Meta-analysis of scientometric research of knowledge management: discovering the identity of the discipline

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Abstract

Purpose – *The purpose of this study is to conduct a meta-analysis of prior scientometric research of the knowledge management (KM) field.*

Design/methodology/approach – *A total of 108 scientometric studies of the KM discipline were subjected to meta-analysis techniques.*

Findings – *The overall volume of scientometric KM works has been growing, reaching up to ten publications per year by 2012, but their key findings are somewhat inconsistent. Most scientometric KM research is published in non-KM-centric journals. The KM discipline has deep historical roots. It suffers from a high degree of over-differentiation and is represented by dissimilar research streams. The top six most productive countries for KM research are the USA, the UK, Canada, Germany, Australia, and Spain. KM exhibits attributes of a healthy academic domain with no apparent anomalies and is progressing towards academic maturity.*

Practical implications – *Scientometric KM researchers should use advanced empirical methods, become aware of prior scientometric research, rely on multiple databases, develop a KM keyword classification scheme, publish their research in KM-centric outlets, focus on rigorous research of the forums for KM publications, improve their cooperation, conduct a comprehensive study of individual and institutional productivity, and investigate interdisciplinary collaboration. KM-centric journals should encourage authors to employ under-represented empirical methods and conduct meta-analysis studies and should discourage conceptual publications, especially the development of new frameworks. To improve the impact of KM research on the state of practice, knowledge dissemination channels should be developed.*

Originality/value – *This is the first documented attempt to conduct a meta-analysis of scientometric research of the KM discipline.*

Keywords *Knowledge management, Research, Research work, Sciences, Scientometrics, Meta-analysis, Discipline identity*

Paper type *Research paper*

1. Introduction

Knowledge management (KM) is a young management discipline that has already made remarkable progress and attracted the attention of researchers, practitioners, and policy-makers. The theoretical roots of KM date back millennia, starting with the earliest documented work of Plato (369 BC), who tried to define and conceptualize knowledge. Basic knowledge preservation, sharing, and re-use practices have existed throughout human history and eventually inspired several pioneers of knowledge studies to begin a systematic, scientific exploration of the phenomenon in the twentieth century. KM is widely recognized as a practitioner-driven concept which emerged as a set of professional practices from the growing pressure on organizations to improve their efficiency and competitiveness in the second half of the last century. The first KM conference, which unexpectedly attracted a large number of attendees, was held in Boston in 1993 (Prusak, 2001). In the mid-1990s, KM entered mainstream academic research, and KM-centric journals, which represent a necessary feature of a scientific discipline, were launched soon

after that. However, despite the steadily expanding theoretical base of the KM discipline (Grant, 2011), its trajectory and identity remain largely unknown.

Scientometrics is a science about science (Price, 1961, 1963). It provides researchers with various concepts, models, and techniques that may be applied to an academic discipline in order to explore its foundations, state, intellectual core, and potential future development. Many studies have analyzed the KM discipline from a scientometric perspective, but a brief overview of these works reveals that many scientometric KM researchers are not fully aware of prior publications. For example, they rarely cite scientometric studies of the KM field, extend previous lines of scientometric research, or compare their findings with those published earlier. Moreover, no meta-analysis study has previously been done to aggregate the results of the seemingly independent scientometric inquiries into the KM domain. Therefore, the present investigation conducts a meta-analysis of scientometric research of the KM discipline in order to consolidate scientometric research of KM, to develop recommendations for future scientometric researchers and to better understand the identity of this scientific field.

The rest of this paper is structured as follows. Section 2 introduces the discipline of scientometrics, demonstrates its value for the KM field, and describes KM as a scholarly domain. Section 3 outlines this study's methodology, and Section 4 presents the findings. Section 5 discusses a number of implications, identifies several limitations of this study, and offers concluding remarks.

2. Theoretical background

2.1 What is scientometrics?

Scientometrics is a systematic approach to analyzing the past, present, and future development of science. It emerged from the interest of a small group of scholars in the dynamics of science (Wilson, 1999). The first attempts to measure, understand, and document scientific progress date back to the nineteenth century when Galton (1874) conducted a survey of 180 eminent men of science in Britain because of his interest in the success of influential scholars and their qualities (Godin, 2006, 2007). This work inspired James McKeen Cattell, the Psychologist and Editor of *Science*, who decided to systematically measure, classify, and observe scientific development (Cattell, 1903, 1910). Most importantly, Cattell introduced two dimensions of scientific productivity that are still used in contemporary scientometric research: quantity (i.e. productivity) and quality (i.e. merit as judged by peers). Other pioneers set the foundations for the growth of the field. For example, Lotka (1926) proposed a mathematical model to predict the frequency of publication by authors in a particular domain, Bradford (1934) identified a pattern of the distribution of articles across a set of journals, Price (1961, 1963) traced the historical evolution of science, Bernal (1939) emphasized the social function of science, and Merton (1968, 1973) focused on the sociology of science.

The term scientometrics was invented by the Russian mathematician Vasiliy Nalimov (*naukometriya* in Russian, meaning the study of the evolution of science through the measurement of scientific information) (Nalimov and Mulchenko, 1969). This term was not noticed in Western scientific circles until it was translated into English (Garfield, 2009). In 1978, an inaugural issue of *Scientometrics* journal was published, and the term gained academic recognition. Currently, there are several journals fully or partially devoted to scientometric topics – for example, *Journal of Informetrics*, *Research Policy*, *Journal of the American Society for Information Science and Technology*, and *Social Studies of Science*. Scientometric studies have several objectives:

- to measure, classify, and describe the output of scientific literature;
- to understand the dissemination of knowledge;
- to identify the theoretical and practical impact of academic studies;
- to comprehend the behavior of individual researchers, research teams, and institutions;

- to explore the nature of scientific outlets;
- to determine the most efficient allocation of resources to maximize research output and impact; and
- to propose recommendations for research policy development.

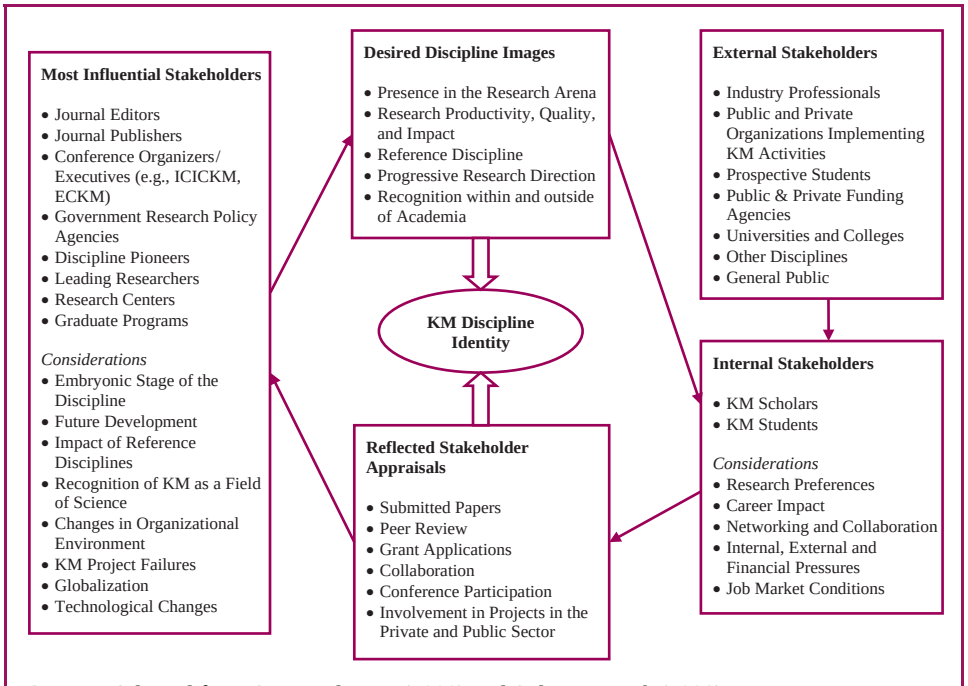
To accomplish these objectives, scientometric researchers have a variety of empirical methods available (Hood and Wilson, 2001).

2.2 The value of scientometrics for the KM discipline

> Understanding the state of play is a logical first step in strategically orienting the discipline and establishing paths for future progress (Petty and Guthrie, 2000, p. 156).

The framework of the stakeholder approach to identity construction of a scientific discipline highlights the value of scientometric studies for the KM field (Scott and Lane, 2000; Sidorova *et al.*, 2008). The KM discipline identity is the central construct of the framework which includes key, distinct, and unique aspects of the domain (e.g. objectives, values, practices, principles, etc.) (Figure 1). The most influential KM stakeholders – such as journal editors, journal publishers, conference organizers, government research policy agencies, pioneers and leading researchers, research centers, and graduate programs – envision the desired images of the KM discipline. Their decisions are based on several considerations of the state of KM. These include the infancy, insufficient academic recognition, lack of scientific rigor, and low scholarly and practical impact of the KM discipline. These realities are further accompanied by a high rate of KM project failures, a constantly changing external environment, accelerating technical progress, and globalization trends. Ideally, the most influential stakeholders want KM to establish its presence in domestic and international research arenas, to generate a high volume of quality publications contributing to both theory and practice, to exhibit signs of a

Figure 1 The framework of the stakeholder approach to identity construction of the KM discipline



Source: Adapted from Scott and Lane (2000) and Sidorova *et al.* (2008)

reference discipline, to ensure progressive research direction, and to gain recognition within and outside of academic circles.

The desired images of the discipline influence the behavior of the internal stakeholders of KM, such as KM scholars and students. They develop their perceptions of the identity of the discipline based on their personal research interests, career directions, networking opportunities, collaboration style, internal (e.g. departmental, institutional, etc.), external (e.g. industry) and financial (e.g. research funding) pressures, and chances of employment. These perceptions are also affected by a number of external stakeholders, including industry professionals, public and private organizations implementing KM activities, prospective students, funding agencies, educational institutions, other academic disciplines, and the general public. The actions of internal stakeholders are manifested through reflected stakeholder appraisals, such as paper submissions, participation in peer-reviews, grant applications, collaboration, conference attendance, and involvement in government and industry projects. Therefore, the current identity of the KM discipline is a combination of two factors:

1. desired discipline images developed by the most influential stakeholders; and
2. reflected stakeholder appraisals based on the actions of internal players.

