A structured literature review of scientometric research of the knowledge management discipline: a 2021 update

Alexander Serenko

Abstract

Purpose – *The purpose of this study is to conduct a structured literature review of scientometric research of the knowledge management (KM) discipline for the 2012–2019 time period.*

Design/methodology/approach – *A total of 175 scientometric studies of the KM discipline were identified and analyzed.*

Findings – *Scientometric KM research has entered the maturity stage: its volume has been growing, reaching six publications per month in 2019. Scientometric KM research has become highly specialized, which explains many inconsistent findings, and the interests of scientometric KM researchers and their preferred inquiry methods have changed over time. There is a dangerous trend toward a monopoly of the scholarly publishing market which affects researchers' behavior. To create a list of keywords for database searches, scientometric KM scholars should rely on the formal KM keyword classification schemes, and KM-centric peer-reviewed journals should continue welcoming manuscripts on scientometric topics.*

Practical implications – *Stakeholders should realize that the KM discipline may successfully exist as a cluster of divergent schools of thought under an overarching KM umbrella and that the notion of intradisciplinary cohesion and consistency should be abandoned.* Journal of Knowledge Management *is unanimously recognized as a leading KM journal, but KM researchers should not limit their focus to the body of knowledge documented in the KM-centric publication forums. The top six most productive countries are the USA, the UK, Taiwan, Canada, Australia and China. There is a need for knowledge brokers that may deliver the KM academic body of knowledge to practitioners.*

Originality/value – *This is the most comprehensive, up-to-date analysis of the KM discipline.*

Keywords *Scientometrics, Academic research, Structured literature review, Discipline identity, Knowledge management*

Paper type *Research paper*

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1. Introduction and purpose of the study

> Study the past, if you would divine the future. (Confucius, 551–479 BC)

The knowledge management (KM) discipline has deep historical roots (Lambe, 2011; Massingham, 2020). The first KM principles were used by the ancient Greeks more than 4,000 years ago. In 400–300 BC, Plato and Aristotle discussed the nature of empirical knowledge and learning. Many Western philosophers and thinkers, including John Locke (1632-1704) and George Berkeley (1685-1753), wrote on the topics of knowing, mind, reality, learning, existence and experience. More than 200 years ago, Westerman (1768) identified *personal knowledge of workers* as a source of competitive advantage. Senior (1836) hypothesized that *intellectual capital* (IC) is the key quality of the laborer. In the beginning of the 20th century, Schumpeter (1912/1934) proposed a theory of economic development which emphasized the importance of managing *organizational resources* to

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respond to external pressures. Eventually, Schumpeter's theory formed a conceptual foundation for contemporary KM ideas (Biranvand *et al.*, 2017). Paton (1922) justified the importance of *intangible assets*, and Dewey (1929) established a basis for a practical side of knowledge application and argued that a disconnect between theory and practice may impede human progress.

After this, several management theorists introduced various KM- and IC-related terms, such as the *stock of knowledge* (Penrose, 1959), a *tacit dimension of knowledge* (Polanyi, 1958), the *knowledge industry* (Machlup, 1962), the *knowledge worker* (Drucker, 1969) and *organizational learning* (Argyris and Schon, 1978). Kronfeld and Rock (1958) theorized that IC is the most significant factor in stock price appraisals, and Henry (1974) further explicated the importance of knowledge in the development of public policy and advocated formal KM principles. In 1975, Chaparral Steel established official KM practices and, in 1980, Digital Equipment Corporation installed the first large-scale KM system (Wiig, 1997a). Soon after that, Kellogg (1983) proposed an AI-based KM application, and, in 1987, the inaugural KM book was published (Sveiby and Lloyd, 1987).

The 1990s witnessed a surge in KM publications inspired by the pioneering works of Senge (1990), Nonaka and Takeuchi (1995), Grant (1996), Wiig (1997b), Davenport and Prusak (1998) and others. In 1993, the first KM conference was organized in Boston (Prusak, 2001) and, in 1994, *The Learning Organization* journal was established. In 1996, McMaster University launched the World Congress on the Management of Intellectual Capital and Innovation (which also included KM topics) (Serenko *et al.*, 2009), followed by numerous other scholarly meetings. In 1997, *Journal of Knowledge Management* published its inaugural issue, which expedited a further recognition of KM within the larger academic community. Since then, KM has made remarkable progress to establish itself as a well-recognized academic discipline with a strong theoretical and practical base.

Table 1 presents a list of six characteristics that define the identity of an academic discipline (Krishnan, 2009; Junghans and Olsson, 2014) in the context of KM. It shows that KM meets these criteria and may be formally referred to as an academic discipline. As the body of knowledge has been growing, many scholars have inquired into the past, present and future development of the KM discipline to better understand its identity and define its trajectory. As a result, many scientometric studies of the KM discipline have been conducted.

Table 1 Characteristics of the knowledge management discipline

Characteristics	*The KM discipline*	*Related works*
Object of research	Soft (i.e. human-centered) and hard (i.e. IT-focused) KM artifacts studied at individual, group, organizational, inter-organizational and national levels	Bedford (2015a); Fteimi and Lehner (2018); Mariano and Awazu (2016)
Unique specialist knowledge not shared with other disciplines	KM-centric peer-reviewed journals, conference proceedings, books, textbooks and citation classics that accumulate the scientific body of knowledge and transfer it to practice	Fteimi and Lehner (2016); Qiu and Lv (2014); Serenko and Bontis (2017); Serenko and Dumay (2015b, 2017)
Concepts and theories	Various KM frameworks, topics (e.g. knowledge creation, sharing and transfer; counterproductive knowledge behavior), models and theories (e.g. the "ba" concept; the SECI model)	Heisig (2009); Nonaka and Konno (1998); Nonaka and Takeuchi (1995)
Technical language	Specific terminology adjusted to the nature of the KM artifact (e.g. knowledge hoarding, hiding and sabotage; KM maturity; KM systems)	Del Giudice and Della Peruta (2016); Kuriakose *et al.* (2010); Serenko (2019, 2020); Trusson *et al.* (2017)
Research methods	Emphasis on case studies, surveys and interviews	Ngulube (2019)
Institutional manifestation	Place in formal academic curricula, research centers and professional associations	Bedford (2013); Katuščáková and Jasečková (2019)

Scientometrics is a science about science (Price, 1963): a systematic approach to explore the past, present and future directions of a scholarly domain. Scientometrics has always attracted the attention of the research community because it helps scholars better understand the idiosyncrasies of their discipline and its identity (Hassan and Loebbecke, 2017). The role of scientometric studies is to sensitize, inform and educate internal and external stakeholders on the discipline's state-of-the-art and to propose a potential corrective action of needed trajectory (Serenko and Jiao, 2012). However, even the highly motivated stakeholder may find it challenging to locate, critically analyze and use the body of knowledge documented in the vast ocean of somewhat disparate scientometric KM publications.

First, the volume of scientometric KM research has been constantly growing, reaching 108 individual publications by 2012. Second, most scientometric studies focus on a single issue which does not allow the reader to form a complete picture of the various intricacies of the KM domain. Third, many scientometric KM studies are conducted in isolation and rarely situate their findings in the context of previous scientometric KM research. Fourth, the results of scientometric KM works are often mixed and inconsistent (Serenko, 2013). Thus, KM discipline stakeholders would benefit from a comprehensive analysis of the previous KM scientometric research. Serenko (2013) conducted such a study by examining 108 scientometric KM publications and developed 19 implications of interest to various KM stakeholders. This study has been well received by the scientific community as manifested in its citation count and numerous inquiries from internal and external discipline stakeholders. However, as the volume of scientometric research has been further accumulating, it is an appropriate time to revisit and update the Serenko's (2013) findings. To ensure the methodological rigor of this update, the present investigation uses the structured literature review [structured literature reviews (SLR] approach.

The SLR is a "method for studying a corpus of scholarly literature, to develop insights, critical reflections, future research paths and research questions" (Massaro *et al.*, 2016a, p. 767) which relies on a formalized and well-articulated approach to identify and analyze relevant works rather than on the skills of a group of researchers (Dumay *et al.*, 2016). SLR investigators follow an explicit set of steps described in Section 2. The sequence of these steps is not "cast in stone": researchers should consider the process a guided journey rather than a rigid path, and they may deviate from the prescribed steps depending on their study's context.

As an empirical approach, the SLR has many advantages over other literature review techniques, such as traditional literature reviews, narrative reviews, meta-analyses and research syntheses (Massaro *et al.*, 2016a). *First and foremost*, in the SLR, researchers follow a prescribed set of rules instead of relying on their personal, subjective opinion regarding which sources to select and discuss. By following the SLR method, researchers are more likely to identify all seminal works in their domain because they do not solely rely on their personal knowledge of a specific corpus of literature. As a result, the SLR decreases the degree of subjectivity inherent in the research process and the reported findings. *Second*, traditional literature reviews require researchers to possess a great degree of expertise in the domain under investigation: they are expected to be aware of all major works, authors, terms and research streams a priori. On the one hand, seasoned scholars may offer valuable insights on the state of the literature. On the other hand, they may consciously or subconsciously introduce personal biases and present a distorted view of a scientific domain. In contrast, one does not have to be a senior scholar to conduct the SLR. Thus, the SLR opens new horizons for academics at various stages of their careers, especially students and emerging scholars, and brings in some "new blood" to brighten up the stagnant domain. As well, by following the SLR approach, experienced academics may further validate their view on the state of the literature and discover paths for future research.

Third, because the SLR process is transparent and is possible to replicate precisely, researchers may easily defend their conclusions and recommendations. The method's replicability also ensures the future continuity of the study. *Fourth*, the SLR analysis process is more rigorous, including reliability and validity checks which reduce (yet not completely eliminate) personal researchers' biases. For example, researchers may address reliability by involving multiple coders who use the same codebook and assure validity by situating their findings in theory. *Fifth*, researchers may use various information technology (IT) tools to analyze the data and create forecasts. *Sixth*, the SLR allows the use of quantitative measures to analyze and present the results, which further reduces the subjectivity inherent in literature analysis studies. For these reasons, the SLR has established itself as a popular method of inquiry in KM research (Paoloni *et al.*, 2020). Thus, it may also serve as a rigorous method of inquiry in scientometric KM projects. Therefore, the purpose of the present study is to conduct the SLR of scientometric KM research to update the findings previously reported by Serenko (2013).

