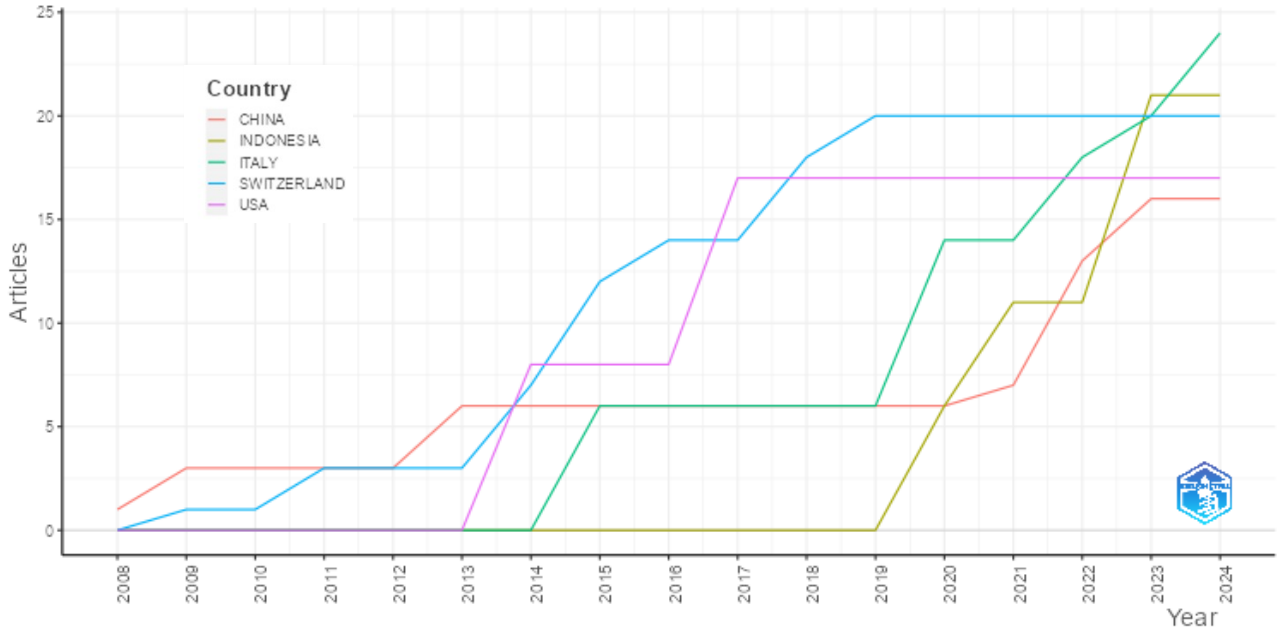

Figure 4: Number of publications by country. Source: Bibliometrix output.

VOSViewer co-citation analysis allows us to identify the articles that serve as foundational pillars for research on OI and banking, highlighting joint appearances. Results for the co-citation of documents is reported in Figure 5. We set the minimum number of references for the document at 3 otherwise the analysis would become too restrictive. By doing so, we end up with the visualisation of 25 documents. We identify three main clusters (and a fourth made of just one document). The first cluster (red) comprises papers on OI in banking and the evaluation of advantages of innovations (e.g., De Brentani, 1993; Fasnacht, 2018). The second cluster (green) includes more dated papers that set the ground for innovation and economic rationale of innovation adoption (e.g., Von Hippel, 1988; Cohen & Levinthal, 1990). The third cluster is focused on OI (e.g., Laursen & Salter, 2006; Enkel et al., 2009).