Scientometric research is important because it may potentially provide all stakeholders of the KM discipline with a realistic, valid description of the field to assist them in their decision-making and help them adjust their actions if necessary (Straub, 2006). First, internal stakeholders may want to know who the most influential scholars, institutions, and countries are. Scientometric studies of research productivity and impact frequently identify the most prolific and influential researchers, institutions, and nations that play a key role in the development of the discipline (Dean *et al.*, 2011). The recognition of their scientific merit helps leading researchers communicate their achievements both within and outside of the KM domain and encourages them to contribute further. By knowing productivity trends, prospective students may select the most appropriate graduate programs, and junior researchers may find academic mentors. Second, scientometric studies often explore the identity of academic conferences, which provides conference organizers and executives with valuable knowledge to help them select executive committee members, track chairs, keynote speakers, and panel topics (McLaren and Mills, 2008; Cocosila *et al.*, 2009).

Third, scientometric studies of the profile, quality, and impact of academic journals provide editors, board members, publishers, reviewers, and potential contributors with valuable information (Lowry *et al.*, 2004; Palvia *et al.*, 2007; Serenko and Dohan, 2011). Fourth, scientometric investigations reveal collaboration patterns of researchers within the field and their contact with the neighbouring disciplines (Bordons *et al.*, 1996; Levitt and Thelwall, 2009), which facilitates intra- and inter-disciplinary cooperation. Fifth, the application of scientometric principles to KM studies – for example, Lotka's Law, the Uncitedness Factor, and the superstar phenomenon (Lotka, 1926; Merton, 1968; Rosen, 1981; Chung and Cox, 1990; Egghe, 2010) – may reveal anomalies and deficiencies within the domain which helps discipline stakeholders call for corrective action. Sixth, studying practical relevance of academic research output is of interest to external stakeholders who want to observe the tangible impact of the implementation of scientific findings (Starkey and Madan, 2001; Bennis and O'Toole, 2005). Seventh, granting agencies, private sponsors, and taxpayers need to know about the prevalence, distribution, trends, and overall effect of research funding, which is a common theme in scientometrics (Levine, 2012). Eighth, the investigation of peer-review processes in scholarly outlets is a controversial yet critical topic in scientometrics, which is of particular interest to all active researchers (Campanario, 1998a, b).

2.3 KM as a scientific discipline

KM is an expansive (and expanding) field that has the potential to offer a unifying foundation for many other disciplines, from information systems to accounting, from operations management to

strategic management, from marketing to human resources and organization design (Holsapple and Wu, 2008, p. 31).

The identity of a scientific discipline is formed by the interaction of its stakeholders. It cumulatively reflects the present state of the discipline and forms the foundation for its future progression (Kuhn, 1962; Biglan, 1973; Baskerville and Myers, 2002; Jennex and Croasdell, 2005; Katerattanakul *et al.*, 2006). Despite its youth, KM already presents all the signs of an independent scientific discipline. For example, it has a place in academic curricula (Ruth *et al.*, 2003; Bontis *et al.*, 2006), academic meetings (Kulkarni and Raghu, 2005; Serenko *et al.*, 2009), 25 peer-reviewed journals (Serenko and Bontis, 2013a), recognized scholars (Serenko *et al.*, 2010; Dwivedi *et al.*, 2011), collaboration networks (Dattero, 2006), and a dynamic cluster of research paradigms. KM is a gradually maturing domain; it is progressing towards becoming a reference discipline that has both theoretical and practical impact (Serenko and Bontis, 2013b).

KM has deep historical roots that have been well-documented in the literature (Wiig, 1997a, b; Ives *et al.*, 1998; Wiig, 1999; Lambe, 2011). Early KM concepts and practical applications date back at least 4,000 years to the ancient Greeks. The invention of the printing press in the fifteenth century further facilitated the preservation of the knowledge base and fostered knowledge dissemination. At each point in history, KM appeared naturally in response to technological, societal, and industrial changes which required organizations to dramatically improve their efficiency. The first attempts to officially establish KM practices date back to 1975 (Chaparral Steel), but, even before that, many KM visionaries and pioneers formed the theoretical foundations of the KM discipline.

The development of KM is best described by following the four-generation approach (Table I). The first-generation of KM existed prior to the mid-1990s, which represents the time period before KM had entered mainstream academic research. It focused on the management-driven, techno-centric processes to identity, codify, and store knowledge already possessed by employees. The second-generation of KM, which existed from approximately the mid-1990s to the early 2000s, recognized the value of human factors, tacit-explicit knowledge conversion, organizational intellectual capital, culture, and personal initiative. Technology was considered merely a tool rather than the force driving KM implementations. The third generation of KM – the stage the field is currently in – tries to reconcile the differences between the first and second generations. It focuses on strategic perspectives, social learning, ethical-social innovation, the impact of KM practices, national development, and value creation. The fourth, future generation of KM will have to deal with an increasing complexity of the knowledge domain by developing new KM metaphors, paradigms, and tools. For example, it may shift attention from the orthodox ''economic man'' to the ''intellectual capital man,'' implement knowledge navigation quizzics (the art and science of questioning), and move towards the Mind Era and Intellectual Capital Consciousness. Each subsequent KM generation does not disregard or displace the previous one; instead, KM development is cumulative, and each new generation often builds upon the ideas introduced earlier.

The KM discipline has made remarkable progress, which has been documented in a number of scientometric studies that explored its history, present, and potential future directions. At the same time, it appears that scientometric research of KM lacks consolidation, and most previous scientometric studies of KM have been conducted in relative isolation. Moreover, no meta-analysis of scientometric research of KM has been done. The purpose of each individual scientometric study is to explore a particular, narrow aspect of an academic discipline. As a result, it describes only a single characteristic of a discipline's identity. The value of a meta-analysis is that it may aggregate and summarize the findings from previous independent investigations and form a more comprehensive understanding of the identity of the KM discipline. The purpose of the present study is, therefore, to conduct this much needed meta-analysis of prior scientometric research of the KM field.

Table I Generations of KM

Generation	*Attributes*
First (prior to the mid-1990s)	Techno-centric view of knowledge processes Existence of a priori knowledge in organizations Emphasis on ''best practices'' and ''lessons learned'' Focus on explicit knowledge Knowledge codification and storage A person is a source of knowledge Knowledge sharing processes are initiated and driven by the management Search for ''true knowledge''
Second (the mid-1990s-the early 2000s)	The importance of human factors and tacit-explicit knowledge conversion The accumulation of human and intellectual capital within an organization The role of social and cultural aspects in organizational learning Focus on bundled knowledge resources of an organization rather than on an individual possessing knowledge Search for ''applied knowledge'' Knowledge sharing processes are initiated and driven by individual employees as part of their daily routine
Third (the early 2000s-2013)	Strategic perspective The reconciliation of human- and techno-centric views on knowledge creation, sharing, and storage The identification, development, and support of autonomous, informal, and self-managed social networks Increasing importance of culture and contextual aspects Collaborative KM Leveraging collective knowledge Societal learning, the democratization of knowledge, and citizen involvement Ethical social innovation Impact on individuals, organizations, and society Managing knowledge as a flow Focus on value creation
Fourth (future)	Increasing complexity of the knowledge domain Knowledge is seen as a relationship Focus on value multiplication, knowledge synergy, and collective intelligence Knowledge navigation quizzics (the art and science of questioning) Shift from the paradigm of the tangible survival economy to the culture of intangible knowledge economy or mind economy Shift from the orthodox ''economic man'' to ''intellectual capital man'' Increasing role of knowledge-based development Transition from the ''theory of the firm'' to the ''theory of the un-firm'' (networked enterprises)

Note: This table presents a general summary of the key points expressed in each work cited
Source: Burstein and Linger (2006), Dixon (2010), Edvinsson (2013), Edvinsson (2010), Huysman and de Wit (2004), Laszlo and Laszlo (2002), Maier and Thalmann (2008), McElroy (2003), Nonaka and Takeuchi (1995), Snowden (2002) and Vorakulpipat and Rezgui (2008)

3. Methodology

First, a comprehensive and exhaustive search for the scientometric studies of the KM discipline published or accepted for publication up to August 2012 (inclusive) was conducted. For this, the following approach was implemented:

- *Step 1. A review of KM-centric journals.* All papers published in all issues of the KM journals identified by Bontis and Serenko (2009) were reviewed to determine whether the purpose of each study pertained to KM as a discipline.
- *Step 2. A search of article databases.* All major article databases (Emerald, ScienceDirect, ProQuest, Scholars Portal, JSTOR, Thomson Reuters, IEEE Xplore, Google Scholar, etc.) were searched using a combination of a KM-related keyword (e.g. ''knowledge management,'' ''organizational learning,'' ''learning organization,'' ''intellectual capital management,'' ''knowledge sharing,'' ''knowledge studies,'' ''brain worker,'' ''knowledge worker,'', etc.) and a scientometrics-related keyword

(e.g. ''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,'' ''management fashion/fad,'', etc.).

- *Step 3. A cited-works analysis.* In all identified papers, all citations were reviewed to locate the scientometric studies of KM that were cited within these papers.
- *Step 4. A citing-works analysis.* By using Google Scholar, all works that cited papers discovered in Steps 1 through 3 were reviewed to find additional scientometric studies of the KM discipline. Cited works of each newly discovered paper were also reviewed (i.e. back to Step 3) until the potential pool of papers was exhausted.