2. Methodology

The SLR method was implemented by following the guidelines proposed by Massaro *et al.* (2016a). The process was adjusted to fit the specific requirements of this study. *The literature review protocol* was based on the previous study by Serenko (2013), who described the state-of-the-art of scientometric KM research. However, as the volume of such research has been accumulating, various discipline stakeholders would benefit from an updated view. Because of the various advantages of the SLR, this method provides the most comprehensive and valid description of the idiosyncrasies of the KM domain. The *general research question* was: What is the current state of scientometric KM research, and what implications can be drawn for the various stakeholders of the KM discipline? The *type of included works* encompassed all peer-reviewed publications on scientometrics in KM, such as journal articles, conference proceedings papers and refereed book chapters. To identify such works, the following five-step *search process* was developed:

1. Step 1. A manual review of all KM-centric journals listed by Serenko and Bontis (2017).
2. Step 2. A keyword search of the following databases: Emerald, ScienceDirect, ProQuest, JSTOR, Web of Science (WoS), IEEE Xplore and Google Scholar, based on the pairs of KM and scientometrics keywords. The KM keywords were selected from the KM classification scheme by Fteimi and Lehner (2018, pp. 1540–1554) from A.1; C.6.15; D.2.13; E.2; H.8.9; L.4.1.; L.4.15; and L.4.26 categories. The scientometrics keywords were adapted from Serenko (2013) and included "scientometric(s)", "bibliometric(s)", "informetric(s)", "ranking", "productivity", "impact", "relevance", "citation analysis", "co-citation analysis", "network analysis", "collaboration", "research", "research policy", "discipline past", "discipline future", "research trend(s)", "paradigm", "method", "management fashion/fad", etc.
3. Step 3: Analysis of the citing works. Google Scholar citations to all papers identified earlier were manually analyzed to discover additional relevant publications.
4. Step 4. Bibliography analysis. Within all publications collected so far, the bibliography lists (i.e. cited works) were analyzed to discover additional relevant works.
5. Step 5. For all newly discovered works, Steps 3 and 4 were repeated.

Because Serenko (2013) analyzed the works published from 1997 to August 2012 (inclusive), the search process focused on the period from September 2012 to August 2019 (inclusive).

The following analysis was done with the help of *analytical frameworks*:

1. The general context of each examined scientometric study was analyzed (see Table 2). After establishing the broader context of the scientometric study, its topic (i.e. the actual objective of the examined works) was coded (see Table 3).
2. The scientometric methods used in the analyzed works were coded. Table 4 offers the codebook. Note that, for topics and methods, multiple codes were assigned when necessary because one work may pursue multiple objectives and use several methods, which is common practice in scientometrics.
3. The quality of implications presented in the examined works – defined as the extent to which the publication builds upon its findings to develop insights, offer recommendations and provide guidance for KM discipline stakeholders and/or scientometric KM researchers – was documented by using the codebook described in Table 5.
4. Coverage comprehensiveness was defined as the extent to which the data used in the empirical part of the examined work covered the KM domain. It was assessed by using two criteria:
    - the data source (where the analyzed data came from, e.g. the target database); and
    - the search criteria (e.g. the keywords applied to locate the data).

Table 2 Codebook – the context in which the examined studies were conducted

Context	*Description*
General	The entire KM discipline; conclusions generalize to the overall KM domain
Geographic location	A particular country or geographic region; conclusions are limited to the selected location only
Topic	A specific research stream or a sub-domain within the KM discipline; conclusions pertain to the area (e.g. topic) of interest only
Publication forum	An individual journal or the proceedings of a specific conference; conclusions are drawn in the context of a single publication forum
Group of people	A particular category of stakeholders or participants within the KM domain; conclusions refer to a unique group of people

Table 3 Codebook – the purpose of the examined scientometric studies

Purpose	*Description*
Analysis and/or ranking of KM journals and/or conferences	Analysis and/or ranking of journals and/or conferences publishing KM research
Collaboration analysis	Collaboration patterns of KM researchers, institutions, funding bodies and countries
Intellectual core of the KM discipline	State, identity, structure, theoretical foundations and intellectual core of the KM discipline (including analysis of research topics, classification schemes and ontologies)
Productivity and impact	Analysis of productivity and impact of KM researchers, institutions and countries
Research paradigms and research methods	Analysis of research paradigms, empirical research methods, methodology trends and methodology agendas
Research relevance, knowledge translation and brokering	Impact of academic KM research on the state of practice, practical relevance of academic KM research and the dissemination of academic and scholarly knowledge to non-academic stakeholders
Retrospective analysis and the future of KM	KM history, origin, historical roots and potential future development

Table 4 Codebook – methodology used in the examined scientometric studies

Method	*Description*
Bibliometric laws and models	The application of bibliometric models and laws such as Lotka's law, Bradford's law and the Bass diffusion model
Case study	A formal case study of the KM discipline
Citation analysis	Any type of citation analysis excluding co-citation analysis
Co-citation analysis	Analysis of co-citations in the bibliography lists of examined works
Content analysis of academic publications	Analysis of the content of academic publications including the title, abstract, full text, etc. but excluding citations and keywords
Content analysis of documents	Analysis of the content of non-academic documents such as email messages, social media posts, websites, course outlines, public reports and job postings
Counting techniques	Counting publications, authors, institutions and countries
Expert opinion	Solicitation of expert opinion by using surveys, interviews, the Delphi method and focus groups
Formal literature review	Systematic literature review, structured literature review and literature meta-analysis
Keywords analysis	Analysis of keywords in academic publications and article classification categories (i.e. subjects) selected from scholarly databases without analyzing the title, abstract and full text
Network analysis	Application of network analysis and network visualization techniques (excluding keywords analysis)
Personal opinion	Most of the ideas are based on the author's personal experience, opinion, views and beliefs, which are not supported by literature and/or empirical evidence
Traditional literature review	Most of the ideas are based on academic literature without doing a systematic/structured literature review, meta-analysis or empirical analysis

Table 5 Codebook – the quality of implications

Ranking	*Description*
None	The work proposes no implications for KM discipline stakeholders
Some	The work briefly mentions some implications for KM discipline stakeholders, but it does not elaborate on them in detail and does not develop actionable recommendations (e.g. the implications part is limited to a few short sentences)
Extensive	The work presents very distinct, detailed, comprehensive, actionable and easy-to-follow implications for KM discipline stakeholders and elaborates on them

5. The impact of the examined scientometric KM works was measured by analyzing citations generated by Google Scholar. Works published in 2019 were excluded from citation analysis because they have not had sufficient time to demonstrate their citation impact.
6. Authors' awareness of previous scientometric KM research is defined as the degree to which the authors are aware of the prior publications in this research domain. Those scientometric KM scholars who are aware of previous works in this domain should cite such publications to acknowledge the intellectual contribution of their predecessors (Hassan and Serenko, 2019). Thus, the authors' awareness of previous scientometric KM research was measured by the number of citations to previous scientometric KM works in their papers' bibliography.
7. Author and paper characteristics were analyzed by:
    - compiling a list of the most productive authors of scientometric KM works by means of the direct count method (i.e. each author of the publication receives a score of one regardless of the number of authors listed in the work);
    - calculating the number of authors per paper; and
    - creating a list of outlets where the examined scientometric KM works appeared.

SLR reliability was ensured by involving two coders who had advanced graduate-level training in qualitative research and who used the same codebook. All discrepancies were

identified and discussed by the coders in person, and agreement on the classification of all items was reached. The Krippendorff's (1980) reliability coefficient exceeded 0.8. *SLR validity* was ensured by comparing the findings with those reported in KM literature and with the theoretical insights in the previous Serenko's (2013) study. Finally, *numerous implications for scientometric KM researchers and KM discipline stakeholders* were proposed.

3. Results

Previously, Serenko (2013) analyzed 108 scientometric KM works for the period from 1997 to August 2012 (inclusive). In this study, 175 additional works were discovered. Of these, eight pertained to the period from 1996 to August 2012 (i.e. these were missed in the previous study and were included in the analyzed data set) and 167 to the period from September 2012 to August 2019 (inclusive). Note that one of the newly discovered papers that was omitted by Serenko (2013) appeared in 1996; thus, the previous period is now referred to as 1996–2012. The large number of additional scientometric KM works has further confirmed the need for a follow-up study: in total, at least 283 scientometric KM papers have been published since the birth of the discipline. All works pertaining to the 2012–2019 period have been cited in this paper.

3.1 Topics and methods in scientometric knowledge management works

Figure 1 depicts the constantly growing volume of scientometric KM research which, by 2019, had reached 74 publications per year. Figure 2 visualizes the context in which the examined studies were situated. Only 43% of them focused on the entire KM discipline; and 40% pertained to scientometric research on specific topics. Examples include KM for development (Ergazakis *et al.*, 2013), IT in KM (KM software, data mining, big data) (Mühlburger *et al.*, 2017), innovation (Torugsa and O'Donohue, 2016), the role of library and information science (LIS) in KM (Agarwal and Islam, 2018), KM in franchising (Iddy and Alon, 2019), process capital (Matthies, 2014), knowledge commercialization (Biranvand *et al.*, 2017), and knowledge sharing, exchange and transfer (Chou and Tang, 2014). In total, 11% of studies were conducted in the context of a single journal or conference (Barik and Jena, 2013) using both KM and non-KM outlets (Bedford and Bekbalaeva, 2018; Potgieter, 2018). A smaller fraction of the projects (3%) was done in the context of specific countries or regions, e.g. India (Chakraborty and Verma, 2018), China (Li *et al.*, 2013), Latin America and the Caribbean (Galvis-Lista *et al.*, 2014), and 3% was conducted in the context of a particular group of people, namely, KM professionals.