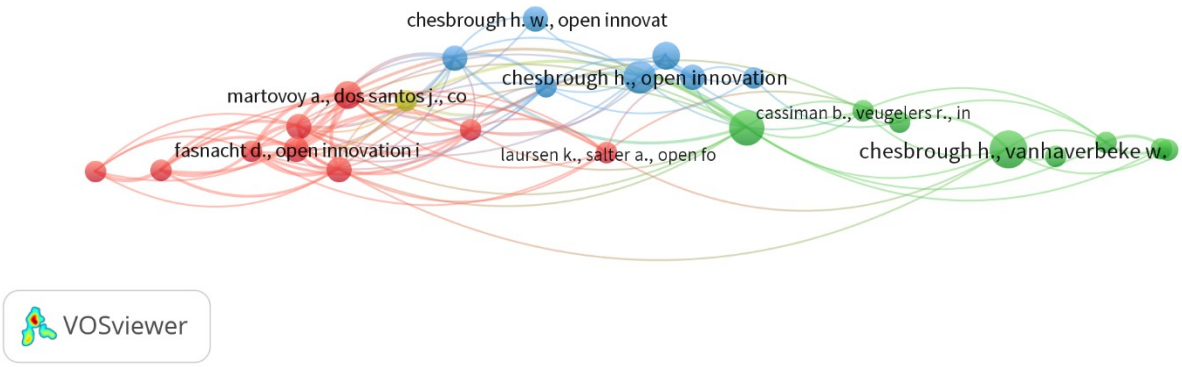

Figure 5: documents co-citation. Source: VosViewer output.

Keywords are also generally analysed within the framework of bibliometric reviews. These analyses can unveil the main topic of interest in the field of OI and banking in the published studies and pave the way for future investigations. OI is the most frequent keyword and the one with the strongest growth (Figure 6). The literature dealing with OI seems to be especially focused on this type of innovation, while other keywords appear to be a complement to the main topic of the studies.

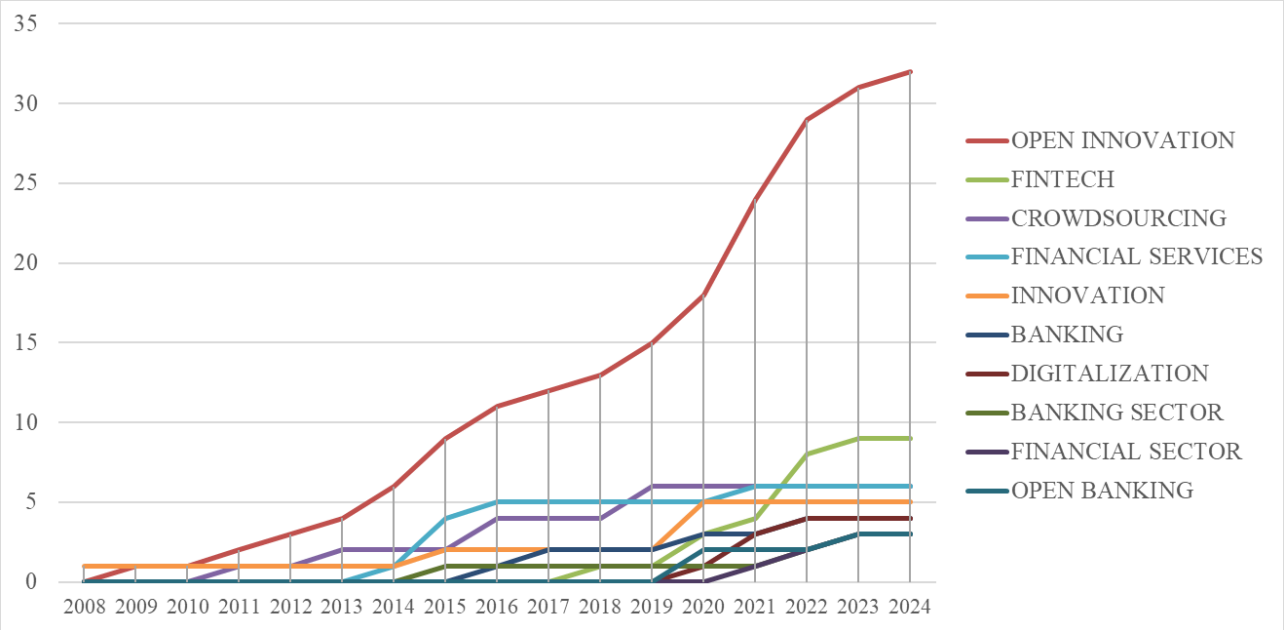

Figure 6: top-10 keywords evolution over time. Source: authors' elaboration on Bibliometrix output.

The trending topic also shows a relatively more recent diffusion of the keyword "fintech" that, together with "open innovation" seems to be one of the core topic for the next set of researches published in this field (Figure 7).

