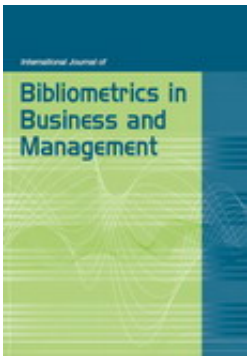

International Journal of Bibliometrics in Business and Management

ISSN online: 2057-0546 - ISSN print: 2057-0538
https://www.inderscience.com/ijbbm

Knowledge management and organisational performance: a holistic bibliometric overview

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DOI: 10.1504/IJBBM.2023.10062399

Article History:

Received:	24 July 2023
Last revised:	09 October 2023
Accepted:	24 October 2023
Published online:	07 June 2024

Knowledge management and organisational performance: a holistic bibliometric overview

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Abstract: This study aims to carry out a comprehensive bibliometric and network analysis of the literature on knowledge management (KM) and organisational performance (OP). Using a dataset of over 5,422 publications from 2012 to 2022, bibliometric methods and R-packages are employed to analyse publication trends, citation patterns, influential sources, authors, institutions, and countries. The findings reveal a sustained interest in KM and OP research, with an average annual growth rate of 5.87% in the number of published documents. The most extensively studied subjects in the field encompass knowledge management, innovation, learning organisations, and organisational culture. Concurrently, nascent areas of interest have emerged with lower frequencies, as reflected by the inclusion of newer keywords such as 'digital transformation', 'Industry 4.0', and 'digital technologies'. This study contributes to the existing literature by offering a comprehensive bibliometric analysis and representing the first holistic analysis on the topic.

Keywords: knowledge management; KM; organisational performance; OP; innovation; competitive advantage; bibliometrix; biblioshiny; Scopus.

Reference to this paper should be made as follows: Benabid, M. (2024) 'Knowledge management and organisational performance: a holistic bibliometric overview', *Int. J. Bibliometrics in Business and Management*, Vol. 3, No. 1, pp.1–31.

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1 Introduction

The interaction between knowledge management (KM) and organisational performance (OP) has garnered significant attention from scholars and practitioners across various sectors. KM, which encompasses the creation, sharing, utilisation, and management of knowledge and information within an organisation (Obeso et al., 2020), is considered a crucial resource (Grant, 1996). Furthermore, it has emerged as a critical factor for firms to maintain and guarantee long-term survival and profitability. Organisations must efficiently manage their knowledge assets to gain a competitive advantage over their rivals in the face of rapid technological innovation, globalisation, and escalating competitiveness (Zack et al., 2009). Effective KM enables organisations to leverage their intellectual capital (IC), leading to improved decision-making, innovation, and overall OP . By effectively managing knowledge and information, organisations can enhance their competitive advantage, adapt to dynamic environments, and achieve their goals more easily through new and effective solutions (Giampaoli et al., 2017).

Numerous studies have examined various components of KM and OP. They have explored the relationship across various industries and sectors, investigating several facets of the connection, and considering information transfer effects, knowledge generation, and other KM subsets on OP. These studies have shed light on their interactions and offered insightful information on how efficient KM enables firms to exploit their IC, enhance decision-making, innovation, and overall OP (Nonaka, 1994; Davenport et al., 1998; Schulz and Jobe, 2001; Massey et al., 2002; Darroch and McNaughton, 2003; Tanriverdi, 2005; Zack et al., 2009; Tseng and Lee, 2014; Mills and Smith, 2011; Obeso et al., 2020; Boamah et al., 2021; Saqib et al., 2017; Abuaddous et al., 2018; Farooq, 2018; Migdadi, 2022).

KM practices positively influence various OP dimensions. These practices can lead to improved financial performance, increased success in introducing new products, enhanced customer satisfaction, and greater market share (Abuaddous et al., 2018). Furthermore, knowledge sharing, learning from experience, and leveraging information technology are identified as essential practices for promoting creative problem-solving and enhancing firm performance (Giampaoli et al., 2017).

The question is not only about knowledge production or management but also about its dissemination. Effective knowledge transfer plays a crucial role in leveraging existing knowledge assets, facilitating innovation, and enhancing overall performance. Organisations can gain and maintain a competitive advantage by transferring knowledge internally and safeguarding valuable knowledge from rivals (Argote and Ingram, 2000). Additionally, tacit knowledge, which refers to information that is difficult to convey through formal communication and is typically acquired through personal experience, observation, and practice, plays a significant role in organisational efficacy. Its management improves employee performance and organisational capabilities (Ahmad et al., 2018; Boamah et al., 2021).

Despite the abundant research on KM and OP, the state of the art is fragmented, and there is a need to look in-depth at the connections between the two constructs and enhance our understanding of how KM and OP are related. This lack of shared understanding is a result of the complicated and comprehensive nature of KM and OP and the various perspectives and findings offered by academics and practitioners (Perez-Arrau et al., 2014; Heisig, 2015; Inkinen, 2016; Saqib et al., 2017). Although several variables, such as information sharing, creation, transfer, and usage, have been

explored in individual studies, the results are frequently context-specific and need a more comprehensive synthesis that combines numerous viewpoints. For its part, performance continues to be a complicated concept with various interpretations based on the setting and goals of the organisation. As it encompasses a variety of factors, including financial profitability, customer satisfaction, operational efficiency, product or service quality, innovation, and social and environmental responsibility, the literature lacks consensus on how to measure it (Al-Qubaisi et al., 2018; Brahami, 2020; Darroch, 2005; Gonzalez-Ramos et al., 2023; Inkinen, 2016; Kareem et al., 2021) or on a direct causal relationship (Muthuveloo et al., 2017).

Moreover, modern perspectives on OP that prioritise the creation of long-term value for all stakeholders have supplanted traditional approaches. A more comprehensive perspective places a greater emphasis on maximising profits for shareholders (Hubbard, 2009). This extensive scope of the debate on the boundaries of OP has increased awareness of the significance of social and environmental factors in business decisions and the need to strike a balance between shareholders, stakeholders, and society's overall interests. Additionally, it is difficult to compare and generalise results as the metrics to measure OP differ in the literature. Some studies prioritise non-financial factors like customer satisfaction, operational efficiency, product quality, and social and environmental responsibility, whereas others prioritise financial factors like profitability and return on investment. In the absence of a standard method for evaluating OP in the context of KM, it is more challenging to draw consistent and conclusive conclusions (Darroch and McNaughton, 2003; Gloet and Terziovski, 2004).

Considering these facts, this study analyses bibliographic data using bibliometric methods. To the best of the authors' knowledge, this is the first bibliometric study that examines the interrelation between KM and OP using a comprehensive definition of both concepts, making it a unique contribution to the field. Only one study to date is similar to our research in spirit. Farooq (2022) investigated KM and performance within a bibliometric analysis. His study was centred on 'KM' and 'Performance' only. As he mentioned in the limitations section of the study, he ignored keywords such as 'business performance,' 'firm performance' and especially 'OP', Our research complements his work by including additional keywords.

Therefore, this study seeks to answer the following research questions (RQs):

RQ1 Which are the most relevant authors, sources, authors, institutions, countries and documents in KM and OP literature?

RQ2 What are the emerging themes, trends, and research directions in the holistic study of KM and OP?

2 Review of literature

2.1 Knowledge management

Often abbreviated as KM, KM is a multifaceted concept widely studied in the literature, with diverse definitions reflecting its evolving nature. Some scholars emphasise a technology-centric perspective, defining KM as systems driven by information technology. This orientation advocates the existence of a connection between knowledge KM systems driven by IT and the knowledge perspective, emphasising that the design of

information systems should be grounded in and guided by an understanding of the nature and various types of organisational knowledge (Alavi and Leidner, 2001).

In contrast, other studies refer to it as a managerial process of capturing both information and the collective experience of individuals and the organisation. This information exists in various forms, such as databases, documents, or the IC of employees. The goal is to distribute this knowledge where it can yield tangible benefits (Shannak, 2010; Razali et al., 2016; Abuaddous et al., 2018). Other authors emphasise the practical aspect of KM and its role in improving OP through effective knowledge utilisation, defining the concept as "doing what is needed to maximise knowledge resources" [Sabherwal, (2014), p.39] or as a 'pack rat' approach to content:' save it, it may prove useful sometime in the future' [Dalkir, (2017), p.13]. Additional definitions highlight its strategic dimension as an approach aimed at effectively capturing, structuring, managing, and disseminating knowledge within an organisation with the goal of enhancing operational efficiency (Pfeffer and Sutton, 1999).

According to Dalkir (2017), KM involves seven keys' processes: capture, creation, codification, sharing, accessing, applying, and reuse of knowledge within and between organisations. Every process plays a vital role in optimising knowledge utilisation within and between organisations.

The measurement of KM has been a challenging endeavour due to the intricate and intangible nature of knowledge. Various measurement frameworks have emerged, reflecting the multifaceted aspects of KM assessment. For a long time, studies focusing on KM measurement favoured a holistic perspective emphasising the importance of the organisational level and neglecting the individual one. However, a recent trend in research has started to advocate for addressing this omission, considering the pivotal role of individuals in the creation, acquisition, codification, sharing, and application of knowledge within an organisation (Adam et al., 2022; Dash, 2022; Hoang and Truong, 2021; Li et al., 2020; Martínez et al., 2016).