Second, the following analysis of all identified works was done:

1. *Focus of the study.* The focus (i.e. overall purpose) of each scientometric study was identified. For this, a codebook was developed and refined during the process (Table II). A priori set of codes was developed based on the most common themes in scientometric research. As the study progressed, the codes were continuously adjusted to reflect the nature of the KM domain. Because a single study may pursue multiple objectives, up to three purposes were recorded per examined paper.
2. *Scientometric methods.* The methodology employed in each scientometric study was recorded. Because a single study may employ several approaches, up to three methods were recorded per examined paper (Table III). Note that the identification of multiple purposes and methods in each examined work is a commonly used scientometric technique (Palvia *et al.*, 2004, 2007). Two trained researchers independently coded the focus and method of each examined work. Every time when a new code was needed, or an existing code required changes, the coders discussed this issue in person. Because they achieved almost perfect agreement, the reliability of the coding process was assured.
3. *Coverage comprehensiveness.* For all empirical studies that involved searching for previous KM publications, search criteria were identified, such as the target databases, time period covered, and keywords.
4. *Citation impact.* The number of Google Scholar citations received by each paper was recorded. Google Scholar was chosen because it is the most comprehensive scientific database that includes citations from all forms of publications (e.g. peer-reviewed articles, books, conference proceedings, reports, etc.) in multiple languages (Kousha and Thelwall, 2007; Harzing and van der Wal, 2008; Harzing, 2013).

Table II Codebook – the purpose of the examined scientometric studies

No.	*Purpose*	*Description*
1	Analysis and ranking of KM journals	Analysis and ranking of journals publishing KM research
2	Collaboration analysis	Collaboration patterns of KM researchers, institutions and countries
3	Intellectual core of the KM discipline	State, identity, structure, theoretical foundations, and intellectual core of the KM discipline
4	Productivity and impact	Analysis of productivity and impact of KM researchers, institutions and countries
5	Research paradigms, methods, and trends	Analysis of KM research methods, state of KM research, research paradigms, research trends, and research agendas (the focus is on KM research, not the entire discipline)
6	Research relevance	Impact of academic KM research on the state of practice. Practical relevance and the application of academic findings
7	Retrospective analysis and future of KM	KM history, origin, historical roots, and potential future development

Table III Codebook – methodology used in the examined scientometric studies

No.	*Method*	*Description*
1	Citation analysis	Analysis of references of select works (excluding co-citations)
2	Co-citation analysis	Analysis of co-citations within the examined work (i.e. cited works)
3	Content analysis	Analysis of the content of publications, including title, abstract, full-text, etc. but excluding citations
4	Counting techniques	Counting articles, authors, institutions, and countries
5	Expert opinion	Solicitation of expert opinion by using surveys, interviews, Delphi methods, and focus groups
6	Keyword analysis	Analysis of keywords and article classification categories (i.e. subjects) selected from article databases without analyzing title, abstract, and full-text
7	Literature review	Most of the ideas expressed in the paper are based on the academic literature (without doing a systematic review, meta-analysis, or empirical analysis)
8	Meta-analysis	Systematic literature review (by following a formal approach) and meta-analysis of the literature
9	Network analysis	Application of network analysis and data visualization techniques
10	Personal opinion	Most of the ideas expressed in the paper are based on the author(s) personal experience, opinion, views, and beliefs, which are not supported by literature and/or empirical evidence
11	Webpage analysis	Analysis of webpages
12	Word frequency analysis	Analysis of word frequencies in the full-text, abstract or title of select articles

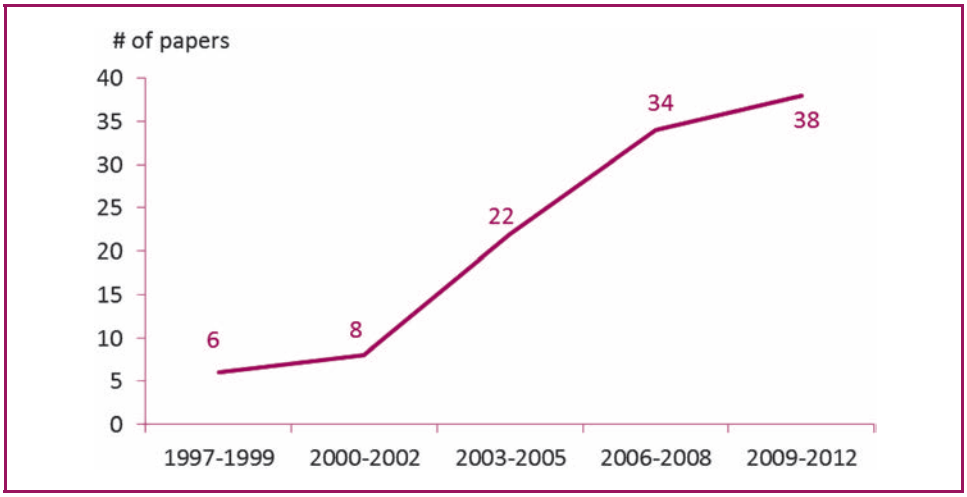
5. *Awareness of prior scientometric research.* In the social and administrative sciences, researchers who embark on a particular line of research are expected to be aware of all previously documented, relevant works. For this, they usually include a literature review section in the first half of the paper. The purpose of the literature review is to provide the necessary historical background, definitions, terms, issues, opinions, and theories for the current study to drive research questions and develop empirical methods. Therefore, it is reasonable to presume that each scientometric study of the KM discipline should cite scientometric KM studies published earlier. To investigate this issue, in each examined paper published after 2001, cited works (i.e. references) were analyzed to observe whether authors cited the previously published scientometric studies of KM. Note that the year 2001 was chosen because researchers needed at least several years to locate previous scientometric works (the first scientometric KM works appeared in 1997).
6. *Author and paper characteristics.* To understand the attributes of scientometric works in KM, the following information was generated:
   - a list of the most productive authors (i.e. of scientometric KM publications) based on the direct count method, which assumes that each author receives a score of one for each publication, regardless of the number of authors listed in the study (Serenko *et al.*, 2008);
   - the number of authors per paper; and
   - a list of outlets in which the examined works were published.
7. *Consolidation of the major findings.* The major findings for each category of scientometric research were aggregated to form a comprehensive understanding of the identity of the KM discipline.

4. Results

4.1 Topics and methods in scientometric studies

108 scientometric studies of the KM discipline were identified and used for analysis (see Appendix). According to Figure 2, the overall volume of scientometric KM publications has

Figure 2 Volume of scientometric research of the KM discipline



been growing, reaching up to ten publications per year by 2012. Figures 3 and 4 show the topics and methods in scientometric KM research, respectively. Investigations of the intellectual core of the KM discipline – including its state, identity, structure, and theoretical foundations – are a leading topic, followed by studies of KM research paradigms, methods, and trends. In contrast, collaboration patterns of KM scholars remained under-explored. Literature reviews, analyses of the content of publications – including title, abstract, full-text, etc. (but excluding citations) – and counting techniques (e.g. counting authors, institutions, countries, etc.) are the most frequently employed research approaches. Advanced scientometric techniques, such as citation analysis, co-citation analysis, network analysis, word frequency analysis, and meta-analysis, are employed less often.

With respect to timeline, three phases of scientometric research were identified (Figure 5). The focus of the first phase (1997-2001) was to document the academic birth of KM, identify its historical roots, and propose avenues for future projects. Related works were based on personal opinion and literature review. Therefore, Phase I is referred to as the *Initiation of Scientometric Research*. The second phase (2002-2006) focused on the investigation of the