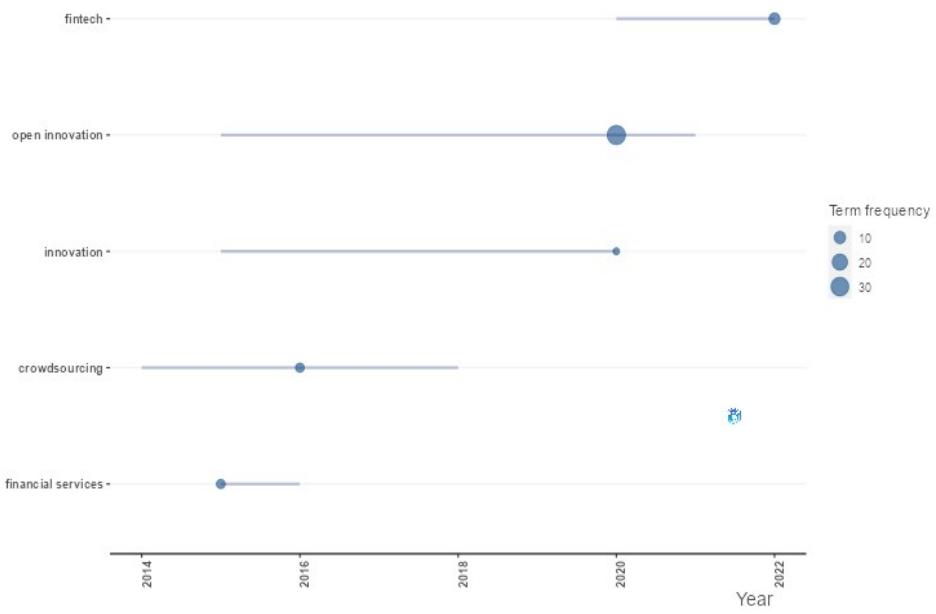

Figure 7: trending topics. Source: Bibliometrix output.

Through the graphical representation of VOSViewer networks we highlight different features: the size of the dots is determined by the occurrence of the keyword, and the thickness and proximity of the lines indicate the frequency of occurrence.

We present the keyword co-occurrences for the full sample (Figure 8) and represent the keywords with at least 3 co-occurrences. We identify 5 different clusters. The main cluster (more central and with higher weight) is the cluster dealing with OI and crowdsourcing (purple). OI has 44 links with the other clusters, that comprise the following other clusters: i) digitalisation, fintech and open banking (yellow); ii) artificial intelligence, machine learning and big data (blue); iii) banking and financial services (green); iv) innovation and management of innovation (red).