The measurement models of KM can be classified into three major categories: a financial approach, a scorecard approach, and a performance-based approach. The first ones are related to a financial approach and involve quantifying IC using financial models such as Tobin's Q economic value added (EVA), human resource accounting (HRA), and value creation intellectual coefficient (VAIC) based on corporate financial statements. The second category includes measurement models of the scorecard-type approach (Kaplan et al., 1992), which dissects IC into components such as human capital (HC), structural capital (SC), and relational capital (RC), employing quantitative indicators to measure each. Models like the Skandia Navigator (Edvinsson and Malone, 1997) (by reference to the conceptual model that was developed within the Swedish company Skandia under the name of navigator) and the IC Index fall within this category. Lastly, the performance-based approach concentrates on evaluating how knowledge and KM practices impact OP, focusing on outcomes rather than knowledge itself (Syed and Murray, 2018).

Scholars identified several factors that influence KM, including: individual characteristics of employees (such as their level of education, professional experience, and motivation); organisational characteristics (such as corporate culture, organisational structure, and reward systems); Information and communication technologies (such as content management systems, enterprise social networks, and online collaboration tools), innovation management and product development processes, which can facilitate or hinder the creation and sharing of knowledge, and human resource management practices

(such as training and skill development, performance management, and compensation) Culture in particular plays a pivotal role in promoting or inhibiting the practice of KM (Lee and Choi, 2003). Indeed, organisational culture embodies the shared values, beliefs, and norms that guide employee behaviour. In a culture that values learning, collaboration, and knowledge sharing, KM practices are more likely to thrive. Conversely, in a culture that prioritises hierarchy and individualism, knowledge sharing may be stifled.

Several KM models have been proposed in the literature. For example, the SECI model (Lee and Choi, 2003) describes the process of knowledge creation and conversion through socialisation, externalisation, combination, and internalisation. The Ba model (Nonaka and Konno, 1998) emphasises the importance of shared physical, social, and mental spaces for knowledge creation and sharing, while the IC model focuses on the identification and measurement of intangible assets such as HC, SC, and RC.

2.2 Organisational performance

OP is a concept widely covered in the literature, but it faces a lack of consensus on its definition among scholars and practitioners. This could be attributed to the absence of a one-dimensional performance construct or the failure to adequately identify or describe the dimensions upon which such a construct could be based (Carton and Hofer, 2006).

OP is sometimes defined as the measurement of a firm's success and achievements (Yeung et al., 2007). It reflects how well an organisation utilises its resources to achieve its goals and objectives. Razali et al. (2016) describe it as the outcome of a firm's operational capabilities, financial stability, and ability to deliver quality products or services.

Scholars have identified various dimensions of OP. Among them, three critical dimensions are highlighted. The first one refers to financial performance, which pertains to a firm's monetary situation and profitability. It includes indicators like revenue growth, profit margin, return on equity, and cash flow. The second one relates to operational performance in terms of the organisation's efficiency and effectiveness in internal operations, such as product or process quality, efficiency, and productivity (Tan et al., 2007). The third relates to product quality, which refers to the intrinsic and extrinsic attributes of a product or service. For example, perceived quality, which is based on past performance, plays a vital role in customer satisfaction and competitiveness.

OP can be measured using various approaches, and the choice of measurement method depends on the specific context and objectives of the study (Richard et al., 2009). Two main approaches to measurement prevail in the literature: objective (hard) measures and subjective (soft) measures (Migdadi, 2022). Objective performance measures are quantifiable indicators typically derived from financial data and financial performance (Liu et al., 2022). These measures include financial indicators like return on investment, profitability, cash flow, sales growth, and market share (Yeung et al., 2007; Kaplan and Norton, 1996). They provide a tangible assessment of a company's financial health and market competitiveness. Subjective or soft measures focus on non-monetary aspects of performance, such as organisational processes, product quality, customer satisfaction, and employee development (Yeung et al., 2007; Abdel-Maksoud et al., 2005). These measures capture the intangible aspects that contribute to an organisation's overall success.

Several factors influence OP, including leadership styles, KM practices, and strategic variables. Leadership characteristics and styles significantly impact OP (Richard et al.,

2009). Transformational leadership, for example, has been found to positively affect team performance. Effective leadership is essential for aligning employee behaviours with organisational goals.

Studies also found that KM practices encompass the strategic management of an organisation's knowledge resources (Roland, 2006; Noruzy et al., 2013). KM practices enhance knowledge creation, transfer, and integration, leading to better performance outcomes (Garcia-Morales et al., 2008; Zack et al., 2001).

2.3 Knowledge management and organisational performance

The link between OP and KM is intricate and multifaceted. Although there is no universally applicable answer, some scholars posit that effective KM practices can contribute to enhancing OP. Following a systematic literature review that focused on 20 research papers, Bayari et al. (2022) found a significant positive relationship between KM and OP. KM has been linked positively to financial performance measures such as return on assets, return on equity, and return on investment. It has also been found to have a positive impact on non-financial performance measures such as quality, innovation, and productivity.

Additionally, Obeso et al. (2020) argue that KM processes encompassing knowledge generation, storage, and flow can aid firms in creating and utilising knowledge assets. This, in turn, can lead to improved performance outcomes such as increased innovation, productivity, and profitability. Nonetheless, the relationship between KM and OP is not always straightforward. Kiessling et al. (2009) suggest that effective KM can positively impact OP outcomes by providing firms with a competitive advantage. Essentially, firms that are able to accumulate and manage knowledge resources are more likely to achieve better performance outcomes than those that do not. However, the specific nature of the relationship between KM and OP may vary depending on the context and the specific KM practices being used. Obeso acknowledges that various factors, such as organisational learning, innovation capabilities, and learning culture, may mediate this relationship. Contextual factors, including industry type, firm size, and market competition levels, can also exert an influence. Overall, the literature suggests that KM can be a powerful tool for improving OP, but that organisations need to be strategic in their approach to KM and focus on the specific practices that are most closely related to their goals and objectives. It is especially advised casting a wide net in the KM strategies to be mobilised. For example, exploring the impact of KM on OP, Zack et al. (2009) arrive at the conclusion that 'OP was significantly related to 11 of the 12 KM practices' [Zack et al., (2009), p.401].

3 Methodology

3.1 Identifying the scope of the research

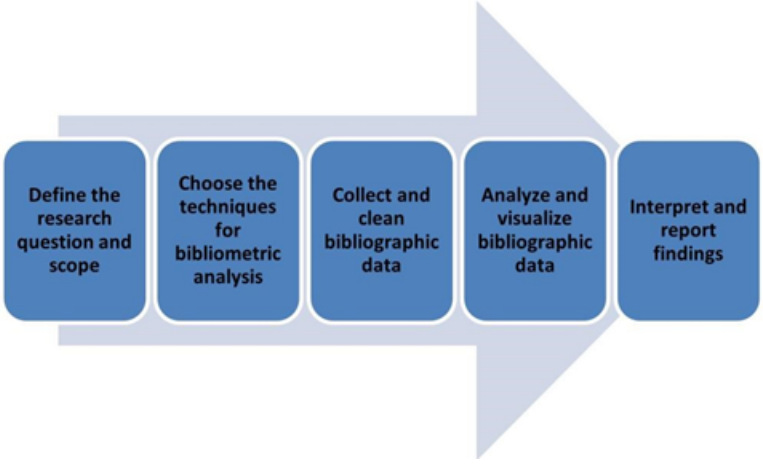
Over the last few years, bibliometric analyses have begun to be seen by researchers and practitioners as interesting quantitative methodologies to assess fields within the literature and evaluate scientific production and knowledge. Utilising statistical techniques to analyse publication, citations, and collaboration patterns among researchers or to identify influential authors, institutions, and publications in a particular field (Rogers et al., 2020),

these approaches can be used to advance theory and practice (Mukherjee et al., 2022) but remain a relative novelty in business research (Donthu et al., 2021). However, bibliometric analyses require a critical sample size for the targeted articles. Rogers et al. (2020) state that this kind of research is only advised when there are at least 200 papers to review as references.

Bibliometric analyses typically involve several stages: stating the research question, choosing the database(s) for collecting data, determining pertinent search terms and phrases, applying inclusion and exclusion criteria to choose pertinent documents, extracting data from selected documents, analysing, and visualising the data using the right software tools, and interpreting the findings.

Each type of analysis employs a unique set of techniques and metrics to investigate distinct facets of the scientific literature. Similarly, network analysis looks at the connections between authors or publications in a field to identify key players and collaborations. There are several tools used in bibliometric analysis, including bibliometrix (an R package for bibliometric analysis that provides a range of functions for data cleaning, analysis, and visualisation), VOSviewer (a software tool for constructing and visualising bibliometric networks based on co-citation or co-authorship data), citeSpace (a software tool for visualising and analysing trends and patterns in scientific literature based on citation data), and more conventional statistical tools such as SPSS.