Figure 3 Topics of scientometric research of the KM discipline

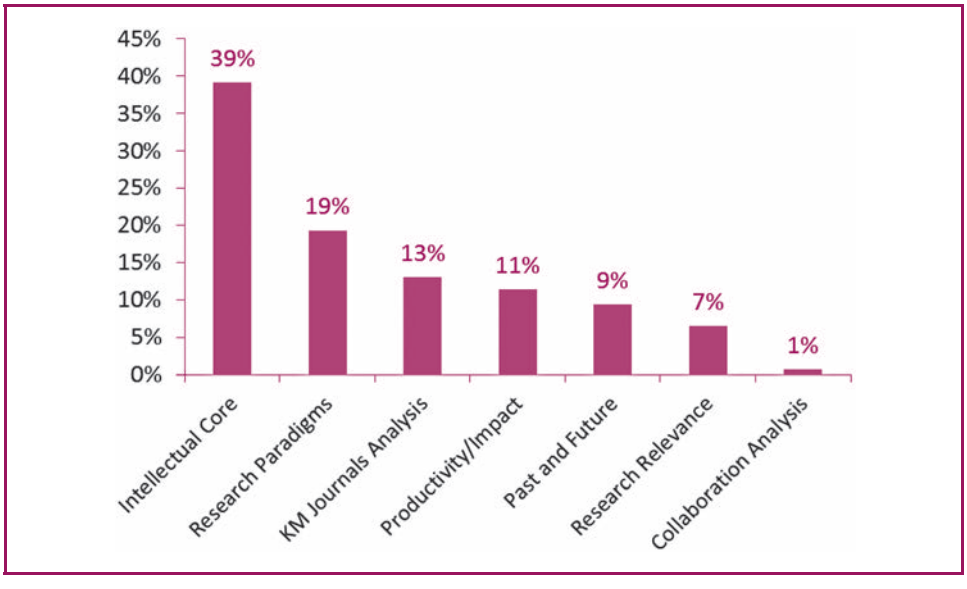


Figure 4 Methods used in scientometric research of the KM discipline

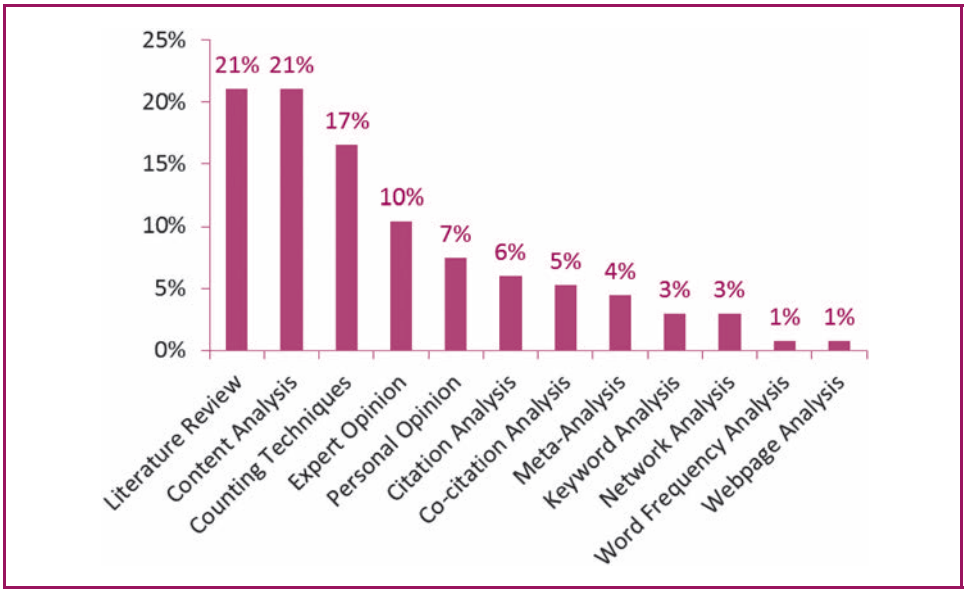
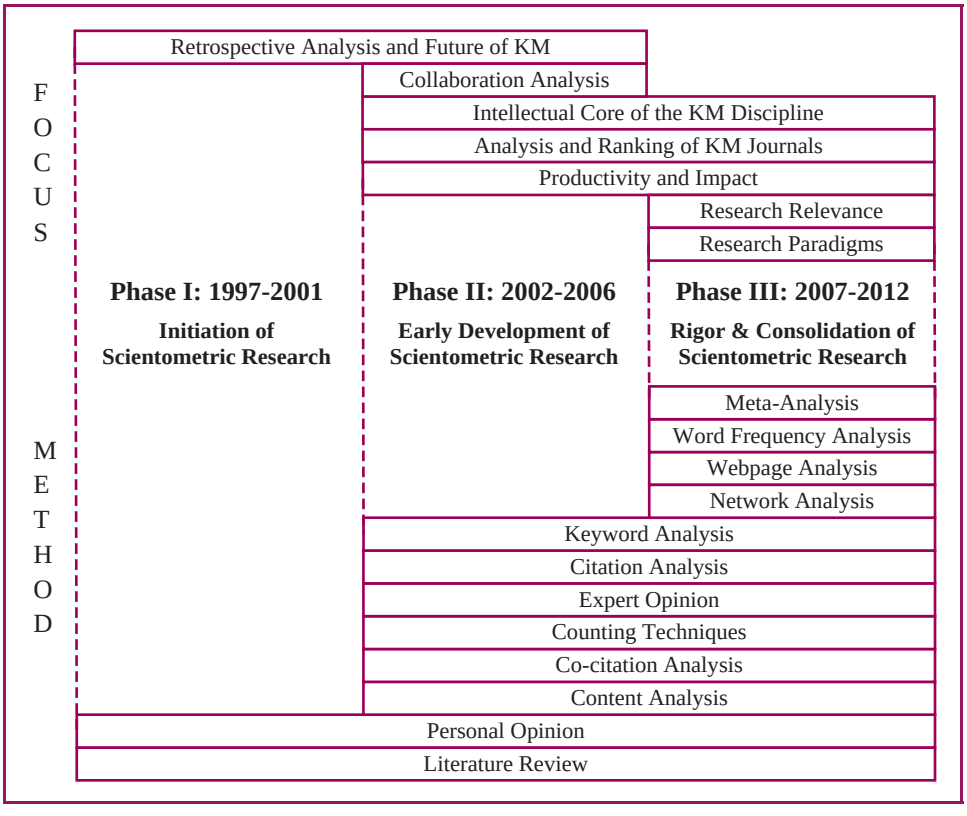


Figure 5 Evolution of scientometric research of the KM discipline



intellectual core of the KM field, KM journals, collaboration patterns, as well as productivity and impact of researchers, institutions, and countries. Such studies required the application of basic scientometric techniques, such as content analysis, citation analysis, co-citation analysis, counting methods, solicitation of expert opinion, and keyword analysis. Thus,

Phase II is labeled as the *Early Development of Scientometric Research*. The goal of Phase III (2007-2012) was not only to continue the lines of research introduced earlier, but also to focus on advanced topics, such as practical relevance of KM research, methods, paradigms, and trends. For this, in addition to the basic scientometric methods, advanced approaches – such as network analysis, analysis of webpages, word-frequency analysis, and meta-analysis – were introduced. Therefore, Phase III is referred to as the *Rigor and Consolidation of Scientometric Research*.

There are two issues that the reader needs to keep in mind when analyzing the phases of scientometric KM research. First, the progression of scientometric research from one phase to another has been cumulative. In most cases, research topics and methods introduced in the previous phase frequently reappeared at subsequent stages. For example, personal opinion and literature reviews were evident during all three phases. Citation analysis, which appeared in Phase II, was also frequently employed in Phase III. Second, the line between the phases is somewhat blurred: the proposed stages simply reflect the major focus of research and the predominant research techniques. For example, the earliest empirical scientometric method was applied to the KM discipline during the first phase (Scarbrough *et al.*, 1999). The use of this empirical approach, however, was an exception during this phase. Overall, the proposed phases overlap and develop the cumulative research tradition.

4.2 Coverage comprehensiveness

All empirical studies examined KM research over an extensive time period, usually going back ten years or more. Three critical issues, however, emerged. First, 17 percent of the examined datasets were retrieved from Thomson Reuters' products, such as Web of Science, Web of Knowledge, Social Sciences Citation Index, and Sciences Citation Index (Table IV). Only 10 percent were extracted directly from KM-centric peer-reviewed journals, which represent the most relevant part of KM research. Second, some studies relied on a

Table IV Sources of examined works

No.	*Category*	*Percentage*
1	Indexes and databases Thomson Reuters Products (Web of Science, Web of Knowledge, Social Sciences Citation Index, and Sciences Citation Index) (17 percent) ProQuest – ABI/INFORM (10 percent) Google Scholar (5 percent) EBSCO Publishing (3.7 percent) ACM Digital Library (2.5 percent) CiteSeer (2.5 percent) Emerald (2.5 percent) ScienceDirect (2.5 percent) Amazon.com (1.2 percent) Brint Institute Portal (1.2 percent) Compendex (1.2 percent) ERIC (1.2 percent) IEEE Xplore (1.2 percent) InderScience (1.2 percent) Inspec (1.2 percent) MS Academic Search (1.2 percent) Nexus Database System (1.2 percent) OCLC WorldCat Dissertations and Theses (1.2 percent) Scopus (1.2 percent) Ulrich's Periodicals Directory (1.2 percent) Wiley Online Library (1.2 percent)	62
2	Other sources Non-KM-centric peer-reviewed journals – predominantly IS, IT, and general management (11 percent) Peer-reviewed conference proceedings (10 percent) KM-centric peer-reviewed journals (10 percent) KM books (5 percent) Practitioner journals and trade magazines (2 percent)	38

single index, which does not offer comprehensive coverage of KM publications. Third, when keywords were used to identify KM works, in 67 percent of all cases, only a single keyword – ''KM'' – was entered into the query search box. Moreover, in several extreme cases, only papers that had ''KM'' in their title were extracted from the database and used for subsequent analysis. Only a minority of the studies utilized over ten different keywords, such as ''organizational learning,'' ''learning organization,'' ''knowledge sharing,'' ''knowledge worker,'' ''human capital management,'' ''intellectual capital management,'', etc. to ensure wide coverage of KM topics.

4.3 Citation impact

Overall, all scientometric studies have been very well cited at the rate of 6.4 citations per year on average. Only 11 papers remained unnoticed and attracted no citations. Table V presents a list of the most frequently cited works (i.e. top 10 percent), which attracted 50 percent of all citations.

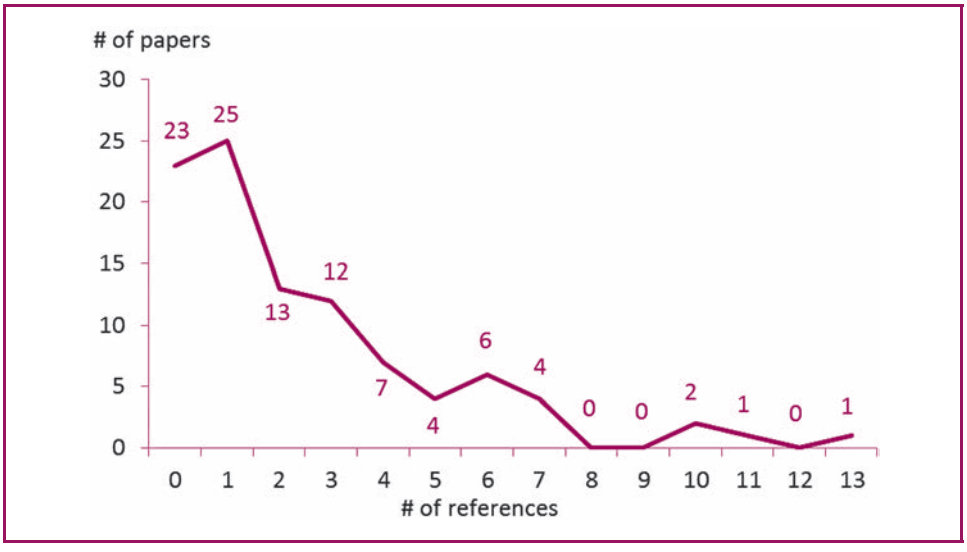
4.4 Awareness of prior scientometric research

Overall, a vast majority of authors of scientometric KM works were unaware of the previous publications on this topic. An average work published after 2001 contained only two citations to the scientometric KM works. Regrettably, despite the abundance of prior publications, 23 did not reference a single work, and 25 referenced only one (Figure 6). For instance, the

Table V The most frequently cited scientometric works (top 10 percent)

Work	*Total number of citations*	*Publication year*	*Number of citations per year*
Wilson (2002)	611	2002	61.10
Grover and Davenport (2001)	603	2001	54.82
Schultze and Leidner (2002)	400	2002	40.00
Prusak (2001)	359	2001	32.64
Wiig (1997b)	459	1997	30.60
Bjørnson and Dingsøyr (2008)	74	2008	18.50
Serenko and Bontis (2004)	148	2004	18.50
Scarbrough and Swan (2001)	200	2001	18.18
Teece (1998)	252	1998	18.00
Ives *et al.* (1998)	246	1998	17.57
Baskerville and Dulipovici (2006)	93	2006	15.50

Figure 6 The number of references to prior KM works in the set of examined publications



authors of a journal article that focused on a citation analysis of the KM discipline published in 2011 ignored all previous relevant publications that applied the identical scientometric technique to the same domain. The other examples are too numerous to list. Only a few authors conducted a comprehensive literature review, which was evident in their citation patterns.