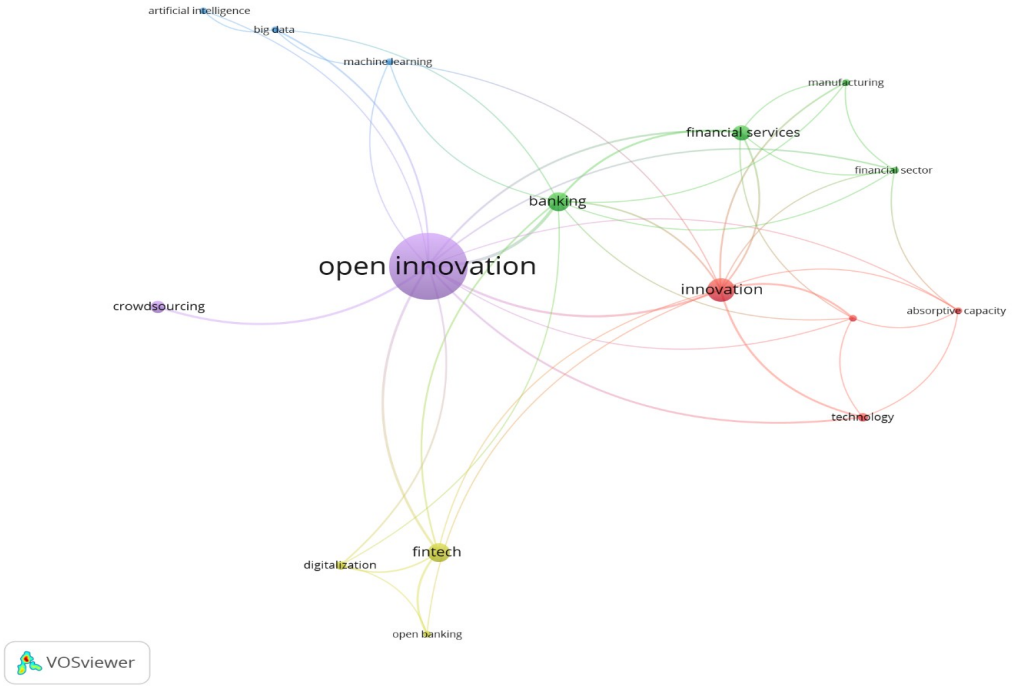

Figure 8: keyword co-occurrences (min 3 occurrences). Source: VosViewer output.

4.2 Overview of the most cited papers and literature thematic mapping

To gain a deeper understanding of the literature in this field of study, we perform two additional analyses. First, we provide an overview of the most influential studies in our sample. Second, we build and briefly discuss the thematic map of the papers in our sample.

To select the most cited papers, we rank the studies in our sample according to total citations and provide a short overview[2]. The selected documents are listed in Table 3. This analysis enables us to identify the studies that are considered most relevant by peer researchers. Furthermore, these papers are commonly consulted by researchers investigating the topic and are likely to influence future literature.

The top-cited papers are published after 2009, not surprisingly, as the topic is relatively recent and still evolving. The three-top papers according to total citations are Alzoubi and Aziz (2021), Rabbani et al. (2021) and Fasnacht (2009). Although all the papers included in the review among the most cited deal with OI and banking, they stress one or the other aspect and generally fail to address the two simultaneously with the same degree of depth. Exception is the seminal paper by Fasnacht that discusses the adoption of OI by the banking sectors and acknowledges a slow speed of adoption.

[2] Since older documents are more likely to be published, we also present the top 10 most-cited papers based on the average number of citations per year (De Giuli et al., 2024) to mitigate the potential effect of document age on the number of citations.

N	Paper	total citations	Main research question	Sample and methodology	Key takeaways
1	Alzoubi and Aziz (2021)	83	● Investigates the correlation between the emotional intelligence (EI) of top managers and the quality of their strategic decisions ● also examines the mediating role of OI, which is conceived as an essential tool for leadership	213 questionnaires collected from national banks in the United Arab Emirates	Significant positive correlation between managers' EI and the quality of their strategic decisions, and that intelligent information systems can enhance OI
2	Rabbani et al. (2021)	63	● Analyses how the Islamic financial system works in the post-COVID-19 recovery and how fintech can address the economic consequences of COVID-19	Review 125 studies	COVID-19 pandemic has encouraged the growth of social and OI, and the financial world has turned to OI to provide the world with a fast, timely, reliable and sustainable solution
3	Fasnacht (2009)	55	● Investigates the transformation of financial services and the new forms of innovation	Literature review and case studies on banks	The adoption of OI in financial services has been slow
4	Muhdi and Boutellier (2011)	52	● Explores crowdsourcing as one of the potential applications of OI	Case studies	Emphasise the emergence of virtual innovation communities, including both firm-hosted and internal company communities as well as third-party actors
5	Altuna et al. (2015)	49	● Explores the social innovations issue, conceived as innovative products or services aimed at meeting social needs and creating new relationships or collaborations under OI frameworks	Case study	Find three main managerial antecedents in the case study: integrating corporate social responsibility into business strategy with top management commitment, separating social innovation activities from traditional banking activities using a structural ambidexterity model, and applying OI principles by involving non-profit organisations for ideas and adoption
6	Najib et al. (2021)	46	● Explores the adoption of fintech in Indonesia.	Evaluates Indonesian small food businesses relying on P2P platforms	Open innovation in the paper is cited by the authors to argue that fintech is an OI product that can also be developed by fintech start-ups - and not only large banks - that can compete with them and that the increasing adoption of fintech solutions by food industry demonstrates its embrace of OI practices in its business model
7	Náñez Alonso et al. (2021)	44	● Analyse Central Bank Digital Currencies (CBDCs) – i.e. digital currencies backed by central banks.	Statistical correlation analysis to identify promising candidate countries/regions across different continents that exhibit high potential for	Although the paper is not focused on OI, the latter is cited as one important tool to develop this type of innovative currencies