Figure 1 Number of scientometric KM works published per year

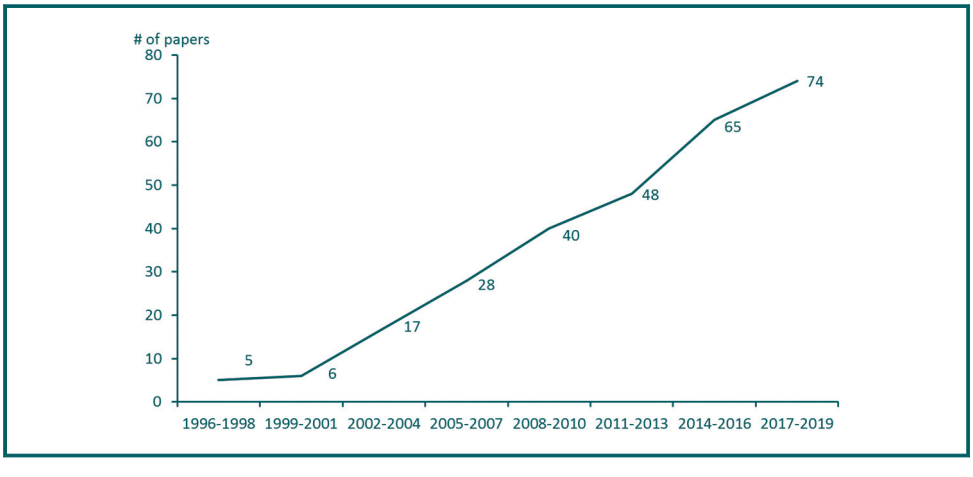


Figure 2 Context of scientometric research of the KM discipline

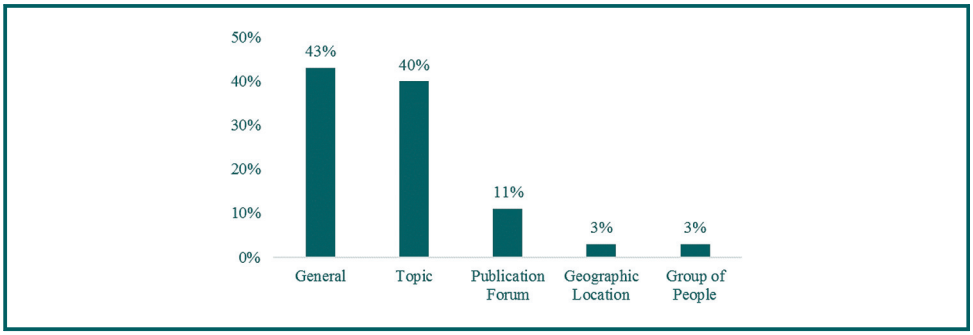


Figure 3 presents the topics of scientometric KM works, and Figure 4 compares the two time periods. There was a noticeable increase in some topics, such as the intellectual core of the KM field; productivity and impact studies; and collaboration patterns. This growth took place at the expense of studies on KM research paradigms and methods, the retrospective analysis and the future of KM, the nature of KM publication venues and the practical relevance of KM research.

Figure 5 outlines the methods of inquiry used in the examined scientometric works, and Figure 6 shows that there was a substantial change over time. Particularly, there was an increase in the use of advanced methods, such as formal literature reviews (e.g. systematic and SLRs), keywords analysis, citation analysis and network analysis at the expense of less rigorous techniques such as expert opinion, personal opinion and traditional literature reviews. In addition, a new category emerged, which pertains to the application of bibliometric models and laws (e.g. Lotka's Law, Bradford's Law and the Bass diffusion model) and which was used in 4% of the examined works. The largest decline (14%) was observed in the analysis of the content of academic publications, including their title, abstract and full text [1].

Previously, Serenko (2013) discussed three distinct phases of scientometric KM research: Phase I – Initiation (1996-2001); Phase II – Early Development (2002-2006); and Phase III – Rigor and Consolidation (2007-2012). The current study identified two additional phases:

Figure 3 Topics of scientometric research of the KM discipline

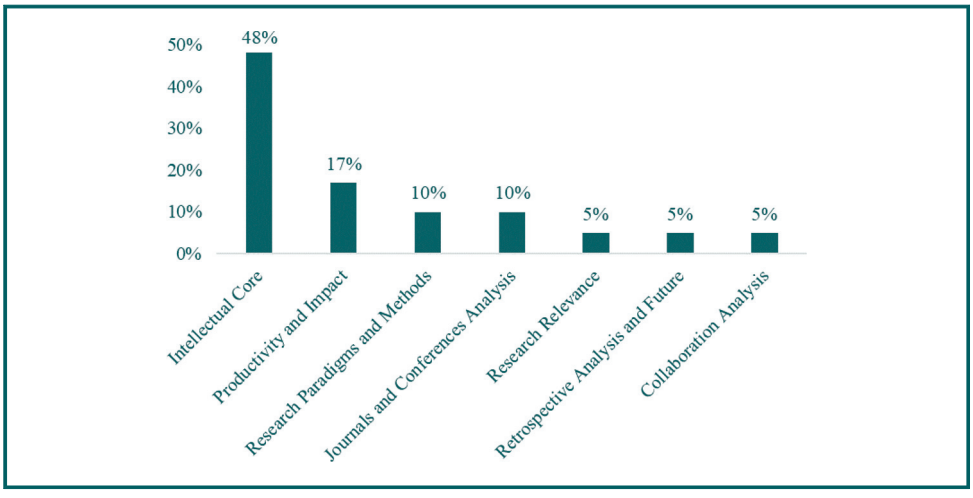


Figure 4 Changes in the topics of scientometric research of the KM discipline

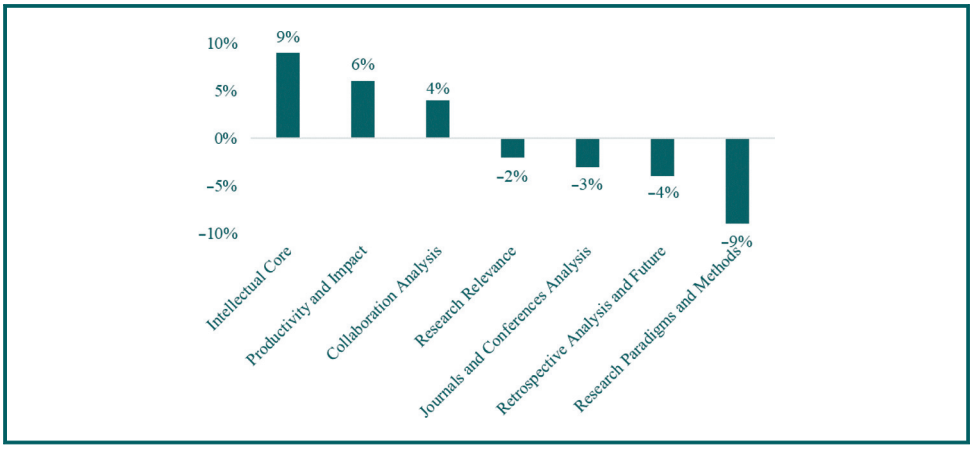
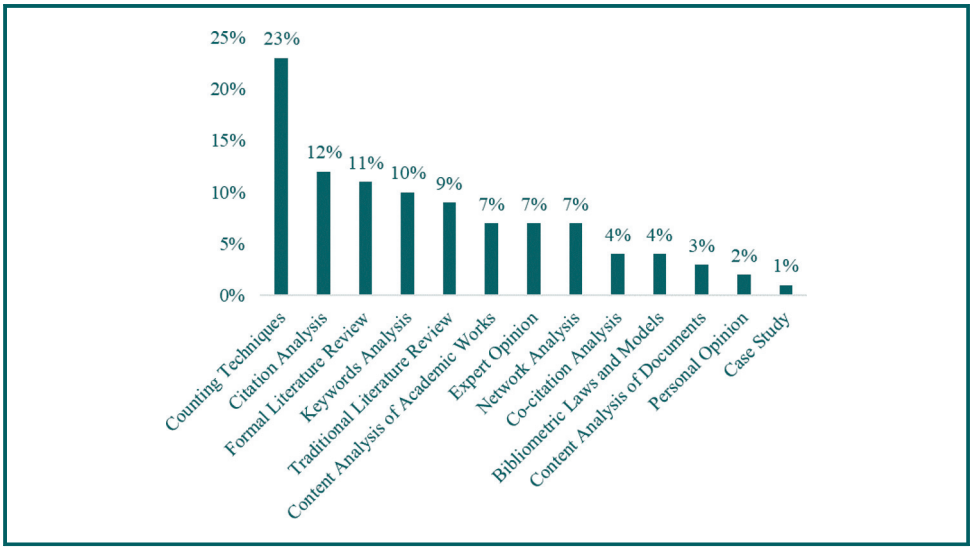


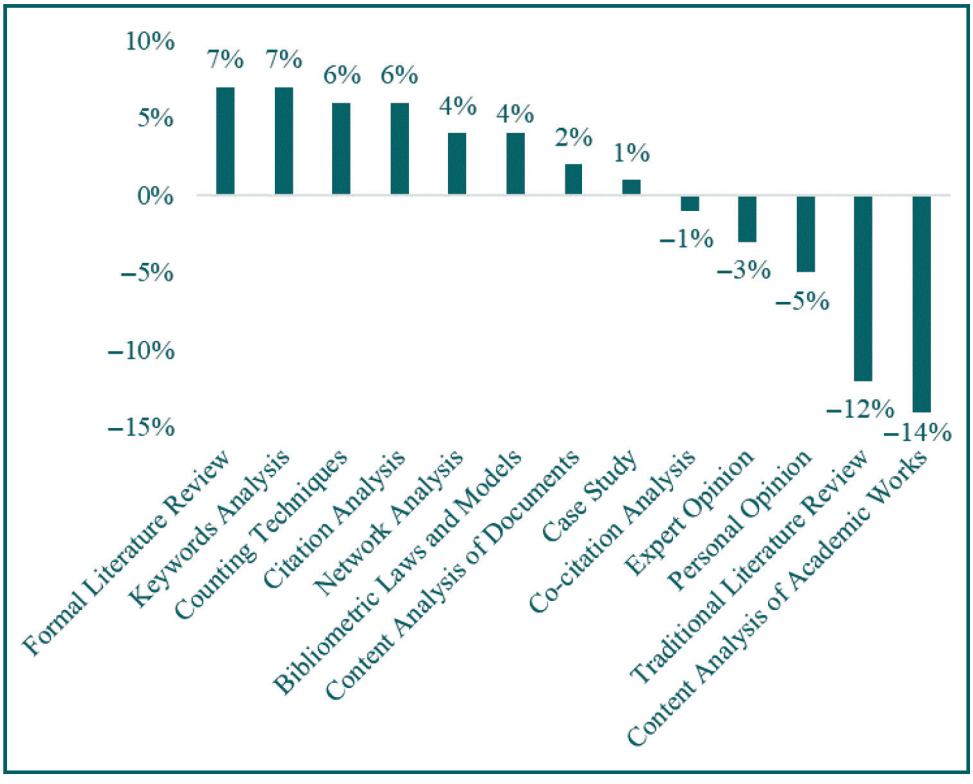
Figure 5 Methods used in scientometric research of the KM discipline



Phase IV – Methodological Advancement (2013-2016) and Phase V – Maturity (2017-2019). During the Methodological Advancement stage, scientometric KM scholars honed their skills by focusing on more innovative, leading edge, and advanced research approaches. In the Maturity phase, they continued using these advanced methods while simultaneously reducing the application of basic techniques such as expert opinion, personal opinion and traditional literature reviews. The biggest decline in the use of less advanced methods took place during the Maturity stage. During the Maturity phase, research on retrospective analysis and the future of KM (KM history, origin, roots and future development) also received less attention. Figure 7 visualizes the phases of scientometric KM research. A unique attribute of the Methodological Advancement and Maturity phases is a high degree of specialization when over half of all studies are conducted in a unique context of specific topics, publication forums, geographic regions and groups of people.