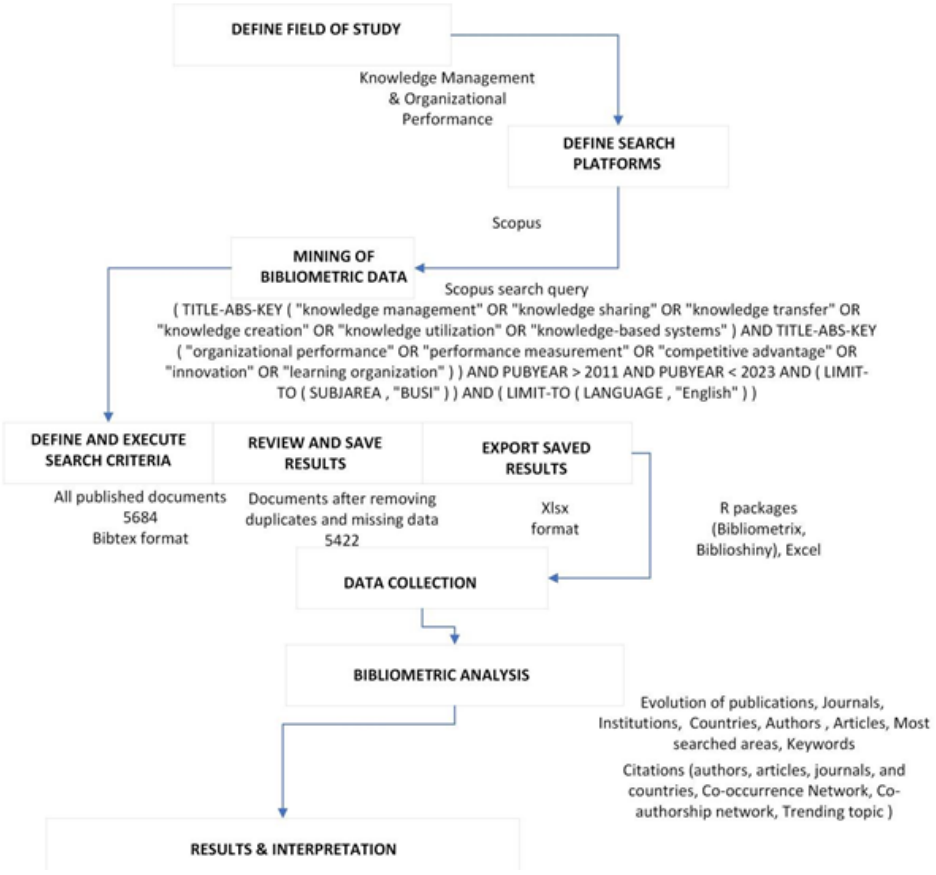
Figure 1 Bibliometric workflow conceptualisation (see online version for colours)



In this article, we used the R packages bibliometrix and its web interface counterpart, biblioshiny (Aria and Cuccurullo, 2017; Moral-Muñoz et al., 2020), along with more conventional tools such as excel. After exporting the dataset obtained from Scopus in bibtex format, we initially imported it using biblioshiny and then exported it to an xlsx file. This process aimed to enable us to clean the dataset by removing duplicates or files with missing data. The cleaned file was then re-imported into biblioshiny, this time in excel format.

The steps of the methodological approach are presented in a workflow conceptualisation in Figure 1 and in more detail in Figure 2.

Figure 2 Stages of bibliometric analysis process (see online version for colours)



3.2 Data collection

The bibliometric analysis relies on the Scopus database to retrieve relevant articles. Launched in November 2004, Scopus is the world's largest database of peer-reviewed literature citations and abstracts (Khiste and Paithankar, 2017). Providing content from 27,950 active peer-reviewed journals in various fields, collaborating with 7,000 publishers in 105 countries for 19 years, and providing access to a wide range of scholarly content (Scopus, 2023). It is appreciated by researchers for its good coverage of management topics (Farrukh et al., 2022; Aksnes and Sivertsen, 2019). Additionally, its features also contribute to its popularity. On competing platforms like WOS, for example, export options are limited to 500 documents, which requires more manual manipulation for large datasets. Scopus, in contrast, allows the export of up to 20,000 documents. Our methodology was based on the preferred reporting items for systematic reviews and meta-analyses (PRISMA) protocol, which recommends enhancing the transparency and reporting of systematic reviews and meta-analyses. It includes the search strategy, data extraction methods, and statistical analysis (Shome et al., 2023; Moher et al., 2009;

Borrett et al., 2018). After collecting the data, the results were filtered to include only business and management papers written in English.

Table 1 Exclusion and inclusion criteria

Criterion	Inclusion	Exclusion
Language	English	Non-english documents
Articles types	Article conference paper Book chapter Review Conference review book	Retracted editorial Note Short survey Erratum Letter Data paper abstract report report
Focus of the title/abstracts/keywords papers	Studies focusing on both impact KM and OP have been included	Studies not focused on both impact KM and OP have been excluded
Subject area	Business, management and accounting	Non-relevant topics from disciplines outside business, management and accounting have been excluded
Publication stage	Final and articles in press were both included	
Period	The study period covered 2012 to 2022	The periods prior to 2012 and after 2022 were excluded (2023 was excluded to analyse complete annual periods)

The search strategy focuses on relevant articles published between 2012 and 2022 in the field of business and incorporates a combination of keywords related to KM and OP. Table 1 outlines the criteria for inclusion and exclusion. The initial keywords used were derived from the relevant literature. A preliminary search on Scopus was conducted to identify additional keywords closely related to our subject. Included in the search criteria are 'KM', 'knowledge sharing', 'knowledge transfer', 'knowledge creation', 'knowledge utilisation', and 'knowledge-based systems'. In addition, the glossary contains the terms 'OP,' 'performance measurement,' 'competitive advantage,' 'innovation,' and 'learning organisation.' To assure a comprehensive analysis, the search is limited to English-language articles only. Then the following keyword query was launched on the search engine: (TITLE-ABS-KEY ('KM' OR 'knowledge sharing' OR 'knowledge transfer' OR 'knowledge creation' OR 'knowledge utilisation' OR 'knowledge-based systems') AND TITLE-ABS-KEY ('OP' OR 'performance measurement' OR 'competitive advantage' OR 'innovation' OR 'learning organisation')) AND PUBYEAR > 2011 AND PUBYEAR < 2023 AND (LIMIT-TO (SUBJAREA , 'BUSI')) AND (LIMIT-TO (LANGUAGE , 'English')).

4 Results

4.1 Descriptive statistics

The dataset for this analysis covers a time span of 10 years, from 2012 to 2022, with a total of 5,422 documents. The diversity of sources is reflected in the inclusion of 1,262

different sources, including journals, books, and others. The average document age of 5.46 years suggests that the included publications are relatively new. The dataset also reveals a 19.64 average citation count and an average yearly growth rate of 5.87% for the number of documents published over this time (Table 2).

Table 2 Main informations

Description	*Results*
Main information about data	
Timespan	*2012:2022*
Sources (journals, books, etc.)	*1,262*
Documents	5,422
Annual growth rate %	5.87
Document average age	5.48
Average citations per doc	19.64
Keywords plus (ID)	8,244
Author's keywords (DE)	10,526
Authors	11,361
Authors of single-authored docs	789
Single-authored docs	903
Co-authors PER Doc	2.77
International co-authorships %	28.99

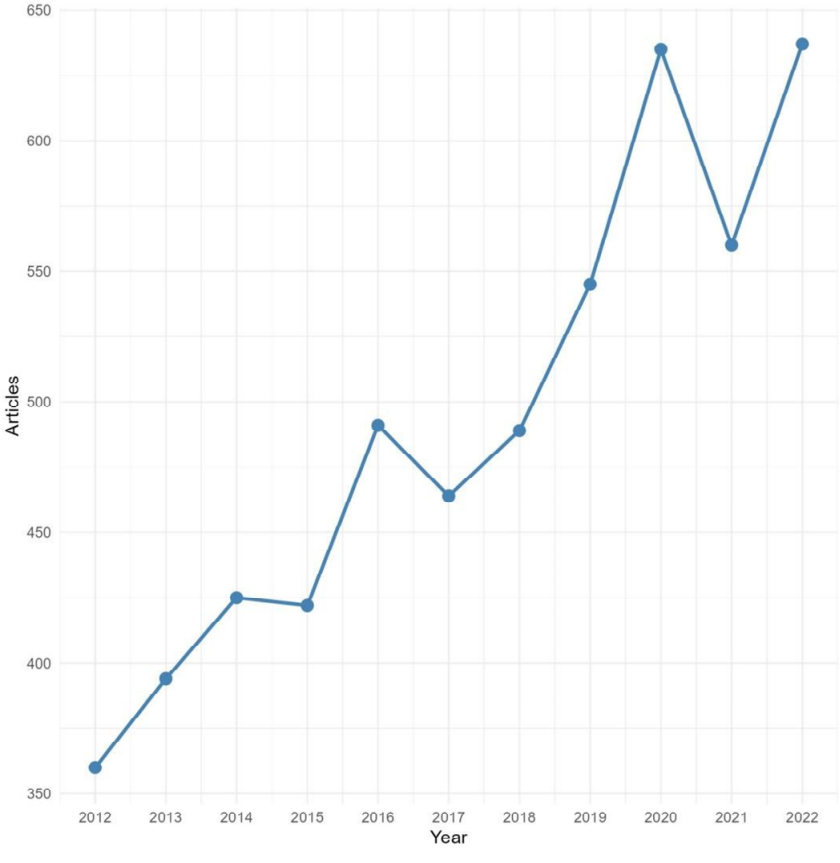
Table 3 Average citation per year, TC: total citation (see online version for colours)

Year	*Mean TC per art.*	*No. of articles*	*Mean TC per year*	*Citable years*
2012	31.76	360	2.65	12
2013	26.69	394	2.43	11
2014	29.84	425	2.98	10
2015	25.84	422	2.87	9
2016	23.91	491	2.99	8
2017	22.74	464	3.25	7
2018	22.56	489	3.76	6
2019	18.13	545	3.63	5
2020	14.57	635	3.64	4
2021	10.36	560	3.45	3
2022	4.23	637	2.12	2

The annual scientific production of articles can be found in Figure 3 and in Table 3. Starting in 2012, the number of articles showed a steady increase, indicating a growing interest in the field. In subsequent years, the curve demonstrates fluctuations, with some years experiencing slight decreases in the number of articles published. The year 2020 stands out as a significant milestone with a notable surge in the number of articles published. This increase is likely attributed to the COVID-19 effect, as indicated by the analysis of the trending topics discussed later in this article (Figure 18). As for the mean

citations per year (mean TC per year), which reflects the cumulative impact of the published work over time, it is worth noting that the numbers remained relatively consistent despite slight fluctuations ranging from 2.65 to 3.76 citations per year. The data shows a gradual decrease in the number of citable years over time, indicating a narrowing window for citations.