				successfully implementing a CBDC	
8	Rossi (2015)	42	● Discusses the role of OI and venture capital (VC) in financing and fostering innovation.	Focus on VC activity in Italy	The synergy between innovative firms with technical expertise and VCs with financial and managerial skills can lead to mutual success, but further empirical testing and comparative research across different industries is needed
9	Carbone et al. (2012)	42	● Understand the organisational changes required to adopt OI approach.	Case study examples from Bankinter, Telefonica I+D, and Repsol.	Adopting OI in an organisation requires both a change in the innovation process and a cultural shift supported by advanced technology
10	Medase and Abdul-Basit (2020)	39	● Examine the importance of external sources of knowledge as an influencing factor on innovation exploiting multiple external sourcing strategies, the internal competencies of firms, and industry characteristics into a singular conceptual model.	Data based on surveys by the World Bank on sub-Saharan Africa	Both internal and external sources of information are necessary to achieve the desired degree of innovativeness in OI domain

Table 3 Top documents by total citations. Source: Authors elaboration on Bibliometrix output.

Beside the top-cited paper by total citations, we also rank papers according to total citation per year (Table 4). Most of them are also present in Table 3. The objectives and key findings of these additional papers are below briefly summarised.

N	Paper	Total citations	Total citations per Year
1*	Alzoubi and Aziz (2021)	83	20.75
2*	RABBANI MR, 2021	63	15.75
3*	NAJIB M, 2021	46	11.5
4	MIKHAYLOV A, 2023	23	11.5
5*	NÁÑEZ ALONSO SLN, 2021	44	11
6	NASEER S, 2021	32	8
7*	MEDASE SK, 2020	39	7.8
8	JIAO H, 2022	18	6
9*	ALTUNA N, 2015	49	4.9
10	RASHID MHU, 2020	24	4.8

Table 4: Top documents by total citations per year. Papers marked with an * are also reported in Table 4. Source: Authors elaboration on Bibliometrix output.

Mikhaylov et al. (2023) argue that financial institutions face growing competition from fintech start-ups and big tech companies like Facebook and Google, which leverage customer big data. To address this, banks must collaborate with fintechs and adopt technologies like cloud platforms, AI, and ML. As younger customers prefer digital banks, incumbents need to boost innovation and digitalisation. The study, focused on Russia's fintech sector (2002-2020), concludes that equal access to information via advanced infrastructure promotes financial development. AI, ML, cloud platforms, and improved technology are key drivers of OI in the banking sector. Naseer et al. (2021) examine how advancements in ICT have transformed the banking sector, using resource-based theory to explore how rare and inimitable resources, like information proactiveness motivation (IPM), affect firm performance in Pakistan. They find that creative cognitive style boosts individual and firm creativity, generating new ideas and innovations, especially for entrepreneurs. IPM, creative cognitive style, and OI enhance operational performance and innovation climate. Jiao and Cui (2022) explore OI in emerging economies, emphasising the role of institutional pressures. They recommend policies supporting digital investment and regional clusters to promote OI. Rashid et al. (2020) examine customer loyalty in Islamic banks, focusing on whether service quality influences loyalty. While the paper touches on OI briefly in the conclusion, it suggests that incorporating customer ideas and feedback can help develop products that meet market needs, potentially boosting customer loyalty and financial success. However, the study does not provide direct empirical evidence on this connection, leaving it as a suggestion for future research.

When looking at the overall picture of the most cited papers, the literature on OI in the financial sector draws upon a diverse array of theoretical foundations. Early works such as Fasnacht (2009) primarily utilised OI theory to examine the transformation of financial services. Subsequent studies expanded the theoretical landscape, incorporating frameworks such as crowdsourcing theory (Muhdi and Boutellier, 2011) and social innovation theory (Altuna et al., 2015). More recent research has further broadened the theoretical base, with Alzoubi and Aziz (2021) integrating emotional intelligence and organisational intelligence theories, while Naseer et al. (2021) employed resource-based theory. The latest studies, exemplified by Jiao and Cui (2022), have adopted more complex theoretical frameworks, combining institutional theory with knowledge management theory to explore OI in emerging economies. This evolution reflects a growing recognition of the multifaceted nature of OI in finance, necessitating interdisciplinary approaches to fully capture its complexities.