Scientometric KM research follows a cumulative research tradition wherein most topics and methods used at one phase reappear at the following stages. At the same time, there is a

Figure 6 Changes in the methods used in scientometric research of the KM discipline

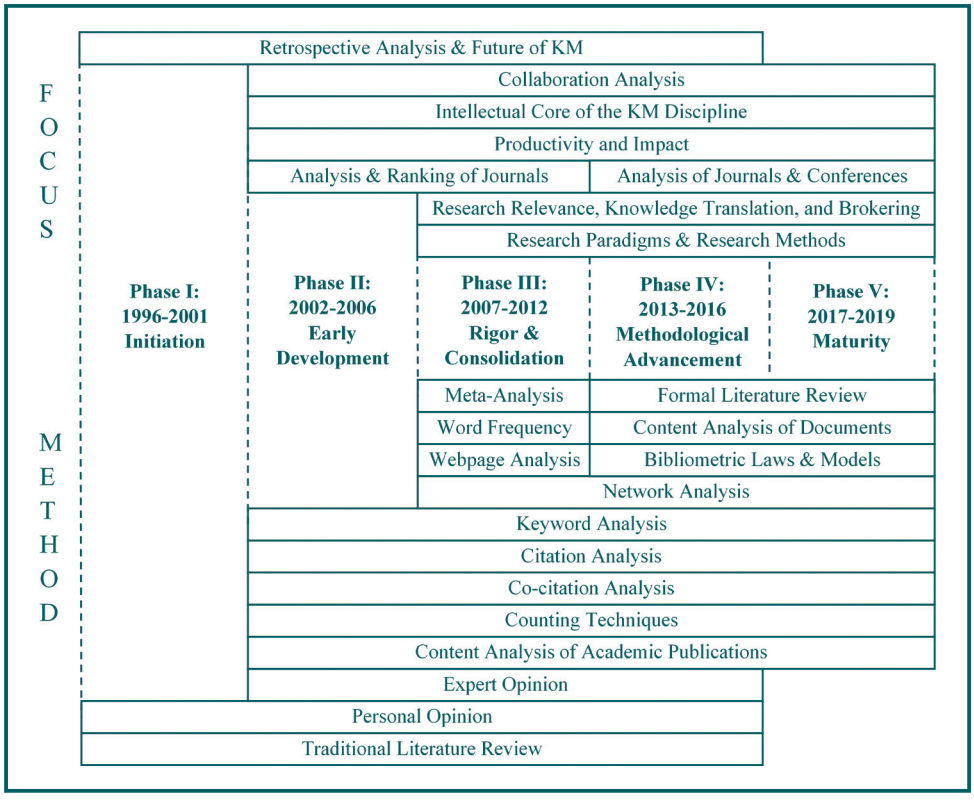


gradual tendency toward continuous improvement and refinement of both topics and methods. For instance, initially, traditional literature reviews played an essential role. Eventually, however, this method has been replaced by more rigorous systematic and SLRs: given the large volume of KM publications, it is difficult to ensure an adequate coverage of the phenomenon by doing a literature review without following a formal inquiry method. Similarly, scientometric KM scholars initially engaged in a retrospective analysis of the discipline to understand its history and future. By the Maturity phase, though, many scholars had lost interest in this topic. Instead, at the Methodological Advancement and Maturity phases, in addition to developing KM journal rankings, researchers began exploring various facets of individual KM journals and conferences, which further attests to the evolution of the scientometric KM domain. Thus, the cumulative research tradition is accompanied by gradual changes in topics and methods which ensures a continuous progression of scientometric KM research.

3.2 Quality of implications and/or recommendations

In 48% of all papers, researchers proposed new research questions, summarized their recommendations in easy-to-comprehend tables and developed detailed, actionable courses of action, followed by a comprehensive elaboration (for exemplars, see Manhart and Thalmann, 2015; Fellnhofer, 2018). Unfortunately, this was not always the case. In 13% of all works, implications were only briefly mentioned in a few short sentences, which was not enough to apply these studies' findings. A total of 39% had no recommendations and/or implications for theory and practice: the authors merely presented and summarized the results and left it up to the reader to draw his or her own conclusions and develop actionable items. In other words, over half of all scientometric KM works failed to properly inform the reader and propose a course of action.

Figure 7 Evolution of scientometric research of the KM discipline



3.3 Coverage comprehensiveness

Coverage comprehensiveness was assessed through:

- the data source; and
- the search criteria.

Analysis of the data source revealed that, *first*, almost half of the examined data sets were retrieved from WoS, Scopus, EBSCO, ScienceDirect and ProQuest–ABI/INFORM, which signifies a trend toward the monopolization of the search space by a few dominant players (Table 6). EBSCO has recently included Emerald and ScienceDirect, which reinforces the state of monopoly. *Second*, since 2012, the role of Scopus has increased from 1.2% to 8.8% of all searches. *Third*, the number of single-use specialized databases (e.g. CINAHL, EconBiz, MEDLINE) has increased. Such databases may be successfully used to locate works on unique research topics. *Fourth*, the role of non-KM-centric peer-reviewed journals has decreased whereas that of KM-centric peer-reviewed journals has increased. The role of peer-reviewed conference proceedings has dropped from 10% to 1.8%. *Fifth*, 57% of studies relied on the use of a single database. Only a small fraction of studies complemented the use of databases with the search of KM-centric journals that were predominantly selected from the ranking lists by Serenko and Bontis (2009; 2013a; 2017). As a data source, the most frequent KM journals were *Journal of Knowledge Management*, *Knowledge Management Research & Practice*, *Journal of Information & Knowledge Management*, *International Journal of Knowledge Management*, *Journal of Intellectual Capital*, and *Knowledge and Process Management*.

With respect to search criteria, the keyword coverage has shown some improvement: 55% of the studies that relied on automatic database searches used a single keyword, mostly

Table 6 Data sources of scientometric KM works

Category	*(%)*
Indexes and databases Clarivate Analytics Web of Science Collection (20.4%) Scopus (8.8%) EBSCO Research Databases (7.5%) ScienceDirect (6.6%) ProQuest – ABI/INFORM (5.3%) Google Scholar (4.9%) Emerald (4.4%) IEEE Xplore (3.5%) ACM Digital Library (2.2%) SpringerLink (1.8%) AISeL (1.3%) Compendex (0.9%) JSTOR (0.9%) Other (9.7%) (China Doctoral Dissertations Full-text Database; CINAHL Complete; CWTS Journal Indicators; EconBiz; Embase; INFORMS; Ingenta Connect; MEDLINE; NDLTD; NISTEP; Oria; OST; Prozesskapital; PsycINFO; ResearchGate; SAGE Journals; SciVerse; Taylor & Francis Online; The Cochrane Library; The United States Patent and Trademark Office; TPAC Database; Wiley Online Library)	78.3
Other sources – direct search KM-centric peer-reviewed journals (13.7%) Non-KM-centric peer-reviewed journals – predominantly IS, IT and general management (4.9%) Peer-reviewed conference proceedings (1.8%) Doctoral dissertations (0.9%) Books (0.4%)	21.7

"knowledge management," compared to 67% reported for the 1996–2012 period, but most searches were quite basic and limited to the title, abstract and keywords. Given the interdisciplinary nature of KM, many articles do not contain "knowledge management" in their titles, abstracts or keywords, and these were missed by the authors of these studies. Analysis of several of the latest issues of volume 24 of *Journal of Knowledge Management* further confirmed that most of the articles do not contain "knowledge management" in their titles, abstracts or keywords. Yet, scientometric researchers used a variety of keywords (Nyamasege *et al.*, 2019) or manually examined each paper to determine its suitability (Massaro *et al.*, 2015) only in rare cases.

To summarize, there is a trend toward the consolidation of searches around a smaller group of major databases while occasionally increasing the breadth of coverage with the use of specialized databases and journals. Many researchers still rely on a single "KM" keyword in automated searches, which may not ensure an adequate coverage of the domain and so result in biased findings. Nevertheless, there is some improvement in the breadth of keyword coverage.

3.4 Impact of scientometric knowledge management works

The 283 examined works received 20,211 citations on Google Scholar. Scientometric KM papers were cited at the rate of 7.38 citations per year, on average [2]. Out of 34 works with no citations, 17 appeared in 2018 and have not yet had enough time to get noticed and cited. Table 7 shows a ranking of the most frequently cited works that attracted 13,742 (68%) of all citations. Of these papers, all except one were published in the previously examined time period (i.e. 1996-2012), which shows that accumulating citations is a time-consuming process. The citation impact of scientometric KM research is extremely skewed because a small number of older works attract a disproportionate number of citations,

Table 7 Most frequently cited scientometric KM works (top 10% – 28 works)

Work	Total # of citations	# of Citations per year	Work	Total # of citations	# of Citations per year
Wilson (2002)	1,355	79.71	Serenko and Bontis (2004)	378	25.20
Grover and Davenport (2001)	1,163	64.61	Durst and Edvardsson (2012)	373	53.29
Wiig (1997b)	1,144	52.00	Crossan and Guatto (1996)	335	14.57
Easterby-Smith *et al.* (2000)	1,142	60.11	Argote (2011)	313	39.13
Schultze and Leidner (2002)	811	47.71	Serenko *et al.* (2010)	287	31.89
Prusak (2001)	726	40.33	Nonaka and Peltokorpi (2006)	264	20.31
Bapuji and Crossan (2004)	632	42.13	Ponzi and Koenig (2002)	262	15.41
Heisig (2009)	522	52.20	Hallin and Marnburg (2008)	251	22.82
Scarbrough *et al.* (1999)	492	24.60	Kebede (2010)	245	27.22
Baskerville and Dulipovici (2006)	408	31.38	Ragab and Arisha (2013)	236	39.33
Teece (1998)	402	19.14	Scholl *et al.* (2004)	231	15.40
Bjørnson and Dingsøyr (2008)	396	36.00	Metaxiotis *et al.* (2005)	229	16.36
Scarbrough and Swan (2001)	395	21.94	Ponzi (2002)	190	11.18
Wiig (1999)	379	18.95	Spender (2008)	180	16.36

which does not bode well for a healthy scientific domain. On a positive note, many new promising works have been recently published (see Table 8). For example, the recent articles by Inkinen (2016) and Girard and Girard (2015) have been attracting more than 30 citations per year and are likely to become the future KM citation classics.