Figure 3 Scientific annual production (see online version for colours)



4.2 Most relevant sources

Over 2,365 diverse sources have contributed to the extensive research on KM and OP since 2012. These sources include journals, conferences, proceedings, and books. Notable sources include the *Journal of Knowledge Management*, which has published 264 articles (Figure 4), and *Technological Forecasting and Social Change*, with 126 articles. Other significant contributors are *Knowledge Management Research and Practice*, the *Journal of Business Research*, and the *Proceedings of the International Conference on Intellectual Capital*, *Knowledge Management and Organisational Learning (ICICKM)*.

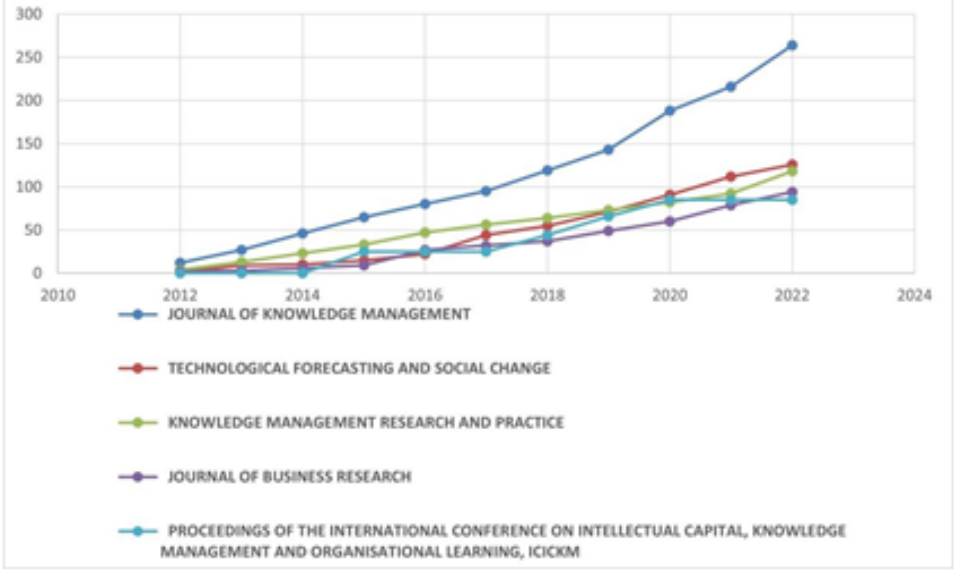
The dynamic analysis of the top sources (Figure 5) reveals interesting trends in their publication output over the years. Among the sources considered, the *Journal of Knowledge Management* has shown a consistent increase in publications, starting with 12

articles in 2012 and reaching its peak of 264 articles in 2022. This growth reflects the journal's continuous commitment to KM research. *Technological Forecasting and Social Change*, *Knowledge Management Research and Practice*, and the *Journal of Business Research* have also demonstrated an upward trajectory in their publication output.

Figure 4 The top 10 most relevant sources (see online version for colours)

The top 10 sources' 'h,' 'g,', and 'm' indexes are displayed in Table 4. The h-index corresponds to the number of articles in a journal that have been published and have each been cited at least h times. When evaluating the overall citation performance of a group of articles, the m-index is defined as H/n, and the g-index is an improvement of the h-index (Merigó and al., 2015; El Baz and Iddik, 2022).

Figure 5 Number of publications per year (see online version for colours)



The *Journal of Knowledge Management*, with an h-index of 61 and a g-index of 92, comes out as the most influential source. This indicates that a considerable number of the journal's articles have received substantial citations, highlighting its influence within the academic community. Following closely, the *Journal of Business Research and Research Policy* also demonstrate strong impact with respective h-indices of 44 and 42. Similarly, *Technological Forecasting and Social Change* and the *Journal of Product Innovation Management* have achieved notable impact with h-indices of 42 and 29, respectively.

Table 4 Top 10 Journals with h, g and m index as well as total citation (TC) (see online version for colours)

Element	*h_index*	*g_index*	*m_index*	*TC*	*NP*	*PY_start*
Journal of Knowledg E-Management	61	92	5.083	11,370	264	2012
Journal of Business Research	44	77	3.667	6,082	94	2012
Research Policy	42	77	3.5	6,462	77	2012
Technological Forecasting and Social Change	42	71	3.5	5,704	126	2012
Journal of Product Innovation Management	29	42	2.417	2593	42	2012
Knowledg E-Management Research and Practice	28	38	2.333	2,022	118	2012
Journal of Cleaner Production	27	48	2.455	2,366	54	2013

4.3 Influential authors, affiliations and countries

Figure 6 lists the most important and influential authors. It displays the overall number of articles (black bars) and the total number of fractionalised articles (red bars). Wang Y. emerges as the most locally cited author, with 29 articles. Similarly, Kasemsap K. has also made a significant impact with 20 articles. Other influential authors include Liu Y., Carayannis EG., Le PB., Vrontis D., Kianto A., Li X., Yang J., and Zhang J.

Fractional authorship measures an author's contributions to a published collection of articles under the assumption that each co-author made an equal contribution to each document (Plume and van Weijen, 2014). For instance, Wang Y. has 29 articles, and the fractionalised score of 8.77 indicates that, on average, he has contributed to approximately 8.77 articles out of the 29.

Analysing the most relevant affiliations based on the corresponding authors of articles, we observe that Lappeenranta University of Technology stands out as the leading institution, with 49 articles published, followed closely by Islamic Azad University, as shown in Figure 7. Copenhagen Business School, Tsinghua University, and Zhejiang University share the third position, with each institution contributing 30 articles.

Figure 8 depicts the distribution of publications across various nations, with the total number of articles reflecting the per-nation frequency. The data includes the number of publications in which each article is assigned to a particular country based on the author's affiliation as well as the fraction of publications in which at least one author is affiliated

with a country other than that of the corresponding author. This metric is referred to as 'Multiple Country Publications' (MCP). We can observe that China leads with 341 publications, out of which 137 have authors affiliated with other countries (MCP). The USA ranks second with 207 publications, of which 86 involve MCP. The UK follows with 147 publications and 109 MCP.

Figure 6 Most relevant and influential authors (see online version for colours)

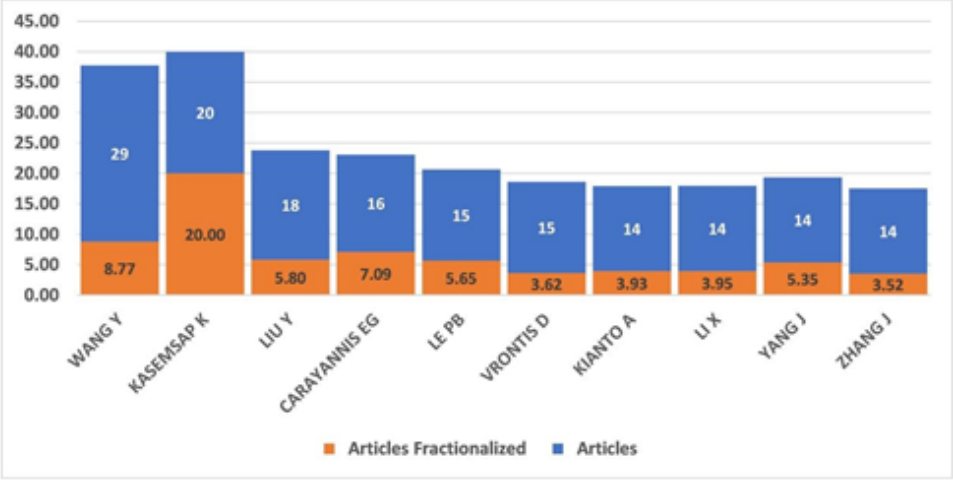
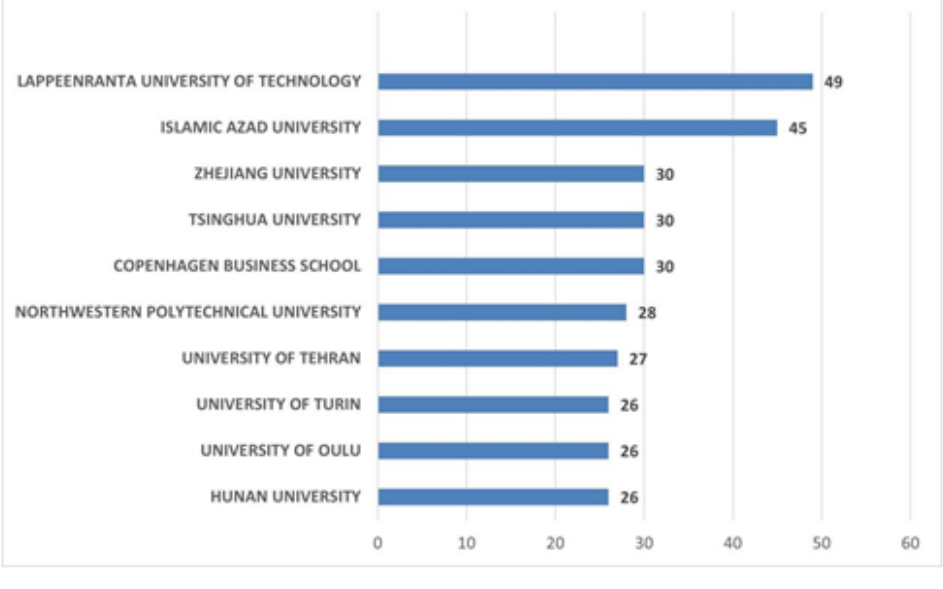