The methodological approaches employed have been as diverse as the theoretical frameworks. Early research relied heavily on qualitative methods, with Fasnacht (2009) utilising literature reviews and case studies. This trend continued with Altuna et al. (2015) and Carbone et al. (2012) also adopting case study approaches. However, there has been a gradual shift towards more quantitative and mixed methods. Alzoubi and Aziz (2021) employed surveys and questionnaires, while Náñez Alonso et al. (2021) conducted statistical correlation analysis. More recent studies have leveraged large-scale datasets, such as Jiao and Cui's (2022) analysis of the World Bank Enterprise Survey. Mikhaylov et al. (2023) analysed macroeconomic indicators,

while Rashid et al. (2020) combined primary and secondary data in a mixed-methods approach. This methodological diversity reflects the field's advancement and the increasing availability of relevant data.

The collective findings of these studies paint a nuanced picture of OI in banking. Fasnacht (2009) initially noted slow adoption of OI in financial services, but subsequent research has revealed its growing importance. Alzoubi and Aziz (2021) found a positive correlation between managers' emotional intelligence and strategic decision quality, while Rabbani et al. (2021) highlighted how COVID-19 accelerated OI adoption in banking. Mikhaylov et al. (2023) identified AI and ML as significant factors for OI-based fintech potential, and Jiao and Cui (2022) demonstrated the positive influence of institutional pressures on OI in emerging economies. Despite these insights, significant research gaps remain. There is a clear need for more empirical testing across geographical contexts, particularly in emerging economies. Furthermore, the relationship between OI, customer loyalty, and financial performance in banking requires empirical examination. Future research should also explore the long-term impact of AI and ML on OI in banking.