3.5 Authors' awareness of prior scientometric research

There has been a steady trend toward the improvement of the citing behavior of scientometric KM scholars (see Table 9 and Figure 8). In the 2012-2019 period, the proportion of papers that cited no previous relevant works decreased by 40%, and the average number of relevant citations almost tripled. At the same time, there is room for improvement. For instance, during 2017-2019, scientometric KM works cited 5.72 relevant publications on average, which is a good sign, but 19% of papers contained no relevant references, and 14% cited only a single scientometric KM paper. There were two distinct types of citation-deficient publications. The first category pertained to narrow scientometric

Table 8 Top ten works for the 2012-2019 period with the largest number of citations per year (not included in Table 7)

Work	# of Citations per year	Work	# of Citations per year
Inkinen (2016)	31.33	Serenko and Bontis (2013a)	21.17
Girard and Girard (2015)	31.00	Trindade *et al.* (2017)	20.00
Fazey *et al.* (2013)	29.00	Serenko and Dumay (2015b)	18.75
Akhavan *et al.* (2016)	27.67	Massaro *et al.* (2016b)	18.33
Massaro *et al.* (2015)	26.75	Manhart and Thalmann (2015)	18.25

Table 9 Authors' awareness of prior scientometric KM research

	1996–Aug 2012	Sept 2012–2019	1996–2019
% of papers with no relevant citations	30.36	18.24	23.05
% of papers with only one relevant citation	25.89	21.76	23.40
Average number of relevant citations	2.01	5.39	4.05

Figure 8 Average number of citations to prior KM works in the set of examined publications

topics – for instance, to the investigation of a particular attribute of the KM discipline – where no (citeable) prior research on this topic had been done. The second type of publications was devoted to general scientometric KM issues for which a comprehensive body of prior knowledge was simply ignored. For example, a 2019 study that analyzed *Journal of Knowledge Management* overlooked all relevant previous publications that also scrutinized this journal. Another 2017 study on the impact of academic KM research missed all previous publications on the practical relevance and dissemination of scientific KM output.

3.6 Publication forums

The vast majority of scientometric KM works were published in peer-reviewed journals, followed by conference proceedings and book chapters (Table 10). There has been a shift toward peer-reviewed KM-centric journals, particularly *Journal of Knowledge Management*, *Knowledge Management Research & Practice* and *VINE: The Journal of Information and Knowledge Management Systems*, and fewer scientometric KM publications appeared in non-KM-centric journals. More works were published in the proceedings of KM-centric conferences, especially in the proceedings of the *European Conference on Knowledge Management*.

3.7 Author characteristics

Table 11 shows an increasing trend in co-authorship in scientometric KM works. For instance, in the years 2018–2019, only 20% of all publications were single authored. The degree of collaboration, which is "the ratio of the number of collaborative research papers to the total number of research papers published in the discipline during a certain period of time" (Subramanyam, 1983, p. 37), further attests to this claim. Since 1996, 486 KM researchers have contributed to scientometric KM research. Table 12 presents a list of 32 productive authors [3]. Of them, only 13 appeared in the 1996–2012 list. This implies that there has been an infusion of new talent in scientometric KM research.

The observed productivity distribution was analyzed by using Lotka's law (Lotka, 1926). It suggests that the number of authors within a particular scientific domain publishing a certain number of papers is a fixed ratio to the number of researchers who published only a single paper. It was found that the predicted number of authors with multiple works dramatically exceeds the observed number of authors. Moreover, out of 486 authors, 317 one-time contributors are expected, whereas their actual number is 394. In addition,

Table 10 Publication forums of scientometric KM works

#	*Category*	*(%)*
1	Peer-reviewed journals	80.56
	– KM-centric (43.46%)	
	– *Journal of Knowledge Management* (15.20%)	
	– *Knowledge Management Research & Practice* (6.01%)	
	– *International Journal of Knowledge Management* (3.53%)	
	– *Knowledge & Process Management* (3.53%)	
	– *VINE: The Journal of Information and Knowledge Management Systems* (3.18%)	
	– *Journal of Information & Knowledge Management* (2.83%)	
	– *Electronic Journal of Knowledge Management* (2.47%)	
	– *Knowledge Management for Development* (2.12%)	
	– Other (4.95%)	
	– Non-KM-centric – predominantly IS/IT, management, scientometrics, and information & library science (36.74%)	
	– *Scientometrics* (2.12%)	
	– *Library Philosophy and Practice* (1.41%)	
	– Other (33.57%)	
2	Peer-reviewed conference proceedings	12.00
	– KM-centric (6.01%)	
	– European Conference on Knowledge Management (2.83%)	
	– Other (3.18%)	
	– Non-KM-centric (6.01%)	
3	Book chapters	6.37
4	Technical reports/working papers	1.07

Table 11 Co-authorship preferences of scientometric KM researchers

	1996–Aug 2012	*Sept 2012–2019*	*1996–2019*
Average number of authors	2.08	2.48	2.31
Maximum number of authors	6	21	21
% of single-authored papers	33.34	21.56	27.20
Degree of collaboration	0.67	0.78	0.73

Table 12 The most productive authors of scientometric KM works

Rank	*Name*	*# of papers*	*Rank*	*Name*	*# of papers*
1	Bontis, N.*	16	17	Chen, T.T.*	3
2	Durst, S.	8	17	Crossan, M.	3
3	Handzic, M.	7	17	Croasdell, D.*	3
4	Heisig, P.*	6	17	Hall, D.*	3
5	Booker, L.*	5	17	Jennex, M.*	3
5	Dumay, J.	5	17	Lee, M.R.*	3
7	Bedford, D.A.D.	4	17	Malik, B.A.	3
7	Edvardsson, I.R.	4	17	Mariano, S.	3
7	Ergazakis, K.*	4	17	Massaro, M.	3
7	Ferenhof, H.A.	4	17	Nakamori, Y.*	3
7	Fteimi, N.	4	17	Onyancha, O.B.	3
7	Lehner, F.	4	17	Ribière, V.	3
7	Metaxiotis, K.*	4	17	Sahoo, J.	3
7	Rechberg, I.D.W.	4	17	Spender, J.-C.	3
7	Scarbrough, H.*	4	17	Swan, J.*	3
7	Syed, J.	4	17	Walter, C.	3

Note: *The author appeared in the 1996-2012 list of scientometric KM researchers

79 rather than 59 scholars were supposed to contribute twice. Thus, the productivity distribution of scientometric KM scholars does not follow Lotka's law.

3.8 Major insights of scientometric knowledge management works

A review of the major findings documented in the examined KM works for the 2012-2019 period sheds some light on the current state and identity of the KM discipline.

3.8.1 Knowledge management journals and conferences. Journal ranking studies indicate that *Journal of Knowledge Management* is the leading outlet, followed by *The Learning Organization*, *Knowledge Management Research & Practice*, *Knowledge and Process Management*, *VINE: The Journal of Information and Knowledge Management Systems* and *International Journal of Knowledge Management* (Serenko and Bontis, 2017). A vast majority of studies that explored various facets of KM publication forums focused on *Journal of Knowledge Management* (e.g. see Gaviria-Marin *et al.*, 2018). They concluded that it is the most productive (Breznik, 2018), highly influential (Teixeira and Oliveira, 2018), balanced (Handzic, 2015) and geographically inclusive (Handzic and Durmic, 2013) journal that publishes positivist empirical papers (Ngulube, 2015) and emphasizes knowledge sharing and transfer topics (Raza and Malik, 2018). Other studies identified *Knowledge Management Research & Practice* as a promising and highly productive KM outlet (Aitouche *et al.*, 2018; Gaviria-Marin *et al.*, 2019) reporting on knowledge sharing, knowledge transfer, situated learning, research methods, KM foundations and IC issues (Ribière and Walter, 2013; Walter and Ribière, 2013). Other journals such as *Electronic Journal of Knowledge Management* and *Journal of Information & Knowledge Management* also underwent some scrutiny (Thanuskodi and Umamaheswari, 2013; Sahoo *et al.*, 2017a; Alajmi and Alhaji, 2018). Oddly enough, KM pioneers – Nonaka, I., Takeuchi, H., Davenport, T. and Prusak, L. – do not generally publish in top KM-centric journals (Handzic and Durmic, 2013).

Over half of all KM publications appear in conference proceedings (Qiu and Lv, 2014; Sahoo *et al.*, 2017b). Of particular importance are the *European Conference on Knowledge Management* (Fteimi and Lehner, 2016), the *International Conference on Intellectual Capital, Knowledge Management, and Organizational Learning* (Silva *et al.*, 2017) and the KM track at the *Hawaii International Conference on System Sciences* (Dittes *et al.*, 2016).

3.8.2 Collaboration patterns. Studies of collaboration patterns of KM researchers, institutions, funding bodies and countries reached several conclusions. First, research collaboration must be encouraged because it results in a higher quality and quantity of scientific output (Sedighi and Jalalimanesh, 2014; Ceballos *et al.*, 2017; Sahoo and Pati, 2018). Second, there has been a steady increase in collaboration which is manifested in a growing number of authors per paper (Wang *et al.*, 2018), but authors' extent of collaboration varies depending on the geographic locations, publication forums and time periods. Third, even though a small number of researchers have extensive collaboration networks (Bontis, N., O'Donnell, D. and Voelpel, S.C.), the overall level of domestic and international cooperation is disappointing (Zuo *et al.*, 2012; Massaro *et al.*, 2016b). The extent of collaboration among the most productive institutions (Qiu and Lv, 2014), developed countries (Wang *et al.*, 2018) and funding agencies (Žlahtič *et al.*, 2017) is also insufficient.

3.8.3 Productivity and impact. Based on the overall volume of publication output, the USA is consistently ranked the most productive country: it is ranked the top one in 76% of all studies and is included in the top three lists in 90% of all studies. Other countries included in the top three lists are the UK (76%), Taiwan (24%), Canada (21%), Australia (17%) and China (17%). There is some level of consistency among the country-level research productivity studies. Of 29 institutions in the top three productivity lists, only five appeared more than once: Hong Kong Polytechnic University, HK (4); National Cheng Kung

University, Taiwan (4); City University of Hong Kong, HK (3); Lakehead University, Canada (3 times); and Nanyang Technological University, Singapore (2).