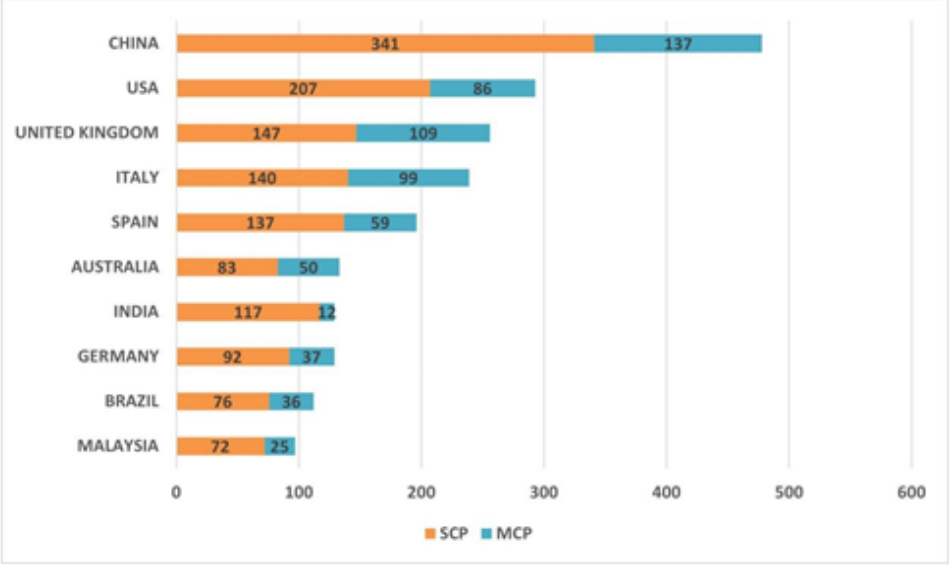
Figure 7 Most relevant affiliation (see online version for colours)



Country Scientific Production measures the appearances of authors based on their country affiliations. Each article contributes to the count of the respective countries for

each author involved. As shown in Figure 9, China has produced more articles, followed by the USA and the UK.

Figure 8 Number of articles based on corresponding author (see online version for colours)



Note: MCP: multiple countries publications, SCP: single country publications.

Figure 9 Scientific production by country (see online version for colours)

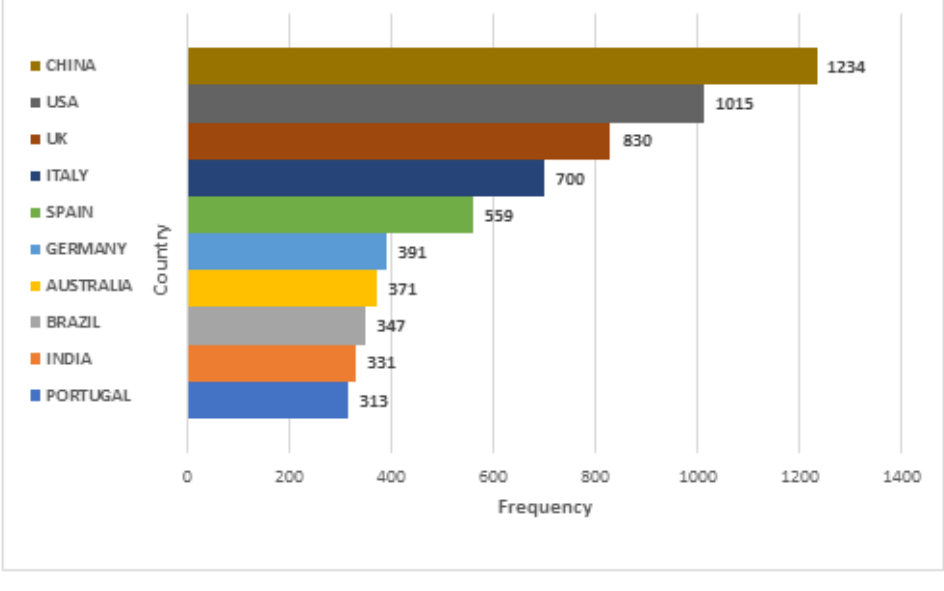


Figure 10 Production of top countries over time (see online version for colours)

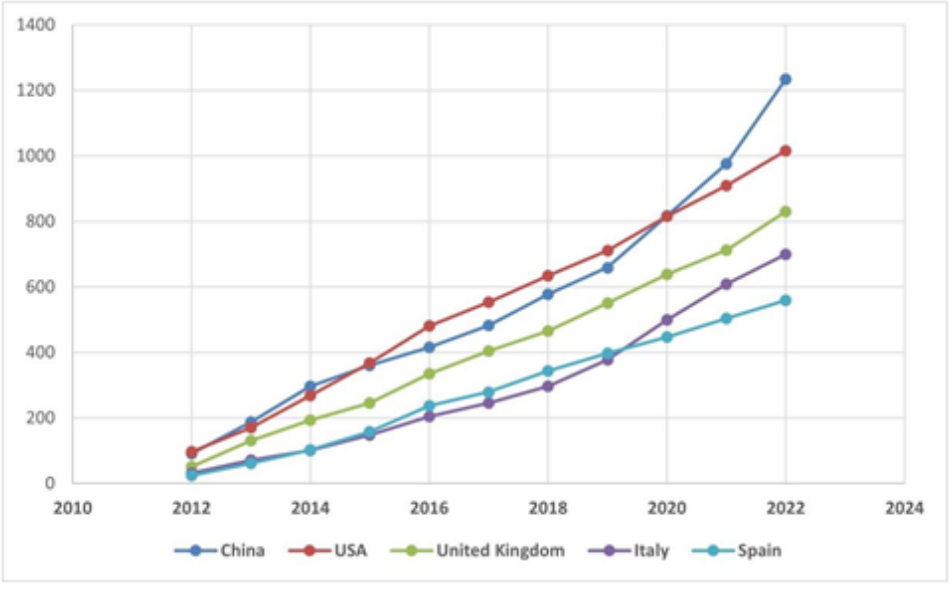


Figure 11 Total and average articles citations of different countries (see online version for colours)

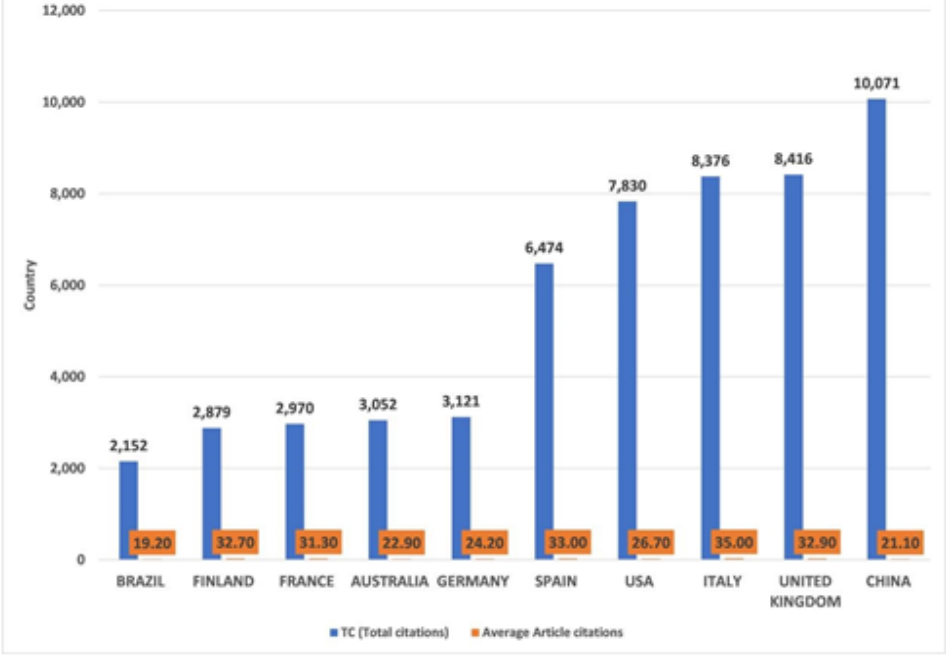


Table 5 Most cited references based on number of global citations from the collection dataset