4.5 Author and paper characteristics

There were 2.1 authors per paper on average. Most empirical studies were produced by multiple co-authors, whereas most works based on literature reviews and personal opinions were solo-authored. For example, out of 11 publications co-authored by four or more researchers, ten employed empirical methods. Table VI reveals that the most works appeared in peer-reviewed journals. The *Journal of Knowledge Management* was a leading KM-centric outlet that published 12 percent of all scientometric studies of the discipline, followed by the *International Journal of Knowledge Management* (5 percent) and *Knowledge & Process Management* (5 percent). Many articles were published in information systems and information technology journals, and only a few appeared in *Scientometrics* and *Journal of Informetrics*, which are entirely devoted to scientometric topics. Table VII lists 27 authors who published multiple papers. Of these, most are known as KM researchers who, in addition to the scientometric studies of KM, have contributed to the general knowledge base of the discipline.

Table VI Paper characteristics – categories of publications

No.	*Category*	*Percentage*
1	Peer-reviewed journals KM-centric (37 percent) *Journal of Knowledge Management* (12 percent) *International Journal of Knowledge Management* (5 percent) *Knowledge & Process Management* (5 percent) *Knowledge Management Research & Practice* (4 percent) *Electronic Journal of Knowledge Management* (3 percent) *Knowledge Management for Development* (3 percent) Other (5 percent) Non-KM-centric – predominantly IS and IT (44 percent)	81
2	Peer-reviewed conference proceedings KM-centric (4 percent) Non-KM-centric (6 percent)	10
3	Book chapters	6
4	Working papers/reports	3

Table VII The most productive authors of scientometric KM works

Rank	*Name*	*Number of papers*	*Rank*	*Name*	*Number of papers*
1	N. Bontis	11	11	D.J. Hall	2
2	A. Serenko	10	11	P. Heisig	2
3	L. Booker	4	11	M. Jennex	2
3	K. Ergazakis	4	11	M. Koenig	2
3	H. Scarbrough	4	11	T. Ma	2
6	T.T. Chen	3	11	K. Nie	2
6	M.R. Lee	3	11	T. Peachey	2
6	K. Metaxiotis	3	11	L.J. Ponzi	2
6	Y. Nakamori	3	11	L. Prusak	2
6	J. Swan	3	11	U. Schultze	2
11	D.T. Croasdell	2	11	J. Song	2
11	K.C. Desouza	2	11	K.M. Wiig	2
11	J.S. Edwards	2	11	Q. Zhong	2
11	Y. Gu	2			

4.6 Consolidation of the major scientometric findings

Studies that analyzed the development, history, and potential future progress of the KM discipline agree that the application of KM concepts and their theoretical development date back millennia. As a profession, KM was born from the pressure to improve organizational performance and competitiveness. In academia, knowledge studies appeared in the 1950s in social sciences, cognitive research, and artificial intelligence, but these schools of thought are usually ignored in contemporary KM publications. Most early academics conducted their research in relative isolation, and this practice still continues. As a result of different perspectives on KM, there is insufficient coherence among diverging KM views. Many studies suggest that, in the future, researchers should identify and measure the impact of KM on organizational performance by using empirical methods and case studies, communicate their findings to non-academic audiences, and engage practitioners. Eventually, KM principles will be internalized by individuals and become regular, invisible organizational practices. As a result, the KM discipline as we know it today may gradually transform or disappear.

A number of studies explored the intellectual core, state, identity, structure, and theoretical foundations of the KM discipline. Overall, they conclude that the KM field is truly interdisciplinary. It encompasses two general schools of thought: hard/technocratic/technology-centered (computer science, knowledge systems, systems science, engineering, artificial intelligence, and information technologies) and soft/behavioral/human-centered (cognitive science, library and information science, philosophy, psychology, strategic management, operational research, organizational behavior, human resource management, organization theory, and economics). The high degree of over-differentiation raises irreconcilable dilemmas and impedes the discipline's progress. The field lacks common ontology, universal definitions, consistent terminology, an integrated theoretical base, coherence, links to its historical roots and reference disciplines, rigorous methods, a dominant paradigm, practical impact, and a clear research direction. Based on the characteristics above, it is considered to be at the pre-science stage of disciplinary development (Kuhn, 1962, 1977).

Much of KM research is inclined towards hard topics, but this focus is expected to shift to soft issues in the future. Inter-disciplinary collaboration and co-operation with practitioners are strongly encouraged. Under-explored topics include the negative consequences of KM, evidence-based KM theories, unlearning principles, non-profit organizations, the role of organizational size, relationship between KM initiatives and organizational performance, historical roots of KM, the academic-practitioner divide, and the practical relevance of academic KM research. Overall, there is a need for a paradigm shift and consolidation. Several independent studies that explored the frequency of publication by KM authors by applying bibliometric principles, such as Lokta's Law, consistently concluded that at least 80 percent of all KM authors contributed only once (i.e. published only a single KM paper).

The state and identity of the KM discipline was frequently explored from the ''scientific fad'' perspective, also referred to as the ''management fad'' or ''management fashion'' approach. A scientific fad is a short-lived line of research that experiences exponential growth followed by sudden decline and eventual demise (Abrahamson, 1991, 2009; Starbuck, 2009). The discussion, evidence, and conclusions concerning whether KM is a maturing academic discipline or merely a scientific fad are highly contradictory. Whereas Scarbrough and colleagues in their numerous studies seem to demonstrate that KM is a fad or a sub-domain of information systems, other researchers identified various signs of healthy progression of KM towards maturity and recognition. Unfortunately, no meta-analysis work was done to reconcile the inconsistent conclusions reached earlier. However, given that more independent studies agree that KM research shows no sign of decline, it is likely that KM will eventually become a healthy, well-established field of science.

There are four categories of scientometric work focusing on journals publishing KM research:

1. identification of journals publishing the most KM papers;
2. development of ranking lists of KM-centric journals;

3. analysis of the nature of KM-centric journals; and

4. review of a single outlet.

The first type of studies compiled lists of peer-reviewed outlets in which a majority of KM works appeared. On the one hand, these studies agreed that a majority of KM research was published in IS and IT journals. On the other hand, they produced highly inconsistent journal lists. Only a few journals frequently appeared in most lists, but the overall conclusions were highly contradictory. A major reason was the use of different databases, data sources, and keywords. For example, a study that analyzed articles selected from 15 MIS journals that had the keyword ''KM'' concluded that most KM research appeared in *Management Science*, *Decision Support Systems*, and the *Journal of Management Information Systems*. In contrast, another investigation that analyzed articles from the Web of Science stated that the largest number of KM articles appeared in *International Journal of Technology Management*, the *Journal of Universal Computer Science*, and *Expert Systems with Applications*. At the same time, when the selection of articles was not restricted to a single database, KM-centric journals were frequently mentioned.

The identification of journals publishing the most KM research proved to be useful at the early stage of discipline development, before KM-centric journals appeared. As the discipline progressed, the focus shifted towards the development of journal rankings. The second category of studies constructed ranking lists of KM-centric peer-reviewed journals by using two well-accepted methods, such as expert surveys and citation impact measures. Despite some differences in the ranking positions of individual journals, the overall results were relatively consistent. The third and fourth types of journal studies were somewhat rare, yet they generated very interesting conclusions. For example, they suggested that *The Learning Organization* journal has lost its practical relevance, the *Journal of Knowledge Management* has played a key role in the dissemination of knowledge management for development (KM4D) research, and KM journals differ from one another in terms of topic coverage.

Productivity studies were conducted at three levels: individual, institutional, and national. Individual and institutional productivity lists were generally inconsistent, which resulted from the use of different databases, keywords, and time periods to select a pool of examined articles. Nevertheless, several author names and institutions were mentioned in several projects. J. Liebowitz, C.W. Holsapple, T. Davenport, N. Bontis, P. Gottschalk and P. Ordonez de Pablos were the leading researchers, and Cranfield University (UK), McMaster University (Canada) and Universidad de Oviedo (Spain) were the most productive institutions. In contrast, there was some degree of consistency in the country productivity rankings. The top six most productive countries are: the USA, the UK, Canada, Germany, Australia, and Spain. As expected, the number of authors per paper has been gradually increasing. Several research impact investigations, which used the number of citations as a measurement technique, relatively consistently identified three major works – namely Nonaka and Takeuchi (1995), Davenport and Prusak (1998) and Nonaka (1994) – which formed the foundation for the development of the KM discipline.

The impact of academic research and scholarly findings on the state of practice also received attention in the KM discipline. Two streams of research appeared: conceptual and empirical. Conceptual works were based on literature review and the personal opinion of the authors. They pointed to the irreconcilable differences between academia and practice and offered a number of prescriptions for KM scholars, which mostly included involving practitioners in research projects and studying practical problems. Empirical studies involved citation analysis, surveys, interviews, and analysis of publications. Their conclusions and recommendations were different, and their assessment of the situation was more optimistic. They suggested that, as the KM discipline continues to progress towards academic maturity, the role of practitioners in KM research will inevitably diminish, and the gap between academia and practice will naturally grow. Practitioners rarely read academic papers to employ scientific findings. However, the academic body of knowledge is still very useful for industry professionals. There should be knowledge translation

mechanisms, which aggregate, summarize, paraphrase, and present academic knowledge in a format suitable for busy practitioners who do not have advanced academic training. As such, academics should not change the way they do research or produce their manuscripts; instead, effective and efficient knowledge translation channels should be developed. At the same time, all studies only analyzed the transfer of scholarly knowledge to practice and mostly ignored the fact that the KM industry often leads academia.

Only one study explored the collaboration patterns of KM researchers and concluded that the collaboration efforts of the leading KM scholars are fragmented. Top researchers do not collaborate among themselves. The reason is that, in most institutions, KM efforts are spearheaded by a single individual, and very few places have developed strong research clusters.