Of 34 researchers identified in the top three lists of individual research productivity, eight appeared multiple times [4]: Bontis, N.; Carrillo, F.J.; Ergazakis, K.; Gottschalk, P.; Nonaka, I.; Tseng, M.L.; and Yigitcanlar, T. In these lists, only Bontis, N. was mentioned three times and the others only twice. The institutional and individual productivity lists reveal a high level of inconsistency among the studies. Hong Kong and Singapore, which were mentioned in the top three institutional lists, were excluded from the top three country rankings. Of the 27 most frequently cited works that were ranked top three, only five were listed in multiple studies: Alavi and Leidner (2001) (two), Davenport and Prusak (1998) (two), Kogut and Zander (1992) (two), Nonaka (1994) (five) and Nonaka and Takeuchi (1995) (four). Except for a few seminal works, there was little consistency on the most frequently cited works. This suggests that the findings of the institutional and individual productivity rankings as well as citation impact studies depend on their methodology, namely, on the source from which the analyzed data set is selected. At the same time, the effect of a data source becomes less salient at the country level of assessment.

A truly disturbing finding is that Lotka's Law (Lotka, 1926) does not apply to the productivity distribution of KM authors: only one scientometric study of the KM discipline empirically supported it (Wallace, 2012), whereas four did not (Kumar and Mohindra, 2015; Muzzammil and Asad, 2016; Sahoo *et al.*, 2017a; Maity and Sahu, 2019). Given that the study by Wallace (2012) is the oldest of these, it is possible that Wallace's conclusion is dated and does not apply to the current state of KM research. The reason for this finding is that more than 80% of KM authors contributed to the discpline only once (i.e. published only a single KM paper) (Ergazakis *et al.*, 2013; Handzic and Durmic, 2013; Tsai, 2013; Maity and Sahu, 2019).

3.8.4 Research paradigms and research methods. Studies that examined KM research paradigms concluded that the discipline is dominated by positivist epistemologies but researchers rarely explicitly state their philosophical assumptions (Hustad *et al.*, 2017; Ngulube, 2019). With respect to the popular methods of inquiry, there was a general conclusion that KM research is empirical by its nature while the number of conceptual works has been gradually declining (Ngulube, 2015). A large number of projects identified case studies as a leading (Handzic, 2015; Durst, 2019) and highly credible (Patil and Kant, 2014) research method. Another substantial pool of studies reported surveys are a top choice of KM researchers (Edvardsson and Durst, 2014; Ferenhof, 2016), followed by interviews (Kör, 2017). At the same time, other methods, such as action research, ethnography, mixed-methods and the use of secondary data were generally underrepresented (Durst *et al.*, 2015; Rechberg, 2018).

3.8.5 Research relevance, knowledge translation and knowledge brokering. Studies on KM research relevance, knowledge translation and knowledge brokering reached several conclusions. It has been generally agreed that the findings reported in the academic KM literature are of high value to practitioners (Moshonsky *et al.*, 2014; Edvardsson and Durst, 2017) and that industry–academia collaboration and dialogue lead to knowledge creation (Fabbe-Costes, 2018). Regrettably, despite the potential usefulness of KM research, practitioners show little interest in the domain, and KM has become a purely academic discipline (Hislop *et al.*, 2018) where scientific research output is targeted at academics rather than industry professionals.

The KM discipline was established as a field of practice. However, the participation of practitioners in academic research has dramatically declined and remains very low (Wallace, 2012; Massaro *et al.*, 2016b; Akakandelwa, 2017). Academics and practitioners have divergent views on the need for more theoretical KM research, and they disagree on various KM issues (Sagsan and Medeni, 2012; Heisig, 2015). There are also dramatic differences between academic and practitioner-oriented journals (Ribeiro-Soriano and Berbegal-Mirabent, 2017). The KM scholarly body of knowledge remains under-used by

professionals: their current awareness of KM models, methods and theories is very shallow and fragmented (Bedford, 2015b), and very few practitioners ever apply recommendations from academic articles in their work (Booker *et al.*, 2013). This results in a gap between theory and practice (Ragab and Arisha, 2013).

Currently, KM practitioners stay up-to-date with the state of the discipline by means of online forums, discussion groups, colleagues, and, only occasionally, academic literature (Booker *et al.*, 2013). As a result, there have been calls to strengthen the relationship between academic research and the needs of industry practitioners (Wang *et al.*, 2018) and embed scholarly recommendations into routine managerial practices (Lönnqvist, 2017). The best solution to bridge the gap between KM theory and practice is to implement knowledge translation mechanisms which aggregate the academic body of knowledge and deliver it to busy practitioners in an efficient, easy-to-comprehend format. This may be achieved by introducing formal positions of knowledge brokers and associations governing the process of knowledge translation (Bedford, 2015b; Cummings *et al.*, 2019). The use of metaphors may also prove to be useful in reaching a wider stakeholder audience (Gündüz, 2019). At the same time, more research on the efficacy of knowledge transfer mechanisms is warranted (Barbour *et al.*, 2018).

3.8.6 Retrospective analysis and the future of knowledge management. KM takes its conceptual roots from the works of Joseph Schumpeter, Friedrich Hayek, Gilbert Ryle, Claude Shannon, Gilbert Ryle, Michael Polanyi, James March, Herbert Simon, Mark S. Granovetter and Chris Argyris (Khasseh and Mokhtarpour, 2016). The discipline has gone through three stages of development: fragmentation (when the KM discipline was represented by distinct schools of thought), integration (when the KM discipline was represented by a holistic view, common vocabulary and analytical approaches) and fusion (when the KM discipline converged with other scientific domains, theories and principles) (Handzic, 2016; Handzic, 2017). Yet, despite a continued interest in KM topics (O'Leary, 2016), the field is full of confusion, sharp divides and disintegration (Spender, 2013; Spender, 2015). Nevertheless, there will likely be a renewed interest in KM concepts and tools in the future (Schmitt, 2015), and other scientific domains offer promising opportunities to incorporate KM ideas (Lee *et al.*, 2016).

The future of KM may evolve into three emerging trends referred to as extension (increasing the depth and breadth of current KM research), specialization (creating sub-domains within a larger KM paradigm) and reconceptualization (revisiting fundamentals and restructuring the entire discipline) (Handzic, 2017). KM researchers should engage more in interdisciplinary research (Brahma and Mishra, 2015). The term "KM" may potentially evolve into "knowledge science," and the field may merge with subjects from strategic management, information economics, artificial intelligence, education, philosophy, industrial and organizational psychology, LIS, human resource management, and information systems (IS) (Kabir, 2014). KM concepts may be also transformed into knowledge design thinking (Boersma, 2017).

3.8.7 Intellectual core of the knowledge management discipline. Analysis of the scientometric works that focused on the intellectual core of the KM discipline identified four findings. *First*, the overall volume of yearly KM publications had reached its peak between 2011 and 2015 and started to decline (Muzzammil and Asad, 2016; Kör and Mutlutürk, 2017; Breznik, 2018; Khiste and Awate, 2018). This, however, does not indicate the collapse of KM (Garlatti and Massaro, 2016) because there has been an increasing research output in the various niches of KM research. Specifically, there has been a steady growth in publications on knowledge sharing (Goswami and Agrawal, 2018), KM in health care (Lopes da Cruz *et al.*, 2017), knowledge-based development (Fombad and Onyancha, 2017), knowledge-based view in franchising (Tsai *et al.*, 2017), KM in data mining (Tsai, 2013), KM in small and medium-sized enterprises (Massaro *et al.*, 2016b) and KM in start-ups (Centobelli *et al.*, 2017). It seems that, instead of increasing its sheer volume, KM

research has extended its interdisciplinary reach and transformed itself into numerous streams that are being explored in detail. The number of KM research institutions and countries participating in KM research has also been growing. KM is considered a stable, distinct program of study in higher education institutions (Cervone, 2017), and KM curricula has already reached maturity (Bedford, 2013). Almost half of LIS schools have implemented formal KM education in their programs, which suggests that KM is progressing well from theory to practice (Katuščáková and Jasečková, 2019). Even though KM is the youngest management field, it is not a fad, and it is progressing well toward maturity and recognition (Serenko and Bontis, 2013b; Tzortzaki and Mihiotis, 2014).

Nevertheless, there is room for improvement. Presently, KM exhibits an insufficient level of intradisciplinary consensus, cohesion and communication (Teixeira and Oliveira, 2018). It lacks a common vocabulary, definitions and terminology (Fteimi and Lehner, 2013; Gavrilova and Kubelskiy, 2018): more than 100 definitions of KM exist which vary depending on the application context (Girard and Girard, 2015). There are arguments that the discipline is dominated by a technocratic school of thought (Girard and Ribière, 2016). The interdisciplinarity of KM (Zavaraqi, 2016) further contributes to its lack of consistency, uniformity and structure. It seems that KM is represented by a number of unique research themes that are expected to continuously evolve (Powell *et al.*, 2016; Sağsan *et al.*, 2016).

Second, most studies confirmed the leading role of *Journal of Knowledge Management* as a flagship KM outlet that publishes the largest number of influential papers on both general and specialized KM topics (Mariano and Walter, 2015). Other KM-centric journals, especially *Knowledge Management Research & Practice*, also play a vital role in the preservation and dissemination of KM research (Ahmadi and Nazim, 2018). At the same time, there are many non-KM-centric journals that publish a large volume of KM studies on specialized topics and serve as a bridge between KM and other domains (Silva *et al.*, 2017). For instance, *Research Policy* dominates knowledge transfer topics (Chou and Tang, 2014), *BMC Health Services Research*, *Implementation Science* and *Journal of Advanced Nursing* dominate knoweldge sharing in health care (Lopes da Cruz *et al.*, 2017), *R&D Management* dominates open innovation in KM (Natalicchio *et al.*, 2017), *Journal of Economic Geography* and *Journal of Development Economics* dominate knowledge leakage and spillover (Ferenhof, 2016) and *Cities*, *Journal of Cleaner Production*, and *Technological Forecasting & Social Change* dominate KM for smart cities and sustainability (Trindade *et al.*, 2017). Computer science (CS), IS and LIS journals (e.g. *Expert Systems with Applications*, *Computers in Human Behavior*, *MIS Quarterly*, *Decision Support Systems*, *Journal of the Association for Information Science and Technology* and *Lecture Notes in Computer Science*) play an important role in the accumulation and distribution of KM research far beyond the KM discipline (Landrum *et al.*, 2014; Akhavan *et al.*, 2016; Huang *et al.*, 2018; Ali *et al.*, 2019). At the same time, a macro-level distribution of KM works is still poorly understood: one study confirmed that the productivity of journals publishing KM research follows Bradford's law (Ali *et al.*, 2019), whereas another failed to do so (S and Sevukan, 2014). *Third*, most studies reported that knowledge sharing is by far the most popular keyword in KM papers, followed by knowledge transfer, KM systems and innovation (Mariano and Awazu, 2016; Ahmadi and Nazim, 2018). Other keywords pertain to IT (e.g. data mining, information and communication technologies) (Fombad and Onyancha, 2017; Kör and Mutlutürk, 2017). For some reason, more than half of all studies mentioned "knowledge management" as one of the most frequent keywords in KM publications.