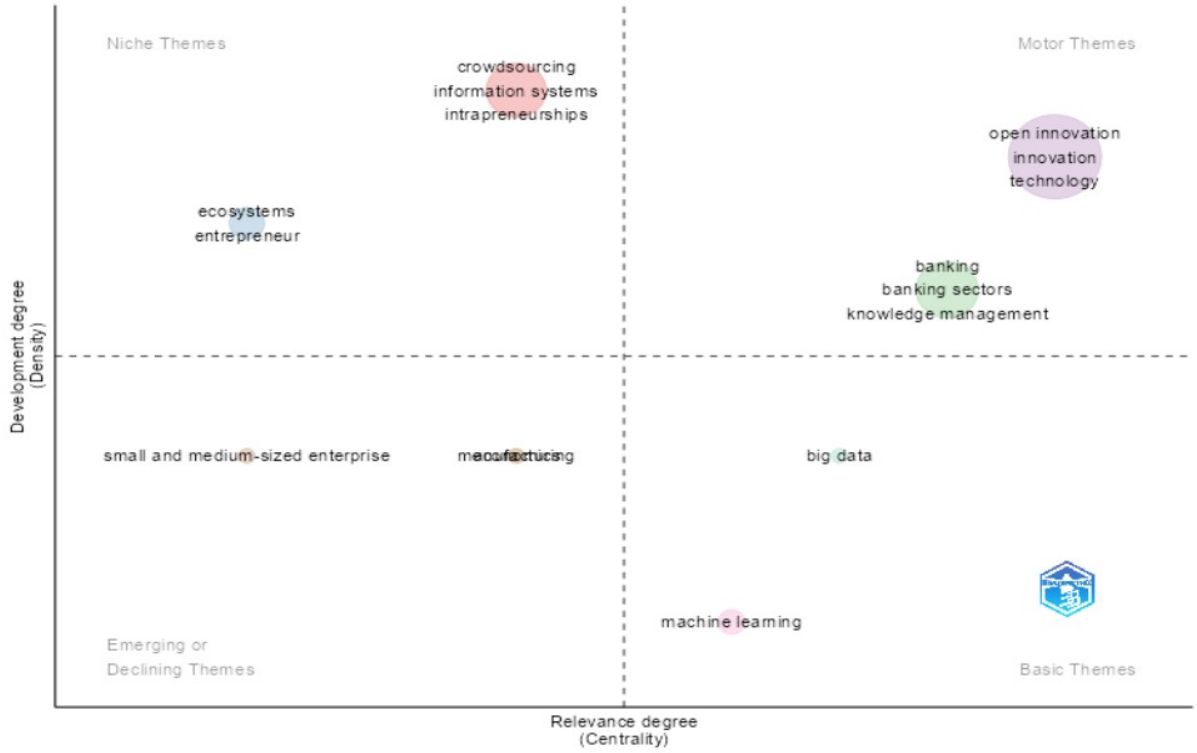

Figure 9: thematic map. Source: Bibliometrix output.

To understand the potential development of the field, we also build and analyse the thematic map through bibliometrix. The thematic map employs co-word network analysis and clustering (Cobo et al., 2011). Figure 9 shows the two largest bubbles are in the motor themes, necessary to have a basic understanding of the topics under analysis. The first contains papers dealing with "open innovation, innovation, technology" (e.g., Fan and Huo, 2009; Carbone et al., 2012); the second includes "banking, banking sectors; knowledge

management" (e.g., Akhavan et al., 2017; Naseer et al., 2021). Basic themes relate to big data and machine learning, the technologies deemed essential to successfully develop OI and innovation in general in banking. The relevance of niche themes is limited, with this particular sample focusing on entrepreneurs and specific platforms or information systems, for example, crowdfunding. Additionally, the emerging/declining themes are underrepresented in the sample and are related to "manufacturing", "economics", or "SMEs."

5. Future research and conclusions

Our study has shown that the literature on banking and OI is growing, consistently with the increasing attention and interest in this type of collaborative innovation in banking and financial markets. Although the banking literature provides interesting case studies on OI, these have a specific focus on very narrow topics and generally lack integration with theories developed in the field of management and organisational studies. This is a shortcoming of the banking literature, which would benefit from a deeper understanding of the phenomenon from an organisational and systemic perspective as well.

On the other side, in general, the banking sector appears to be less advanced in its application of the OI approach than other industries. Consequently, the nascent stage of research on the nexus between OI and banking provides a significant opportunity for further investigation.

Indeed, overcoming thematic silos in the academic debate would provide the basis for applying a more systemic logic and, thus, more interesting insights, with considerable benefits for actors such as banks, fintechs, policymakers and supervisors who see OI as an important tool not only for fostering growth and innovation in financial services and products but also for better understanding future development scenarios.

We present here some research questions that are considered appropriate to nourish the stream of studies on the overlap between OI and banking literature.

From the methodological point of view, more empirical testing and comparative research are needed, particularly across different countries, e.g. in emerging economies and different institutional contexts.

1. What are the specificities of OI in financial services compared to traditional product-based industries, and how do organisational resistance, strategic aspects, and institutional pressures influence OI in this sector?
2. What are the key strategic resources that banks need to develop effective OI strategies?
3. What is the significance of organisational platforms, business ecosystems and social issues in banking applying a systemic logic and how does this relate to OI?
4. How can the "banking-as-a-platform" concept be utilised to assess the efficiency and productivity of the fintech sector?

5. What are the mechanisms through which the "banking-as-a-platform" model can reduce information asymmetry, encourage the entry of neo-banks, and enhance competition in the market?
6. What policy-making activities are needed to regulate the fintech market and address regulatory gaps in OI approaches?
7. How can banks and fintech companies best integrate at the micro level to maximise the benefits of their collaboration through OI platforms?
8. How can incorporating customer ideas and feedback through OI help banks develop products and services that better meet market needs and technological advancements, and how can this contribute to increased customer loyalty and financial success (e.g., performing empirical studies on the relationship between OI, customer loyalty, and financial performance in banking)?
9. How do big data analytics, AI and ML have a systemic impact on the definition of new strategies, also based on the OI paradigm, for the banking system, especially in the long term?

We believe these questions can serve as a useful starting point for further research in the areas of OI, banking, fintech, and related topics.

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