A number of scientometric studies analyzed KM research paradigms, methods, trends, and agendas. All studies concluded that the overall volume of all types of KM publications has been growing continuously. Several studies identified topics pursued by KM researchers, but their findings were too inconsistent to reach a generalizable conclusion. For instance, whereas one investigation concluded that KM researchers focus on organizational memory and organizational learning, another argued that the leading KM topics pertain to semantic webs, agent systems, and distributed knowledge representation. Moreover, despite a variety of KM frameworks and models, no consistent terminology exists. The rigor, generalizability, and quality of empirical evidence in many KM publications contain various flaws.

The predominant empirical research methods include case studies, interviews, and surveys. Under-represented approaches are field studies, field experiments, the use of secondary data, action research, ethnography, design science, focus groups, and laboratory experiments. Conceptual methods embraced framework development and literature reviews. Over 160 KM frameworks have been developed, but little meta-analysis work has been done. Despite general agreement on the categories of methods used in KM research, the proportion (i.e. percentage) of each varied considerably among the studies. At the same time, these issues are common for a new academic discipline (Kuhn, 1962, 1977). Overall, KM does not exhibit extremely abnormal behavior and is slowly progressing towards academic maturity.

5. Implications, limitations, and conclusions

The goal of this study was to conduct a meta-analysis of the scientometric studies of the KM discipline to form a better understanding of its identity. Based on the findings, numerous issues emerged that warrant further elaboration. Implications one through ten discuss the state of scientometric KM research, and implications 11 through 19 describe the identity of the KM discipline.

5.1 Implications and recommendations

Implication no. 1: the overall volume of scientometric KM publications has been growing. The number of scientometric studies of the KM discipline has been steadily growing, reaching up to ten works per year. This is a positive sign of high interest and recognition of KM as a scholarly discipline worth studying. The three evolutionary periods of scientometric KM research (the Initiation of Scientometric Research, from 1997 to 2001; the Early Development of Scientometric Research, from 2002 to 2006; and the Rigor and Consolidation of Scientometric Research, from 2007 to 2012) reflect a healthy progression from a basic retrospective analysis (e.g. KM history) to the mainstream topics (e.g. the intellectual core of KM, publication outlets, productivity, and impact), and further to the advanced issues (e.g. research relevance and research paradigms).

Implication no. 2: a majority of scientometric KM studies use basic scientometric techniques. Literature review and personal opinion, which represented 21 and 8 percent of all methods employed in scientometric works, respectively, have appeared consistently since 1997. First, the use of personal opinion and speculation is acceptable only at an early stage of

discipline development, before the accumulation of a sufficient knowledge base that may be analyzed empirically. By 2002, a large number of KM papers had been published, and the use of personal opinion to discuss the state of the discipline was no longer necessary. Second, whereas many researchers were able to obtain critical insights on the state of the discipline by conducting literature review, there are other, more rigorous approaches, such as meta-analysis or systematic literature review, which should be employed more frequently.

Of all empirical methods, content analysis (21 percent) and counting techniques (17 percent), which represent the basic scientometric methods, have occupied the dominant position since 2002. Gradually, more advanced methods – for example, co-citation analysis, network analysis, and word frequency analysis – appeared. Whereas all scientometric techniques help generate useful findings, future researchers should concentrate on the employment of under-represented scientometric techniques.

Implication no. 3: scientometric KM researchers are inadequately aware of prior scientometric works in the discipline. Regardless of their view of the KM discipline, scientometric KM works are generally well cited at an average rate of 6.4 citations per year. For example, the list of the most frequently cited works (Table V) includes a pessimistic article by Wilson (2002) entitled ''The nonsense of 'knowledge management''' and seminal papers by Wiig (1997b) and Prusak (2001). At the same time, most researchers who conducted a scientometric assessment of the KM discipline were insufficiently familiar with the extant body of knowledge. On average, scientometric papers published after 2001 included only two citations to the previous scientometric works. For instance, despite the availability of prior publications, 23 had no relevant references, and 25 had only one. The authors of recent works on the productivity of KM scholars missed prior relevant publications, which diminished the quality and impact of their own work. Therefore, it is necessary for scientometric KM researchers to develop a comprehensive understanding of the literature.

Implication no. 4: the results reported in scientometric KM studies are inconsistent. Generally, the findings and conclusions of the scientometric studies of the KM discipline are inconsistent. For example, the lists of the most productive KM scholars and institutions differed among the studies, and only a few names and affiliations consistently appeared in a majority of rankings. The same discrepancy was observed with respect to the empirical studies of KM paradigms, topics, methods, and journals publishing KM research. Even though several general trends characterizing the identity of the KM discipline were determined, the lack of agreement dramatically diminished the value of scientometric research for the KM discipline. Several factors explaining the reason for the inconsistency of scientometric findings are presented below.

Implication no. 5: exclusive use of Thomson's databases – such as Web of Science, Web of Knowledge, Social Sciences Citation Index, Science Citation Index, etc. – should be discouraged. 17 percent of the datasets employed in the examined scientometric papers were obtained from Thomson Reuters' databases. On the one hand, these indexes – which include over 12,000 journals, 150,000 conference proceedings, and thousands of books – are commonly used in scientometric research. On the other hand, they exclude many KM-centric journals, which represent perhaps the most valuable segment of the KM body of knowledge. At the time of this study, out of 25 KM-centric journals, only two – the *Journal of Knowledge Management* and *Knowledge Management Research & Practice* – were included in Thomson's Journal Citation Reports. Therefore, scientometric investigations that select the examined pool of articles exclusively from the Thomson's databases report an incomplete view of the KM discipline. The present study, however, does not dismiss the use of Thomson; instead, it argues that Thomson should be employed as one of several target databases and sources of articles in a single scientometric project. For example, to obtain a representative sample of KM works, researchers may select KM publications directly from KM-centric journals and various databases, including Thomson. At the same time, exclusive use of Thomson is unlikely to produce valid and generalizable findings. Recently, Amara and Landry (2012) reached a similar conclusion in their scientometric analysis of the field of business and management.

Implication no. 6: there is a need for a KM keyword classification scheme. In order to conduct an empirical scientometric study, researchers need to select a representative pool of articles. The most common approach is to conduct a search of one or several major databases by using specific keywords. Recall that, in 67 percent of all cases, only the ''KM'' keywords were entered into the search box, and only a fraction of researchers employed multiple keywords. In several extreme cases, only articles that mentioned ''KM'' in their title were selected. However, many works do not use the keywords ''knowledge'' and/or ''management,'' yet they fit the KM domain. Examples include ''intellectual capital assets,'' ''human capital,'' ''relational capital,'' ''brain worker,'' ''organizational learning,'' ''chief knowledge officer,'' ''communities of practice,'' ''shared hard-drives,'' ''smart city,'', etc.

To address this issue, a unified KM keyword classification scheme should be developed. A keyword classification scheme is an agreed-upon list of keywords describing the content, topics, tools, techniques, models, terms, etc. used within a scientific discipline and its various sub-domains. A scheme also introduces a common language; prevents the introduction of needless synonyms; reduces the cognitive load on researchers; helps editors, librarians, and publishers classify academic works; standardizes meta-data of article databases; and facilitates comprehensive, effective, and efficient searches. As the KM field grew, it became more complicated and fragmented. Highly specialized sub-domains emerged that may use different keywords to describe their content. Therefore, the development of a unified keyword classification scheme should become a priority to ensure the continued progression of the KM discipline. Examples of keyword classification schemes already exist in various academic disciplines (Barki *et al.*, 1988, 1993).

Implication no. 7: KM-centric journals should welcome manuscripts devoted to the scientometric assessment of the discipline. As indicated in Table VI, 44 percent of scientometric publications devoted to the KM discipline were published in non-discipline specific journals, mostly in information systems and information technology outlets. 6 percent of scientometric works also appeared in the proceedings of non-KM-centric conferences. Except for the *Journal of Knowledge Management*, which published 12 percent of all scientometric KM studies, only a few KM-focused outlets published related works. As a result, it is difficult for active KM researchers to find these works. If these works are not read, they make no impact on the development of the KM discipline. Therefore, the editors and reviewers of KM-centric journals should welcome manuscripts devoted to the scientometric assessment of the entire discipline. Special issues on the state, identity, and future development of the KM discipline may also serve as a valuable approach to increase the awareness of the discipline progression among its active researchers. Professional associations and conferences may also fund scientometric studies of the KM field. For example, professional bodies may be interested in studying policies guiding the transfer of scholarly knowledge to practice. Conference organizers may want to know about the impact of their annual meetings on the state of theory and practice.

Implication no. 8: more rigorous research of the forums for KM publications is required. Many scientometric investigations of the outlets publishing academic KM works lacked methodological rigor and, as a result, produced highly inconsistent findings. The conclusions were highly dependent on the method used to identify candidate journals. For example, several studies selected KM articles from a set of IS and IT journals, only to conclude that most KM research appears in IS and IT outlets. The two major methodological flaws are:

1. the use of target databases and journals that do not offer comprehensive coverage of the KM domain; and
2. the use of limited keywords to identify KM-relevant works, which results from the lack of a uniform keyword classification scheme of the KM discipline.

The development of journal ranking lists is another critical line of inquiry in the KM discipline. The previous rankings were constructed with the use of expert survey and citation impact measures, which are well-recognized journal ranking techniques. However, there are other

ranking methods – for example, the Uncitedness Factor (Egghe, 2010), Publication Power Approach (Holsapple, 2008; Serenko and Jiao, 2012), and Author Affiliation Index (Cronin and Meho, 2008) – which should be also utilized in future investigations. In addition, insufficient attention has been paid to the profile of particular KM journals, whereas such studies are commonplace in the other academic disciplines (Egghe, 2012).

Implication no. 9: scientometric KM researchers should engage in inter-departmental and international cooperation. Empirical scientometric studies require substantial investment of time and effort. Theoretical scientometric KM studies are mostly solo-authored, whereas empirical ones involve the work of multiple contributors. The application of advanced scientometric methods to investigate a particular scientific domain requires the knowledge of the research field under investigation, the ability to obtain and manually review the datasets, and the skills to apply scientometric techniques and interpret the results. It is for this reason researchers cooperate when they engage in the empirical studies of a new discipline. Ideally, each research team should include both experts from the KM domain and scientometric scholars, who are situated in the library and information science departments of different institutions and countries. In fact, larger, interdisciplinary, and international research teams are considered the most productive clusters of excellence (Katz and Hicks, 1997; Liu *et al.*, 2012), and, as the number of authors per paper increases, so does its quality, rigor, and impact (Kostoff, 2007).