Analysis of prevalent and expanding research streams indicated a more comprehensive state of KM research directions. Even though knowledge sharing and transfer topics topped the list again (Kennedy and Burford, 2013; Costa and Monteiro, 2016; Ferguson, 2016; Fteimi *et al.*, 2019), other popular themes signaled the breadth and further advancement of KM research. Examples of popular and growing research streams include communities of

practice (Bolisani and Scarso, 2014), the consequences of knowledge spillover, loss and leakage (Ferenhof, 2016), knowledge-based urban development (Edvardsson *et al.*, 2016), KM success factors (Fteimi and Lehner, 2018), public sector KM (Jussila *et al.*, 2017), KM in project management (Cabral *et al.*, 2014; Handzic and Durmic, 2015; Sareminia *et al.*, 2016), adoption, use and diffusion of KM systems (Matayong and Mahmood, 2013), process capital (Matthies, 2014), social media for knowledge sharing (Sarka and Ipsen, 2017), the role of KM in innovation (Leon and Bolisani, 2016) and the intersection of KM and IT (Iskandar *et al.*, 2017; Khan and Vorley, 2017; Usai *et al.*, 2018). KM also includes knowledge-based development (Akude and Grunewald, 2014) and organizational learning (Song *et al.*, 2014; Adžić, 2018; Castaneda *et al.*, 2018) research streams, and it is closely connected to IC topics (Pereira and Machado, 2019). At the same time, there are several underrepresented or poorly understood KM themes: outsourcing of knowledge processes (Edvardsson and Durst, 2014), knowledge waste (Ferenhof *et al.*, 2015), the role of an individual (Rechberg and Syed, 2012; Rechberg and Syed, 2014a; Rechberg and Syed, 2014b), business outcomes of KM (e.g. the impact of KM on performance) (Heisig *et al.*, 2016), unlearning and forgetting (Klammer and Gueldenberg, 2019), the management of knowledge risks (Durst *et al.*, 2016), various aspects of customer KM (Wilhelm and Gueldenberg, 2014; Khosravi and Hussin, 2018) and human factors in KM technologies (Sarka *et al.*, 2019).

Fourth, the KM discipline has deep historical roots (Khasseh and Mokhtarpour, 2016), and it has progressed through many stages of development from technological to strategic to sociological (González-Valiente *et al.*, 2019). It draws upon and extends the knowledge base from various domains, including CS, management (especially accounting and organizational behavior), engineering, economics, social sciences (particularly psychology) and mathematics (Tomé and Gonzalez-Loureiro, 2014; Malik and Ali, 2018), but it distinguishes itself from the other disciplines (Harper, 2013). Most importantly, KM has been showing a steady process of moving away from borrowing knowledge from other (reference) disciplines toward the development of its own body of knowledge (Dulipovici and Baskerville, 2015). For example, KM works are frequently cited in CS and social sciences (Alajmi and Alhaji, 2018), and KM offers much value to humanities researchers (Handzic and Dizdar, 2016), which is a sign of disciplinary maturity.

4. Implications

4.1 Implications for scientometric knowledge management research

Implication #1: Scientometrics represents a fruitful research avenue for KM scholars. The overall volume of scientometric KM publications has continued growing, and the KM scientometric research has been continuously attracting the attention of the research community. As of 2019, on average, six scientometric KM works were published per month, which confirms the status of KM as a recognized scientific discipline that is worth exploring further.

Implication #2: Scientometric KM researchers should engage in highly specialized studies. Only 43% of scientometric KM studies focus on the entire KM discipline, whereas 57% explore specific topics, publications forums, geographic locations or groups of people. There is a strong trend toward highly specialized scientometric KM projects. As the volume of KM research grows, it becomes difficult to explore the entire KM discipline in a single study. As a result, researchers investigate a particular facet of KM and draw their conclusions in the context of a particular attribute that they study, which represents a natural progression of scientometric KM research.

Implication #3: It is expected that scientometric KM researchers gradually change their interests and preferred inquiry methods. Recently, scientometric KM scholars have become less interested in exploring research paradigms and methods and have started focusing

more on the discipline's intellectual core. They reduced their reliance on traditional literature reviews and publications' content analysis. This shift is understandable because these topics and inquiry methods have reached a saturation point. It is likely that other similar changes will persist in the future.

Implication #4: Scientometric KM research has entered the maturity stage. Scientometric KM research has progressed through four phases of development – Initiation, Early Development, Rigor and Consolidation and Methodological Advancement – and has entered the Maturity stage. The Maturity stage is accompanied by a decline in the use of less rigorous methods – personal opinion, traditional literature reviews and expert opinion – and an increase in advanced approaches, including SLRs, keywords analysis, counting techniques, citation analysis, network analysis and the use of bibliometric laws and models. During this phase, researchers also pay less attention to the retrospective analysis of the KM field.

Implication #5: Scientometric KM projects should not be considered a methodological exercise. Instead, their objective must be to develop actionable implications and recommendations for various KM stakeholders. On the one hand, 48% of all scientometric KM works offer evidence-based implications and recommendations. On the other hand, in 13% of the works, implications are extremely limited, and, in 39%, are missing. Scientometric scholars should always keep in mind that the ultimate goal of their work is to inform busy readers who may lack the expertise to interpret the findings by themselves, and so the scholars should go beyond the mere documentation of their method and the results. In other words, they should always return to the "so what" question and answer it from the perspective of the discipline's stakeholders.

Implication #6: A trend toward a monopoly of the scholarly publishing market is reflected in the behavior of scientometric KM researchers. Several recent partnerships and acquisitions among the leading scholarly publishers suggest a trend toward a monopoly of the for-profit academic publishing market. Scientometric KM scholars have also consolidated their selection of data sources around five major databases: WoS, Scopus, EBSCO, ScienceDirect, and ProQuest – ABI/INFORM. Given the recent addition of ScienceDirect and Emerald searchable content to EBSCO, this trend is likely to persist. On the one hand, an ability to conduct a comprehensive search for academic literature by using a single interface offers efficiency and increases search breadth. On the other hand, it may reinforce a state of monopoly and create a dangerous precedent in the academic world that is supposed to strive toward democracy and debate.

Implication #7: Scientometric KM scholars should further improve the rigor of their literature search approaches. Scientometric KM researchers have increased the coverage comprehensiveness of the literature included in their empirical analyses: during the 2012–2019 period, 57% of all data retrieval methods relied on a single database (vs 64% for the 1996–2012 period), and 55% of all database searches used a single keyword (vs 67% for the 1996–2012 period). Though this improvement is encouraging, it is not sufficient to ensure an adequate coverage of the entire KM domain. For example, as of September 2020, only 11 out of 26 KM-centric journals were covered by WoS. Thus, relying on Clarivate's products exclusively, which was done in 20.4% of all cases, may bias the findings and should be discouraged.

Implication #8: To create a list of keywords for database searches, scientometric KM scholars should rely on the KM keyword classification scheme. In the previous study, Serenko (2013) emphasized a need for the development of a unified KM keyword classification scheme. Bedford (2015a) and Fteimi and Lehner (2018) answered his call in a very rigorous way, and future scientometric KM scholars are strongly recommended to make use of their work.

Implication #9: KM-centric peer-reviewed journals should continue welcoming manuscripts on scientometric topics. Compared to the previous period (i.e. 1996-2012), a larger proportion of all scientometric KM works have appeared in KM-centric journals. This is

encouraging because the works documented in the outlets that cater to the discipline's target audience are more likely to be used by KM scholars. However, 36.7% of such works appeared in non-KM-centric outlets, and these are less likely to reach KM readers. Thus, scientometric KM scholars are advised to submit their manuscripts to KM-centric journals, and these outlets are advised to welcome such submissions. A notable example is *Journal of Knowledge Management* that has published 15.2% of the entire scientometric KM research output.

Implication #10: Scientometric KM researchers should continue improving their awareness of the existing body of knowledge and use it in their work. This study observed that a growing number of scientometric KM authors conduct comprehensive literature reviews to form a theoretical and methodological foundation for their studies and to situate their findings in light of prior research, which is reflected in their citation behavior. Regrettably, some scholars still ignore the very tenet of academic research – standing on the shoulders of the giants who have gone before (Merton, 1993): 19% of all publications failed to cite prior works, and 14% cited only one relevant paper. At this stage of scientometric KM research, it is unlikely that no pertinent publications exist. Those who work on niche topics where "no giants have gone before" may, at the bare minimum, relate their findings to the overall state of the entire KM discipline.

Implication #11: Citation impact of scientometric KM research is highly skewed. Scientometric KM publications achieve high impact: an average work is cited 7.38 times per year. At the same time, the top 10% of all works have attracted a disproportionately high volume of citations – an astonishing 68% (i.e. 13,742 citations for 28 papers, or 490 citations per paper, on average). On the one hand, the skewness of science is a well-established fact, and it may be hypothesized that scientometric KM research exhibits the attributes of other scholarly domains. On the other hand, a more equal distribution of citation impact is desirable to ensure that no relevant works remain unnoticed. Moreover, there is a danger that some scientometric KM scholars may engage in counterproductive citation behavior by citing prior works without reading, understanding, and properly using them merely because these papers have been cited by others. For example, 30% of all citations in the KM discipline are problematic (Serenko and Dumay, 2015a), and it is possible that scientometric KM scholars are not immune to effects of this problem.

Implication #12: A large-scale, comprehensive investigation of KM publication forums is warranted. Serenko (2013) called for further research into the nature of KM publication forums because "many scientometric investigations of the outlets publishing academic KM works lacked methodological rigor and, as a result, produced highly inconsistent findings" (p. 790). The present study identified many rigorous studies of KM publication forums, most of which focused on a single journal or conference. However, these studies were done in relative isolation which, in most cases, was a methodological necessity. As a result, they offer a very narrow view of the KM discipline and do not help the reader form a holistic perspective of the entire spectrum of KM publication forums. For example, it is reasonable to expect that the studies focusing exclusively on *Journal of Knowledge Management*, *Knowledge Management Research & Practice* or *Electronic Journal of Knowledge Management* offer a unique scientometric portrait of a respective outlet which may lead to different conclusions on the state of the entire KM discipline. Thus, KM discipline stakeholders would benefit from a large-scale, comprehensive assessment of the entire data base that is used to preserve the discipline's body of knowledge.