Document title	*Author and year publication*	*Publication source*	*DOI*	*Total citations*
Knowledge, networks, and knowledge networks	Phelps et al. (2012)	*Journal of Management*	10.1177/0149206311432640	725
How knowledge affects radical innovation: Knowledge base, market knowledge acquisition, and internal knowledge sharing	Zhou and Li (2012)	*Strategic Management Journal*	10.1002/smj.1959	642
Modelling the smart city performance	Lombardi et al. (2012)	*The European Journal of Social Science Research*	10.1080/13511610.2012.660325	623
Service innovation in the digital age: key contributions and future directions	Barrett et al. (2015)	*MIS Quarterly*	10.25300/MISQ/2015/39:1.03	623
Three frames for innovation policy: R&D, systems of innovation and transformative change	Schot and Steinmueller (2018)	*Research Policy*	10.1016/j.respol.2018.08.011	578
Sustainable supply chain management practices and dynamic capabilities in the food industry: a critical analysis of the literature	Beske et al. (2014)	*International Journal of Production Economics*	10.1016/j.ijpe.2013.12.026	566
Social media, knowledge sharing, and innovation: toward a theory of communication visibility	Leonardi (2014)	*Information Systems Research*	10.1287/isre.2014.0536	483
Smart cities: a conjuncture of four forces	Angelidou (2015)	*Cities*	10.1016/j.cities.2015.05.004	480

Regarding the production over time of the top countries (Figure 10), it should be noted that China stands out with a significant increase in research output, particularly in 2021,

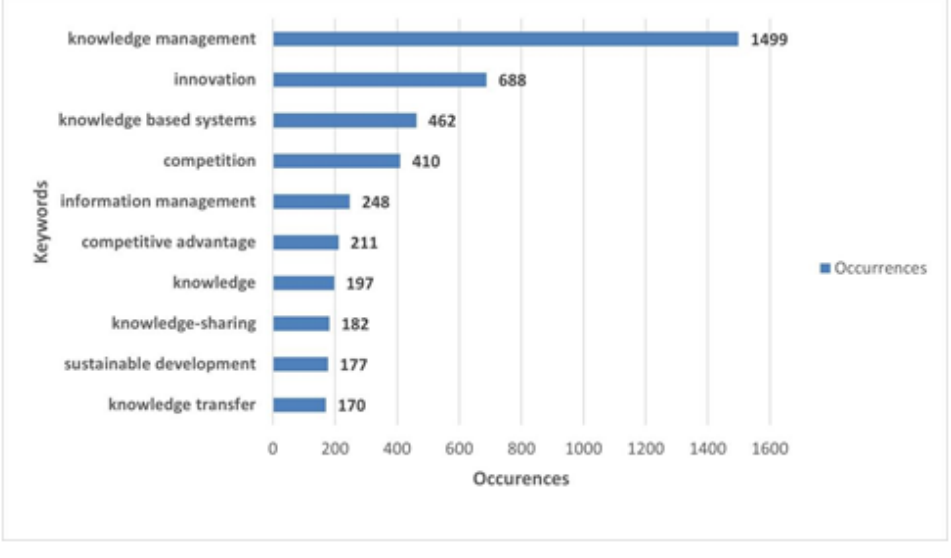
solidifying its position as a leading contributor. The USA consistently maintains a high level of scientific production, while Italy, Spain, and the UK also show notable growth over the years. China also emerges as the most cited country, with a total citation count of 10,071 and an average of 21.10. The UK follows closely behind with 8,416 total citations and an average of 32.90 citations per article (Figure 11).

4.4 Document analysis

Another level of analysis in this research focuses on document analysis. Table 5 displays the most cited documents along with their number of citations. The analysis reveals that the most cited document in the field is 'knowledge, networks, and knowledge networks,' published in the *Journal of Management* by Phelps et al. (2012) (725 citations). Another highly cited article is 'How knowledge affects radical innovation: knowledge base, market knowledge acquisition, and internal knowledge sharing' by Zhou and Li (2012), published in the *Strategic Management Journal*, which has been cited 642 times.

The article 'Modelling the smart city performance' by Lombardi et al. (2012), published in *The European Journal of Social Science Research*, has received 623 citations. It focuses on modelling the performance of smart cities. In the third position, we find two articles tied with a similar number of citations: 'Modelling the smart city performance' by Lombardi et al. (2012), published in *The European Journal of Social Science Research*, R & D, systems of innovation and transformative change' by Schot and Steinmueller (2018), published in *Research Policy*.

Figure 12 Most frequently used keywords (see online version for colours)

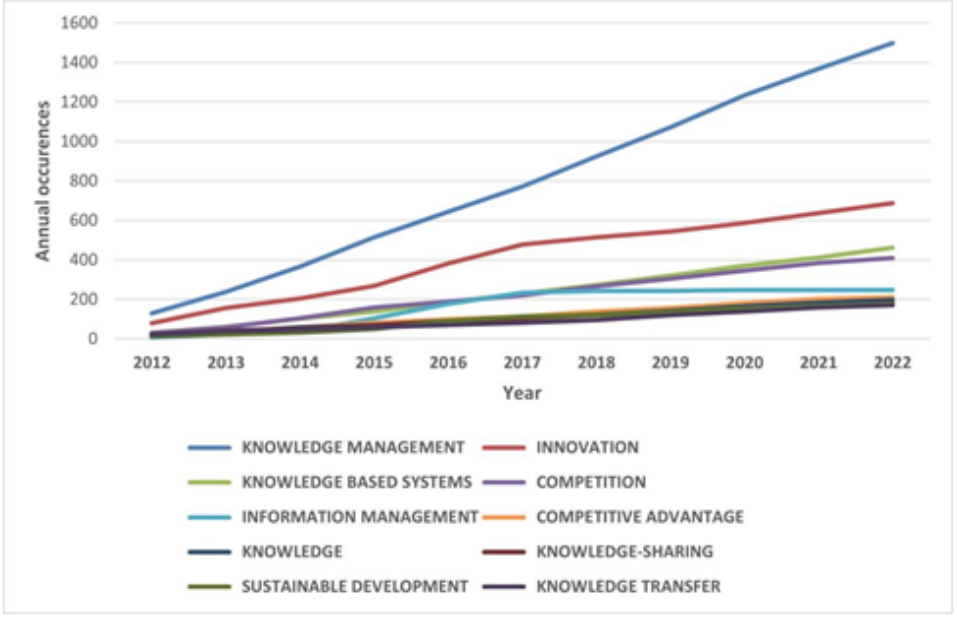


4.5 Keywords and conceptual structure

In the section related to keywords, bibliometric studies typically distinguish between two types of units of analysis: author-provided keywords, identified by the letters 'DE' in

major academic databases, and keywords corresponding to the distribution frequency of keywords associated with the manuscript source, recognisable by the letters 'ID'. In this study, we focused on author-provided keywords. The top 10 keywords used in the documents is shown in Figure 12. It can be observed that 'KM' consistently appears as the most frequently used keyword throughout the dataset, indicating its central importance in the field. The keyword 'innovation' also shows a high frequency, highlighting the significance of fostering innovative practices and strategies within organisations.

Figure 13 Annual occurrences of author's keywords (see online version for colours)



Other frequently used keywords include 'knowledge-based systems,' 'competition,' 'information management,' 'competitive advantage,' 'knowledge sharing,' 'sustainable development,' and 'knowledge transfer.' These keywords signify the key themes and areas of interest within the field of KM and OP research. The frequency of these keywords shows variations over time, with generally increasing trends (Figure 13). This suggests the evolving nature of research and the growing emphasis on topics such as innovation, competition, information management, and competitive advantage.

Conceptual networks in bibliometric analyses consist of a structured representation of the main themes and trends within a research field. These networks are created using the co-occurrence of words in documents, where words appearing together are connected in a network. The conceptual structure helps identify different topics and associated issues within the field and provides insights into the evolution of research over time. In the network, each node represents a keyword or study topic, and its size reflects its degree of occurrence. Evaluating the field based on word proximity can reveal the frequency of word co-occurrences and their association within documents. These approaches, which are rooted in graph theory and use network analysis tools (Wasserman and Faust, 1994), aim to explore the patterns of relational structures. In these analyses, network structures

differentiate actors or nodes (such as words, authors' names, or universities in our case) and the links between them, which represent the relations or interactions connecting them. These links are typically referred to as 'edges' in network analyses.

In order to provide insights into the community structure, connectivity, influence, and intermediary roles within the network, network analysis commonly various metrics that include: modularity (degree of community structure), number of communities (distinct groups identified within the network), degree (average strength of connections), weighted degree (considering both the number and weight of connections), eigenvector centrality (importance of nodes based on connections to other important nodes), betweenness centrality (extent of node's bridging role in connecting other nodes), PageRank (The SEO community is familiar with PageRank, a metric developed by Google's founders, Larry Page and Sergey Brin in the late 1990s, which assigns scores to pages/nodes based on the links they receive, resembling the evaluation of hyperlinked web pages). In bibliometric approaches, measures of betweenness centrality and PageRank remain the most popular. Generated through the biblioshiny R package, the co-occurrence network structure (Figure 14) clusters of related keywords and their characteristics based on betweenness, closeness, and PageRank measures.