Implication no. 10: a large-scale, comprehensive study of individual and institutional productivity of KM scholars is required. Recall that the findings of individual and institutional productivity studies were very inconsistent, and only a few names (J. Liebowitz, C.W. Holsapple, T. Davenport, N. Bontis, P. Gottschalk, and P. Ordonez de Pablos) or affiliations (Cranfield University – the UK, McMaster University – Canada, and Universidad de Oviedo – Spain) were mentioned multiple times. In scientometrics, the most common approach to construct a list of prolific scholars or institutions is to select their names from a representative sample of publications in a set of journals and to assign scores based on the number of articles. Inconsistent findings emerge when different sets of journals or databases are employed to extract the names, which has been the case in scientometric KM research (Table IV). This observation warrants two conclusions. First, the results of the small-scale productivity studies of the KM discipline should be interpreted with caution. Second, a comprehensive project, in which multiple sources of publications are employed, should be launched. Ideally, a pool of articles should be extracted from various databases, KM-centric journals, KM-relevant journals, and other management outlets. This, however, will require expertise, dedication to scholarship, and a tremendous investment of time.

Implication no. 11: the KM discipline has deep historical roots. All scientometric studies that conducted a retrospective analysis of the discipline agreed that the field has deep historical roots and strong theoretical foundations. Basic KM principles were followed for thousands of years in various areas of human activities. KM first appeared as a field of practice driven by the needs of organizations that wanted to improve their efficiency. As an academic discipline, KM has roots in social sciences, cognitive research, and artificial intelligence, which explains the soft (i.e. human-centered) and hard (i.e. IT-focused) perspectives in KM research. At the same time, contemporary KM researchers are often unfamiliar with the foundational works, ignore antecedent schools of thought, and miss the historical origins of the discipline. To address this important issue, journal editors and reviewers should exercise due diligence to ensure adequate historical coverage of the phenomenon of interest in peer-review processes and paper-acceptance decisions. Foundational KM works should be included as part of the reading assignments for graduate KM students.

Implication no. 12: the KM discipline suffers from a high degree of over-differentiation. There are two factors explaining why the KM discipline has suffered from over-differentiation. First, from the 1950s to the official birth of the KM discipline, most pioneers of knowledge studies worked in relative isolation from one another. Unfortunately, insufficient collaboration has continued throughout the entire lifespan of the discipline. Second, several independent studies that explored the frequency of publication by KM authors by applying bibliometric principles, such as Lokta's Law, consistently concluded that at least 80 percent of all KM

authors contributed only once (i.e. published only a single KM paper). As a result, the academic body of knowledge became over-differentiated, exhibited inconsistencies, and lacked a common theoretical core. This reveals a major problem inherent in the KM domain because a healthy, mature field should be driven by a large, dedicated group of researchers who contribute consistently (i.e. publish multiple articles) and devote at least half of their time to the discipline (Cattell, 1917).

The problem, however, is not related to the inability of academics to explore KM topics and publish in KM journals: most scientists work long hours, sacrifice their personal lives, and accept the uncertainty associated with peer-review processes (Wang *et al.*, 2012). Academic fields compete for the loyalty of their scholars (Abbott, 1988, 2001). This rivalry is highly intense within the inter-disciplinary domain of KM because business researchers specializing in KM-relevant areas such as information systems, human resources, organizational behavior, strategy, etc. may easily join the KM discipline and publish in KM-centric journals. It is possible that many business academics publish a single KM article but leave the KM discipline after that for various reasons. Recently, Serenko and Bontis (2013a) observed that only 24 percent of active KM researchers considered KM their primary area of concentration. This is a critical issue that needs to be explored in future scientometric research.

Implication no. 13: special attention should be paid to several under-studied KM topics. There are several important topics that have not received sufficient attention in previous KM research. These include the negative consequences of KM, unlearning concepts, evidence-based KM theories, non-profit organizations, the role of organizational size, KM in small and medium enterprises, the historical roots of KM, and the practical impact of academic KM research. These issues represent unique opportunities for graduate students looking for topics for their theses or dissertations. Journal editors may also introduce special issues, and conference executives may organize panels or mini-tracks devoted to these under-represented topics.

Implication no. 14: the leading KM researchers insufficiently cooperate among themselves. From the 1950s to the official birth of the KM discipline, most pioneers of the knowledge studies domain worked in isolation. This practice still continues because the most productive KM researchers rarely cooperate with the other leading researchers. Even though KM research clusters and centers exist in many institutions – such as Cranfield University (UK), Monash University (Australia), Queen's University (Canada), and Hong Kong Polytechnic University (Hong Kong) – the overall level of cooperation among discipline leaders is insufficient. This may be interpreted as a sign of the youth and immaturity of the KM discipline.

Researchers determine their collaboration preferences and approaches based on a variety of factors, including informal communication styles, cultural proximity, funding availability, and suitability of appropriate technology (Jeong *et al.*, 2011). Cooperation produces better outcomes in terms of productivity and impact. Due to its importance, intellectual cooperation has become one of the major lines of inquiry in scientometrics (Hennemann *et al.*, 2012; Jeong and Choi, 2012), and various models, principles, and policies supporting cooperation have been proposed (Wagner, 2005; Liao, 2011; Liao and Yen, 2012). One of the factors affecting decisions about whether to involve oneself in collaborative scientific endeavors is the academic potential of prospective co-authors because researchers wish to engage in a mutually beneficial knowledge-sharing process to generate new knowledge. The cooperation of leading academics may potentially improve the rigor and impact of KM studies and improve the status of KM as a reference discipline. For this, journal editors may take the first step by introducing editor-commissioned articles on the various aspects of KM, jointly written by the most prominent KM researchers. KM research centers should also improve their cooperation by embarking on joint multinational projects and seek funding from international agencies.

Implication no. 15: the KM discipline has been progressing towards academic maturity. Overall, scientometric researchers did not agree whether KM is an academic discipline or

merely a scientific fad. The line of research advocating that KM is a short-lived phenomenon which is expected to fade away in the future started with a pessimistic (yet well-cited) article by Wilson (2002) and continued in the somewhat more optimistic works of Scarbrough and colleagues (Scarbrough and Swan, 2001; Scarbrough *et al.*, 2005). In contrast, many independent researchers empirically confirmed that the overall volume of KM publications has been steadily growing and showing no sign of decline. Instead, they argue that KM exhibits attributes of a healthy academic domain with no apparent anomalies (Curado *et al.*, 2011; Grant, 2011; Lee and Chen, 2012; Serenko *et al.*, 2011b; Zhong and Song, 2008). Recently, Koenig and Jank (2012) also concluded that KM has established itself as a major component of managerial practices. Therefore, it is more likely that KM has the potential to become a recognized field of science in the future. Currently, it may be considered at the pre-science stage of disciplinary development (Kuhn, 1962, 1977).

Implication no. 16: the top six most productive countries are the USA, the UK, Canada, Germany, Australia, and Spain. Regardless of the methodology, all studies agreed that the USA and the UK are the most productive countries, followed by Canada, Germany, Australia, and Spain. This finding is not surprising since the USA and the UK usually top country-level productivity lists in virtually all scientific disciplines (Looy *et al.*, 2007; Schulz and Manganote, 2012). However, the initial scientific advancements require continued support to ensure a long-term success. Currently, the predominant role of the USA has already diminished in some disciplines (Huang *et al.*, 2012) as new nations develop strong domestic research programs, attract foreign scholars, and increase research funding. For example, the volume of publications in nanotechnology in China has already surpassed that in the USA (Kostoff, 2012). This is an important factor that needs to be considered by the policy-makers of research-intensive countries.

Implication no. 17: the most influential works that formed the foundation for KM research are: Nonaka and Takeuchi (1995), entitled ''The knowledge-creating company'', Davenport and Prusak (1998), entitled ''Working knowledge'', and Nonaka (1994), entitled ''A dynamic theory of organizational knowledge creation.''. Starting from the earliest (Croasdell *et al.*, 2003) to the latest (Ma and Yu, 2010) empirical attempts to identify the most frequently cited KM works, the impact of the publications by Nonaka and Takeuchi (1995), Davenport and Prusak (1998) and Nonaka (1994) on the development of KM as a scientific discipline has been consistently recognized. As discussed above, the KM discipline has deep historical roots, and it is vital for the future generations of scholars to be aware of the foundational works. Therefore, these publications should be included in the reading package of graduate students specializing in KM. They can also serve as a starting point for practitioners who want to develop a comprehensive understanding of the KM domain.

Implication no. 18: to improve the impact of academic KM research on the state of practice, KM scholars should not change their research approaches. Instead, effective and efficient knowledge dissemination channels should be developed. To ensure the applicability of academic findings in practical settings, it is not necessary for KM scholars to change their research objectives (e.g. concentrate on topics of interest to practitioners), communication style (e.g. write in simple language targeted at non-academic audiences), and methods (e.g. favor field experiments). Instead, effective and efficient knowledge dissemination channels should be created. The purpose of these knowledge-translation mechanisms is to summarize, aggregate, contextualize, paraphrase, and deliver academic findings to the practitioners in an easily comprehensible format. For example, a long-term line of academic research may be reduced to a number of practical implications and summarized in a form of short articles published in a professional magazine. Professional associations and large organizations should introduce positions of ''knowledge brokers,'' also referred to as ''knowledge intermediaries,'' ''knowledge translators,'' and ''boundary spanners'' (Ward *et al.*, 2009) whose primary objective is to establish a link between the academic body of knowledge and needs of practitioners (Meyer, 2010).

In addition, previous studies only analyzed the flow of knowledge from academia to practice, whereas industry often leads academia and influences research agendas. It is

recommended that future scholars consider the academia – industry relationship a two-way communication channel.