Implication #13: Scientometric KM researchers should continue engaging in inter-departmental and international research collaboration. Earlier, Serenko (2013) emphasized a need for more internal and external collaboration among scientometric KM scholars. This study revealed an increasing collaboration trend manifested in a higher number of authors per paper and a lower fraction of single-authored publications, which ultimately improves the quality, impact and rigor of scientometric KM works.

Implication #14: It is important to understand whether the productivity distribution of scientometric KM researchers is expected to follow Lotka's law. The productivity distribution of scientometric KM scholars does not follow Lotka's law because too many scholars contribute to the research area only once or very rarely. Two explanations are proposed. First, this may reveal a somewhat unhealthy state of scientometric KM research which is represented by many scholars who contribute only once or at least less frequently than Lotka's law predicts. Presently, only 36% of active KM researchers consider KM their primary research domain (Serenko and Bontis, 2017). As an interdisciplinary field, KM is represented by scholars from IS, organizational behavior, human resources, strategy, etc. who have ample opportunities to pursue non-KM topics. After contributing only once or twice, they abandon KM in favor of other research areas.

Second, scientometric publications require a lot of mechanical work which involves manual and extremely time-consuming processes of data collection, aggregation, verification, coding, analysis, etc. It is possible that such type of work is allocated to research assistants (e.g. graduate students) in exchange for authorship. In this case, many such research assistants may have no interest in working in the scientometric KM domain in the future, but they agree to take part in the project as an opportunity to gain some research experience and secure a publication. In this case, the fact that the authorship distribution patterns of scientometric KM scholars deviate from Lotka's law does not indicate the domain's immaturity. It is critical, therefore, to empirically investigate the propositions above by surveying or interviewing KM authors.

Implication #15: The inconsistency observed in the findings of scientometric KM works may be attributed to a high degree of the specialization of most studies. Serenko (2013) concluded that "the results reported in scientometric KM studies are inconsistent" (p. 789). A high level of inconsistency was also observed in the present study. For example, there are dramatic discrepancies among the studies in terms of productivity rankings of individuals and institutions, lists of the most impactful works, longitudinal fluctuations in the overall KM research output (e.g. see Cardenas and Udo, 2013), and popular research topics. A closer examination of the entire body of scientometric KM research shows that these inconsistencies are a natural product of the high degree of specialization of a majority of scientometric KM studies. For instance, the field comprises general, knowledge-based development and organizational learning topics, and it is this specialization that naturally results in a high discrepancy in these studies' conclusions.

4.2 Implications for the knowledge management discipline

Implication #1: Scholars should realize that the KM discipline may successfully exist as a cluster of divergent schools of thought under an overarching KM umbrella and that the notion of intradisciplinary cohesion and consistency should be abandoned. Hannabuss (1987) envisioned the interdisciplinary nature of the KM discipline, and it seems that his prediction has materialized: there is a general consensus that the field has progressed in an interdisciplinary direction. Interdisciplinary research leads to creativity, value, impact and high scientific output. Thus, as an interdisciplinary field of science, KM has great potential to contribute to the state of theory and practice, and the scientific KM community should fully embrace the notion of interdisciplinarity, a divergence of opinion and a multiplicity of co-existing paradigms.

Implication #2: A recent decline in the overall volume of yearly KM publications reported by scientometric KM studies does not signify a diminished interest in the discipline. A majority of scientometric KM studies have agreed that, between 2011 and 2015, the overall volume of yearly studies on KM topics reached its peak and started to decline. This statement, however, does not accurately reflect the status of the KM discipline. First, KM has extended its interdisciplinary reach, and KM topics have been increasingly incorporated in publications in other scientific domains; thus, it is difficult to distinguish between a "KM" and

a "non-KM" paper and decide whether to count it as a part of the KM research output. In particular, there has been a growing interest in niche KM topics that intersect with other management domains – for instance, innovation, IS and health care. It is unclear whether one should consider these papers KM-centric publications. Second, most studies measuring the volume of KM research use "knowledge management" as a major keyword. By doing so, they miss a large number of relevant KM papers because a growing number of KM publications omit the phrase "knowledge management" in their titles, abstracts and keywords. Thus, the interdisciplinary progression of KM makes it more difficult to identify and measure, but the interest in KM topics is very strong.

Implication #3: Journal of Knowledge Management is unanimously recognized as the discipline's leading publication forum. There is consensus that *Journal of Knowledge Management* is the discipline's flagship journal: it is a highly productive, influential, innovative, balanced and geographically inclusive outlet that has consistently topped KM journal rankings and has achieved recognition both within and outside the KM discipline. In 2019, it was ranked A according to the Australian Business Deans Council (ABDC) Journal Quality List and received the Journal Impact Factor of 4.745, which exceeds that of more than half of all journals included in the Financial Times 50 list.

Implication #4: KM researchers should not limit their interest to the body of knowledge documented in the KM-centric sources. The KM body of knowledge is documented and preserved in both KM-centric and non-KM-centric journals and conference proceedings. As of September 2020, there were 26 KM-centric journals and several conferences that focus specifically on various KM topics. However, a large share of KM works is also preserved in outlets catering to other disciplines, especially to CS, IS, LIS, health care and economics.

Implication #5: It is important to understand why so many researchers publish only a single KM work. The application of Lotka's law to the productivity patterns of KM scholars revealed that more than 80% of KM authors publish only a single KM paper, which is a truly disturbing sign. However, before discussing this fact in the context of the discipline's health, it is critical to understand why this phenomenon takes place, and this represents an important research avenue.

Implication #6: The top six most productive countries are the USA, the UK, Taiwan, Canada, Australia and China. Irrespective of the method, there was general agreement on the list of the countries that generated the largest number of KM publications. These countries have already achieved a high standard of living or have been progressing well toward achieving one. Though a causal directional relationship between the number of research articles published and economic growth is more complicated than it seems (Ntuli *et al.*, 2015), evidence suggests that KM research activity is directly linked to a country's economic prosperity, which highlights the relationship between knowledge and wealth (Ramy *et al.*, 2018). This further confirms the importance of supporting KM research at a national level.

Implication #7: KM scholars should continue increasing their research collaboration. On the one hand, KM scholars have improved their collaboration behavior. On the other hand, the extent of collaboration depends on geographic locations, publication venues and time periods. Only a few leading KM scholars have developed extensive collaborative networks, and collaborative efforts rarely cross international borders. By engaging in national and international collaboration, KM scholars may reach multiple populations of individuals and organizations, stimulate their creativity, ensure an effective use of their research expertise, expedite the process of scientific discovery, enhance the visibility of their research output, avoid effort duplication and infuse the latest academic knowledge into the knowledge base of developing countries. In addition, having strong, well-developed collaborative networks serves as a sign of disciplinary maturity.

Implication #8: There is life beyond case studies, surveys and interviews as research methods. In the early days of KM research, case studies, surveys and interviews represented the most common empirical approaches, but it seems that this trend has

prevailed throughout the entire lifespan of KM research. As such, the role of these methods in the development and cultivation of KM research is unarguable. At the same time, other methods of inquiry which are dramatically under-represented in KM research – for example, action research, laboratory experiments, design science, ethnography, field studies, field experiments, mixed-methods and the use of secondary data – may not only fill the gaps in our knowledge but also cause a paradigm shift. Thus, it is strongly recommended that researchers embark on the use of these methodologies and that journal editors and reviewers welcome these submissions.

Implication #9: There is a need for knowledge brokers that may deliver the KM academic body of knowledge to practitioners. Previously, Serenko (2013) identified a growing gap between KM academics and practitioners which, as the present study showed, has only widened. At this stage, it is obvious that the direct knowledge dissemination channel – which assumes that practitioners directly access, read and benefit from academic publications – does not function. A proposed solution includes the introduction of formal and informal positions of knowledge brokers who aggregate, summarize and deliver the academic knowledge scattered across disparate publication venues to busy practitioners in an easy-to-comprehend format. For this, the KM discipline may follow the basic KM principles and adapt the model that has been successfully pioneered in the medical field under the general term of translational research.

Implication #10: The KM discipline has been progressing well toward maturity and recognition, but it has been a bumpy ride. During its relatively short history, KM has made remarkable progress by drawing upon and extending knowledge from reference disciplines such as CS, management, engineering, economics, social sciences and mathematics. Because of its interdisciplinary nature, it is difficult to take a precise snapshot of the discipline's state, which is evident in the many inconsistencies reported in the findings of the 175 scientometric studies analyzed in this investigation. However, it is evident that KM is not a management fad and, as a discipline, it has gained recognition within the broader scientific community. Most importantly, there are signs that KM has started infusing knowledge into other disciplines, and KM topics appear in non-KM-centric management and even non-management journals. In the future, it is likely that KM will undergo a further transformation process on its bumpy ride toward full academic maturity.

5. Limitations and conclusions

No scientific endeavor is flawless, and this study is no exception. First, despite the use of a rigorous SLR method, it is possible that some relevant studies were missed. Examples include publications existing in non-electronic form at only or those that were not indexed by academic databases, including Google Scholar. Second, this study focused on peer-reviewed works only, such as refereed journal articles, conference proceedings papers and book chapters. However, non-academic sources – for instance, practitioner magazines – may also contain valuable insights on the state of the KM discipline. Third, the search was limited to English-language publications, but it is possible that works published in other languages may portray a different picture of the KM discipline. Fourth, the KM discipline has close ties with the IC domain, and it is difficult to study KM in isolation from IC. Thus, future researchers should keep these issues in mind when building upon the findings reported in this study.

The purpose of this study was to conduct the SLR to update the findings of a previous project by Serenko (2013) who examined 108 scientometric KM works. In this study, 175 additional publications were analyzed to form an updated picture of the discipline's identity. The growth in the volume of scientometric KM research signifies the interest in the KM discipline and further confirms its status as a recognized management discipline. Based on the findings, 15 distinct implications for scientometric KM researchers and 10 distinct

implications for KM discipline stakeholders were proposed. Among the major findings is the fact that it is an appropriate time to recognize that the KM discipline may successfully evolve as a cluster of distinct schools of thought under an overarching KM framework, and its body of knowledge may eventually merge with that existing in other management disciplines and beyond. It seems that Wilson (2002), who claimed that KM is nonsense, was wrong: even though, as he envisioned, KM may be viewed as an umbrella term because of its interdisciplinary nature, KM concepts and activities have never evolved into a "nonsense science".

Notes

1. In Figures 5 and 6, the sum may differ from zero because of rounding.
2. Works published in 2019 were excluded from citation analysis.
3. The author of this study excluded himself from this list to remain impartial.
4. The author of this study excluded himself from this list to remain impartial. It is for this reason, only seven names are mentioned.

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