Figure 14 Co-occurrence network (see online version for colours)

In the first cluster, keywords such as 'KM,' 'innovation,' 'knowledge-based systems,' 'information management,' and 'knowledge' have high betweenness, indicating their centrality in connecting other keywords within the cluster. These keywords play essential roles in knowledge-related research and demonstrate their influence in the field.

The second cluster focuses on keywords like 'competition,' 'competitive advantage,' 'knowledge sharing,' 'surveys,' and 'human resource management.' These keywords emphasise the importance of competition, strategic advantages, and knowledge exchange in organisational settings. They exhibit relatively high betweenness and PageRank values, suggesting their significant contributions to the overall network.

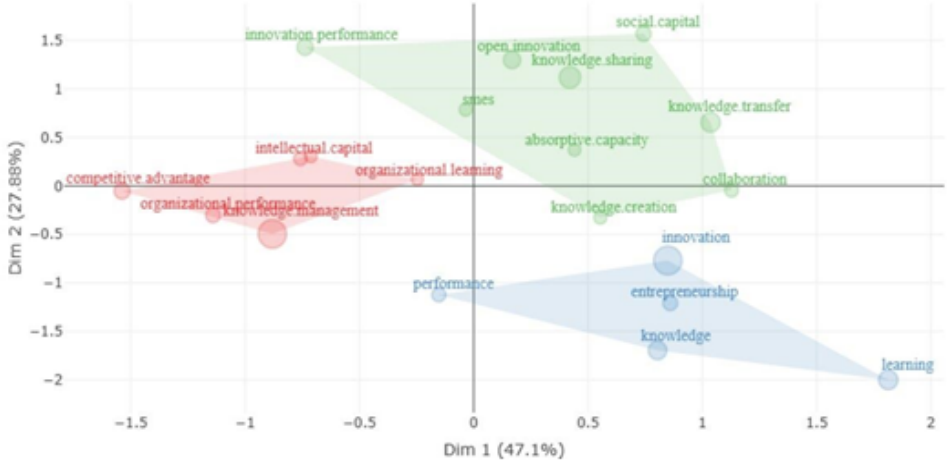
Other keywords, such as 'sustainable development,' 'economics,' 'open innovation,' and 'industry,' show their relevance in the KM context. Although they have lower betweenness and PageRank values compared to the central keywords, they still contribute to the overall network structure.

To provide a comprehensive understanding of the relationships and patterns among these keywords, our study utilised factorial analysis, employing the method of multiple correspondence analysis (MCA). MCA is commonly used to explore the

interdependencies among categorical variables, such as author keywords, keywords plus, titles, or abstracts, with the aim of identifying latent variables. As a result of this analysis (Figure 15), three distinct clusters have emerged. The first cluster, depicted in green, comprises words related to knowledge sharing, knowledge transfer, open innovation, knowledge creation, and innovation performance.

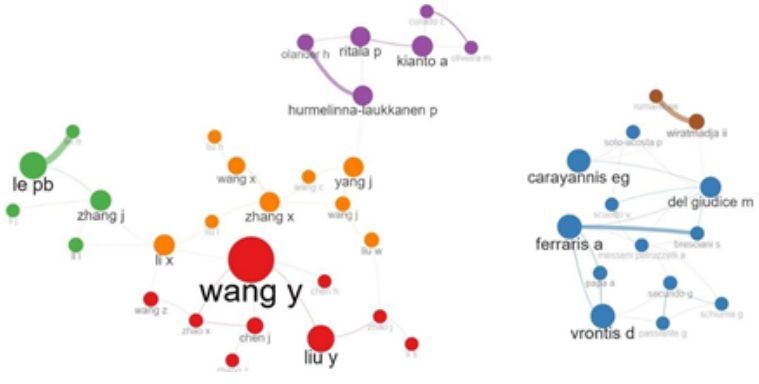
The second cluster, shown in red, includes words such as 'competitive advantage', 'organisational learning', 'KM', 'OP', and 'IC.' Finally, the third cluster, represented in blue, consists of words such as 'innovation,' 'entrepreneurship,' 'performance,' 'knowledge,' and 'learning'.

Figure 15 Factorial analysis using the biblioshiny package (see online version for colours)



To further explore the collaboration structure within the network of authors, we analysed network measures such as betweenness, closeness, and PageRank. Figure 16 and Table 6 provide valuable insights into the centrality and influence of each author within the network, as each node represents a different author assigned to specific clusters. These measures offer a comprehensive understanding of the collaborative dynamics and the influential authors shaping the research landscape in the field of KM and OP.

Figure 16 Co-authorship network (see online version for colours)



Examining cluster 1, we can identify influential authors such as Kianto A., Ritala P., HurmelinnaLaukkanen P., Olander H., Curado C., and Oliveira M. Notably, Ritala P. stands out with the highest betweenness value (75), indicating his potential to bridge different parts of the collaboration network. Olander H exhibits a relatively high closeness value (0.007092199), suggesting his close connections with other authors within the cluster. Additionally, Hurmelinna-Laukkanen P demonstrates significant influence within the cluster, as evidenced by her high PageRank value (0.031172011).

Table 6 Co-authorship based on network metrics

Node	*Cluster*	*Betweennes*	*Closeness*	*PageRank*
Kianto, A.	1	52	0.00621118	0.02125732
Ritala, P.	1	75	0.00724638	0.02405399
Hurmelinna-Laukkanen, P.	1	115	0.00847458	0.03117201
Olander, H.	1	0	0.0070922	0.03017583
Curado, C.	1	0	0.00534759	0.02219411
Oliveira, M.	1	0	0.00534759	0.02219411
Yang, J.	2	133.904762	0.00990099	0.02371247
Wang, X.	2	27	0.00943396	0.02328475
Zhang, X.	2	185.056349	0.01234568	0.03961241
Wang, J.	2	111.796032	0.01136364	0.02565408
Wang, C.	2	38.7333333	0.0106383	0.01413903
Liu, H.	2	0	0.0075188	0.01008572
Liu, L.	2	40.0625	0.0106383	0.01447528
Carayannis, Eg.	3	1	0.03448276	0.01570596
Vrontis, D.	3	8.2538961	0.03571429	0.02511459
Ferraris, A.	3	19.4771104	0.04545455	0.0411313
Del Giudice, M.	3	37.1642857	0.05	0.03731096
Soto-Acosta, P.	3	0.2	0.03333333	0.01312523
Messeni Petruzzelli, A.	3	19.5961039	0.04761905	0.02190295
Schiuma, G.	3	1.08831169	0.03448276	0.01643489
Scuotto, V.	3	1.78571429	0.03703704	0.01607635
Secundo, G.	3	4.8155303	0.03703704	0.02670213
Bresciani, S.	3	0	0.04	0.02849365
Papa, A.	3	0	0.03225807	0.01227698
Passiante, G.	3	0.61904762	0.02857143	0.01975762
Le, P.b	4	27	0.00724638	0.03797586
Li, X.	4	128.030556	0.01075269	0.03161855
Zhang, J.	4	77	0.00884956	0.02815389
Li, L.	4	0	0.00862069	0.01364969
Li, J.	4	0	0.00714286	0.00827453
Lei, H.	4	0	0.00606061	0.02931195
Wang, Y.	5	183.158135	0.0125	0.05004023

Table 6 Co-authorship based on network metrics (continued)

Node	*Cluster*	*Betweennes*	*Closeness*	*PageRank*
Chen, J.	5	27	0.00970874	0.02761537
Wang, Z.	5	2.2	0.00862069	0.01429206
Zhao, X.	5	11.9583333	0.00970874	0.03193258
Zhang, Z.	5	0	0.00769231	0.00935664
Chen, H.	5	0	0.00934579	0.00880515
Liu, Y.	6	40.4706349	0.00990099	0.02671819
Liu, W.	6	21.5793651	0.00917431	0.015238
Zhao, J.	6	40.05	0.00925926	0.02963829
Li, S.	6	0	0.00740741	0.00978651
Wiratmadja, Ii.	7	12	0.03448276	0.02893269
Rumanti, Aa.	7	0	0.02439024	0.02261609

In cluster 2, authors such as Yang J., Wang X., Zhang X., Wang J., Wang C., Liu H., and Liu L. are included. Zhang X. stands out with the highest betweenness value (185.0563492), implying his role in bridging different parts of the collaboration network. Yang J. exhibits the highest closeness value (0.00990099), indicating his close connections with other authors in the cluster. Furthermore, Zhang X. emerges as a highly influential author within the cluster, as reflected by his high PageRank value (0.039612414).

In cluster 3, we find authors such as Carayannis EG, Vrontis D, Ferraris A, Del Giudice M., Soto-Acosta P., Messeni Petruzzelli A., Schiuma G., Scuotto V., Secundo G., Bresciani S., Papa A., Passiante G., and Del Giudice M. exhibits the highest betweenness value (37.16428571), suggesting a high potential to bridge different parts of the collaboration network. Ferraris A. has the highest closeness value (0.045454545), indicating close connections with other authors within the cluster. Furthermore, Wang Y. stands out with a significant PageRank value (0.041131298), signifying his high influence within the cluster.

In cluster 4, we observe authors like Le PB., Li X., Zhang J., Li L., Li J., and Lei H. Li X. demonstrates the highest betweenness value (128.0305556), implying his role in bridging different parts of the collaboration network. Le PB. has the highest closeness value (0.037975856), indicating his close connections with other authors within the cluster. Li X. also exhibits a high PageRank value (0.031618548), suggesting his influence within the cluster.

Finally, in cluster 5, we find authors such as Wang Y., Chen J., Wang Z., Zhao X., Zhang Z., and Chen H. Wang Y. stands out with the highest betweenness value (183.1581349), indicating his potential to bridge different parts of the collaboration network. Wang Y. also exhibits the highest closeness value (0.0125) and the highest PageRank value (0.050040233), suggesting both close connections and significant influence with other authors within the cluster.

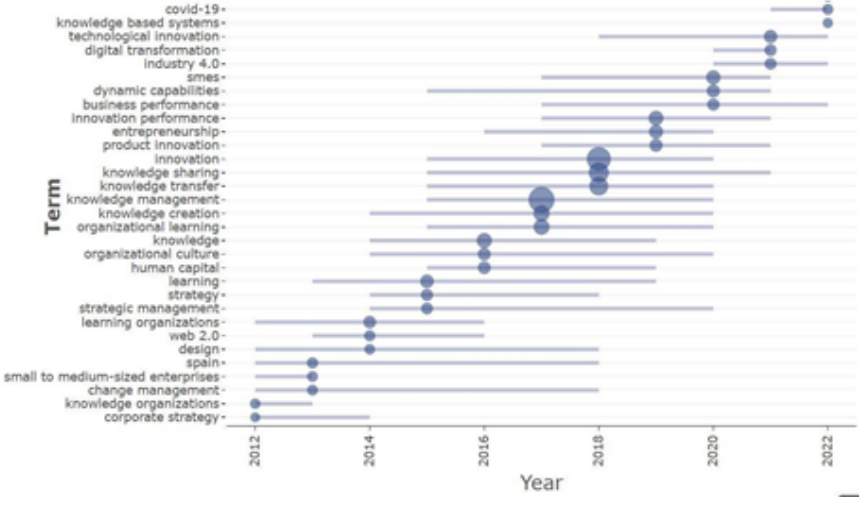
From an institutional perspective, distinct collaborating clusters can be identified when analysing the relationships and interconnectedness among universities (Figure 17). The first cluster consists of universities such as Universiti Sains Malaysia, Universiti Teknologi Malaysia, Universiti Teknologi MARA, and the University of Malaya. These

universities exhibit high betweenness centrality, highlighting their crucial role in connecting different parts of the network.

Moving on to the second cluster, we find universities such as Tsinghua University, Zhejiang University, the School of Management, Tianjin University, and Cambridge University.

Figure 17 Collaboration network of different universities (see online version for colours)

Figure 18 Trending topic (by author's keyword) (see online version for colours)



In the third cluster, we observe a diverse group of institutions, including the University of Turin, the University of Salento, the George Washington University, the National Research University Higher School of Economics, and the University of Nicosia.

Finally, the fourth cluster comprises institutions such as Islamic Azad University, the University of Tehran, the University of Murcia, Coventry University, and the University of Isfahan. These institutions display moderate betweenness centrality.

In addition to analysing the collaboration network, this study also highlights the trending topics in the field, as shown in Figure 18. The bibliometric analysis considers the frequency of keywords per year, with a minimum keyword count set to three for authors. The most studied topics in the field include 'KM', 'innovation', 'learning organisations', and 'organisational culture', alongside the prominent topic of 'COVID-19'. These topics have consistently been researched, with high frequencies observed. However, newer keywords such as 'digital transformation', 'industry 4.0', and 'digital technologies' have emerged more recently with lower frequencies, indicating emerging areas of interest.

5 Discussion and conclusions

This research provides a general overview of studies appearing in KM and OP by using bibliometric indicators and the Scopus database. The data collection process involved retrieving relevant articles published between 2012 and 2022, focusing on the field of business and management. Only English written papers were considered to ensure consistency in the analysis.

The study reveals several key findings. Firstly, the dataset covers a time span of 10 years, with an average annual growth rate of 5.87% in the number of published documents, indicating sustained interest in research on KM and OP over the years. The analysis of the annual scientific production shows a significant surge in the number of articles published in 2020, likely influenced by the COVID19 pandemic.

Examining the most relevant sources, the analysis highlights the *Journal of Knowledge Management* as the most impactful source in the field, with a high h-index and g-index. Other notable sources include *Technological Forecasting and Social Change*, *Knowledge Management Research and Practice*, the *Journal of Business Research*, and the *Proceedings of the International Conference on Intellectual Capital*, *Knowledge Management*, and *Organisational Learning (ICICKM)*.

Furthermore, examining influential authors, affiliations, and countries provide insights into the key contributors in the field. The most influential authors include Wang Y., Kasemsap K., Liu Y., Carayannis EG., Le PB, Vrontis D., Kianto A., Li X., Yang J., and Zhang J.. Lappeenranta University of Technology, Islamic Azad University, and Copenhagen Business School emerge as leading affiliations. China leads in terms of scientific production, followed by the USA and the UK.

Lastly, the analysis of keywords and conceptual networks reveals the central themes and trends within the KM and OP literature. 'KM' consistently appears as the most frequently used keyword, highlighting its central importance in the field. Other frequently used keywords include 'innovation,' 'knowledge-based systems,' 'competition,' and 'knowledge sharing.' The conceptual structure analysis helps identify different topics and their associations within the field, providing insights into the evolution of research over time.

Overall, this bibliometric analysis offers valuable insights into the research landscape of KM and OP. We believe our findings contribute to the theoretical understanding of the field, inform researchers about the most influential sources and authors, and provide practitioners with insights for improving OP through effective KM.

The analysis revealed a substantial volume of scholarly articles, indicating the significance and growing interest in the subject. However, the boundaries of this research

domain appear somewhat blurred. This is due to a combination of factors. First, the interdisciplinarity of KM and OP contributes to the convergence of ideas and theories from different fields, making knowledge consolidation difficult. In addition, the evolving nature of the field and the emergence of new concepts and frameworks add another layer of complexity. Moreover, the wide variety of perspectives and methodologies employed by academics and practitioners provides both a wealth of research perspectives and an overall impression of ambiguity.

Consequently, the fluidity and dynamic nature of KM and OP research call for continuous exploration and refinement of these boundaries to ensure a comprehensive understanding of the field. Ongoing efforts to navigate and define the scope of KM and OP will contribute to the advancement of knowledge and practice in this area.

6 Future research directions

The results of this bibliometric study offer valuable insights into potential future research directions in the field of KM and OP. These findings suggest several promising avenues for further exploration. Firstly, the analysis reveals fluctuations in the number of articles published over the years, particularly the substantial increase in 2020 attributed to the COVID-19 pandemic. This emphasises the need for a more comprehensive temporal analysis, which could involve a deeper examination of the underlying reasons behind these trends. Researchers could investigate the influence of global events, technological advancements, or paradigm shifts on research patterns. Secondly, the identification of influential authors, affiliations, and countries opens up opportunities for an in-depth analysis of collaboration networks. Future research could delve into inter-institutional collaborations, research ecosystems, and the factors that either facilitate or hinder collaboration among researchers. Additionally, emerging keywords such as ‘digital transformation,’ ‘industry 4.0,’ and ‘digital technologies’ indicate evolving trends in the field. These topics merit further investigation to comprehend their growing significance and potential impact on organisational practices. Furthermore, amidst the abundance of bibliometric research, conducting in-depth case studies can offer valuable insights. These studies could explore how KM concepts are implemented in specific organisations, their influence on OP, and the practical challenges encountered.

Moreover, integrating contextual factors into future research, such as company size, industry sector, and organisational culture, could provide a deeper understanding of how these factors influence the relationship between KM and performance. In addition, considering the diversity of countries involved in KM research, international comparative studies could be undertaken to compare KM practices and OP across different national contexts.

7 Limitations

Similar to any research, the current study is not exempt from limitations. Firstly, a valid query could be raised regarding the analysis conducted solely using the Scopus database, as alternative databases might yield disparate results. This limitation could be addressed by considering the inclusion of other prominent databases, such as Web of Science or

Google Scholar, to ensure a more comprehensive analysis and enhance the robustness of the findings.

In addition, the choice of keywords and inclusion criteria may have affected the results. While efforts were made to select relevant keywords and establish appropriate inclusion criteria, it is possible that some relevant studies were missed or excluded. To overcome this limitation, future research could identify a more exhaustive list of keywords and refine the inclusion criteria. This would help ensure a more comprehensive coverage of relevant studies and provide a more accurate representation of the relationship between KM and OP.

Furthermore, the scope of analysis in this study focused on the bibliometric and network analysis of the literature on KM and OP. Future research should consider expanding the scope to incorporate additional variables and methodologies, such as qualitative interviews or case studies, to provide a more holistic understanding of the relationship between KM and OP. By incorporating multiple perspectives and methodologies, a deeper insight into the nuances and complexities of this relationship can be gained.

Defining the boundaries of OP, which encompasses multiple interconnected concepts, is also a challenge. The concept of OP can vary across different industries, sectors, and organisational contexts, leading to diverse interpretations and measurements. Future research should aim to clarify and define the boundaries of OP in the context of KM, considering different dimensions such as financial performance, customer satisfaction, operational efficiency, innovation, and social and environmental responsibility. By establishing a clear understanding of the dimensions and indicators of OP in relation to KM, researchers can better assess and evaluate the impact of KM practices on OP. This limitation underscores the need for further research to clarify the scope of interactions between the two concepts.

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