Implication no. 19: KM-centric journals should encourage authors to employ under-represented empirical methods and conduct meta-analysis studies. Conceptual publications, especially the development of new frameworks that are not accompanied by rigorous empirical testing, should be discouraged. When a new academic field appears, it is common for researchers to engage in the theoretical discussions of the phenomenon of interest and publish conceptual papers. Eventually, however, they need to shift their focus to the use of rigorous empirical methods to validate the theoretical propositions made earlier. In KM, over 160 frameworks have been introduced, and thousands of conceptual articles have been written. At some point, theoretical knowledge within the KM discipline will reach saturation, and rigorous empirical work will need to be introduced to ensure the usefulness, impact, and sustainability of KM as an academic discipline. Therefore, KM researchers should refrain from conceptual studies in favor of empirical investigations that employ under-represented methods, such as field studies, field experiments, laboratory experiments, action research, ethnography, design science, and focus groups. The use of various meta-analysis techniques, which have not received sufficient attention in KM research, should be encouraged. This is a critical point that journal editors, publishers, and reviewers need to consider, because the discipline is unlikely to benefit from another article asking the basic questions of ''what is KM?'' and ''why is KM important?''

5.2 Limitations

Despite its innovativeness, this study has had several limitations. First, it is possible that not all scientometric works were identified. If, for example, some publications existed only in a hard copy, such as a non-digitized book chapter, or were never cited, it is possible that they have been missed. Second, this study ignored scientometric research of the intellectual capital discipline. The line between the field of KM and intellectual capital has always been blurred, especially at the early stages of discipline development. Therefore, it is possible that some scientometric works which were excluded in the present study because they analyzed the intellectual capital discipline also contained valuable insights on the identity of the KM domain. Third, in meta-analysis studies, it is always difficult to identify the most recently published works, especially those appearing within the last year, because of publication delays and slow updates of citation indexes. Thus, it is probable that the present study did not identify several most recent scientometric publications. Fourth, only works in English language were examined. Fifth, only an academic side of KM was investigated whereas many other practical issues of KM still remain unexplored. Nevertheless, none of the limitations above was detrimental, and this project has reached its main objective.

5.3 Conclusions

The purpose of this study was to conduct a meta-analysis of the scientometric literature on the KM discipline in order to better understand its identity. The value of scientometric research was demonstrated by using the framework of the stakeholder approach to identity construction of the KM discipline that described a variety of stakeholders who need to understand the past, present, and future development of KM. 108 scientometric KM studies were identified and subjected to several meta-analysis techniques. Overall, the volume of scientometric research has been steadily growing, which reveals the dedicated efforts of various scholars to establish KM as a recognized field of science. Scientometric KM research has progressed through three distinct phases:

1. the Initiation of Scientometric Research (1997-2001);
2. the Early Development of Scientometric Research (2002-2006); and
3. the Rigor and Consolidation of Scientometric Research (2007-2012).

Scientometric research has evolved from one phase to another in a cumulative fashion, and each subsequent wave of research has not only introduced new topics and methods, but also continued the lines of research established earlier.

However, the conclusions reached in independent scientometric studies have been somewhat mixed and incongruent, which resulted from the use of inconsistent research methods, over-reliance on Thomson Reuters' databases, and the absence of a keyword classification scheme of the KM discipline. Nevertheless, based on these studies, a reasonable understanding of the identity of the KM discipline has been formed. KM is a slowly maturing field of science that has a strong historical core. Inspired by the works by Nonaka and Takeuchi (1995), Davenport and Prusak (1998) and Nonaka (1994), its knowledge base has been continuously growing and shows no sign of decline. To ensure the practical impact of research discoveries, various knowledge translation mechanisms should be implemented. The most productive countries are the USA, the UK, Canada, Germany, Australia, and Spain. However, there are many aspects of KM that need attention. KM researchers are often unaware of the deep theoretical roots of KM and so ignore them. The leading KM researchers insufficiently cooperate among themselves. The discipline also suffers from over-differentiation because most pioneers of KM work in relative isolation and a majority of the authors of KM publications contribute only once (i.e. publish only a single KM paper). As a result, the discipline is represented by the distinct soft (i.e. human-centered) and hard (i.e. IT-focused) perspectives, which are rarely combined in a single line of research.

At the same time, the issues described above are common for an academic discipline that has not gained maturity, yet KM is moving in the progressive direction. The author hopes that the findings presented in this study will help the stakeholders of KM become aware of the critical issues facing the discipline, and that they, in turn, will take corrective action.

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Appendix. List of examined publications

Table AI

Work	*Key findings*
Shariq (1997)	KM will play a pivotal role in the transformation from the manufacturing-based to IC-based economy. The development of the KM discipline will be a challenging endeavor. KM researchers should respond to the needs of organizations in a timely manner. Establishing an international society of knowledge professionals will be highly beneficial
Wiig (1997b)	KM practices have been implicitly followed for thousands of years. The KM discipline emerged naturally because of economic, industrial, and societal changes. It is a logical step towards the development of the ''knowledge society.'' The first attempt to officially establish KM practices dates back to 1975 (Chaparral Steel). As a field, KM will become outdated in the second quarter of the twenty-first century
Ives *et al.* (1998)	The concept of managing and preserving knowledge dates back over 4,000 years. The invention of the printing press, information technologies, and new communications systems offers new KM capabilities. KM is an emerging discipline with no unified definition
Teece (1998)	KM research should integrate the body of knowledge from other disciplines, including accounting, entrepreneurship, economics, marketing, sociology, organizational behavior, and strategy. To ensure the success of the discipline, KM researchers should demonstrate the value of knowledge assets, quantify the value of intangible assets, and explore the importance of entrepreneurial vs administrative capabilities
Scarbrough *et al.* (1999)	There is a decline in learning organization terms and increase in KM terms. 70 percent of KM research focuses on IT-related issues, whereas learning organization research favors human topics, including training, organizational development, and human resources. KM is not a relabeling of learning organization concepts; it is a new management fashion
Wiig (1999)	KM emerged due to advances in the intellectual, societal, and business areas. Its core roots extend back for millennia. The key KM concepts will eventually become part of regular management practices, and the KM discipline, as we know it today, will gradually disappear
Grover and Davenport (2001)	The study of knowledge extends back to the ancient philosophers. In academia, knowledge studies appeared in the 1950s due to the progress in cognitive sciences and artificial intelligence. In the IS field, KM research follows a cognitive perspective and focuses on KM systems, knowledge representation, knowledge transfer, and knowledge work
Prusak (2001)	KM initiatives appeared in response to social, economic, and technological changes, such as globalization, ubiquitous computing, and knowledge-based view of the firm. Ideally, KM will become regular and virtually invisible organizational practices
Scarbrough and Swan (2001)	The management fashion model offers a useful but incomplete explanation of the KM field discourse. There is a lack of learning transfer between the KM and learning organization discourse
Ponzi (2002)	The interdisciplinary breadth of KM includes the following areas: management (39 percent); business (28 percent); computer science and IS (9 percent); information and library science (7 percent); and planning and development (4 percent)
Ponzi and Koenig (2002)	Since 1996, KM research focused on computer science, business, and management domains. In the 2000s, it became interdisciplinary. KM is not a fad or fashion; instead, it is in the process of establishing its academic maturity
Schultze and Leidner (2002)	71 percent of all KM articles in IS journals represent the normative discourse (concepts are developed by academics who exhibit consensus), 26 percent – the interpretive discourse (concepts are developed with the help of organizational members participating in research who exhibit consensus), 3 percent – the dialogic discourse (concepts are developed with the help of organizational members participating in research who exhibit dissensus), and 1 percent – the critical discourse (concepts are developed by academics who exhibit dissensus). The negative implications of KM and its unintended consequences are mostly unexplored
Tuomi (2002)	The KM discipline is a synthesis of the following fields: organizational information processing; business intelligence; organizational cognition; and organizational development
Wilson (2002)	Most KM articles appeared in IS journals, including *Decision Support Systems*, *Journal of Management Information Systems*, *Wirtschaftsinformatik* (in German), *European Journal of Information Systems*, and *Expert Systems with Applications*. There is no agreement what KM means in the practitioner community. KM is a management fad that will fade away in the future
Croasdell *et al.* (2003)	The overall volume of KM papers at the Hawaii International Conference for System Sciences has been growing. The main topics include KM, organizational memory, and organizational learning. The most productive countries are: the USA (37 percent); the UK (13 percent); Germany (10 percent); Australia (6 percent); and Sweden (6 percent). The most frequently cited KM works are: Nonaka and Takeuchi (1995), Davenport and Prusak (1998) and Nonaka (1994). Methods used in KM research are: conceptual (45 percent); case study (28 percent); quantitative (14 percent); action research (10 percent); and experiment (2 percent)

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Table AI

Work	*Key findings*
Edwards *et al.* (2003)	The most influential ideas in KM are an integrated content-narrative-context framework, communities of practice, and the explicit-tacit knowledge taxonomy. Theories, cultural concepts and business aspects are important in KM research. Nonaka, Takeuchi, Davenport, and Prusak are the most influential people in KM. There is a strong need for consistent and cohesive theory supported by empirical evidence, and connecting theory to practice
Gray and Meister (2003)	There is a considerable diversity in the KM field. KM researchers should synthesize different schools of thought within KM instead of pursuing further fragmentation of the field
Scarbrough (2003)	KM falls into the category of management fashion. The institutionalization of KM is constrained within the IT boundaries. The practical application of KM is somewhat limited. Intermediary groups, such as professionals and consultants, play a distinct role in theorizing and diffusing KM knowledge
Subramani *et al.* (2003)	The KM discipline is comprised of eight domains, which reflect the influence of management, economics, and philosophy on the evolution of KM: (1) knowledge as firm capability; (2) organizational information processing and IT support for KM; (3) knowledge communication, transfer, and replication; (4) situated learning and communities of practice; (5) practice of KM; (6) innovation and change; (7) philosophy of knowledge; and (8) organizational learning and learning organizations. The contribution of IS researchers to the KM field was not recognized
Wolfe (2003)	The first KM works appeared in the early 1980s, and the volume of publications has been continuously growing since 1995. There is an emphasis on IT, computer science, artificial intelligence, and expert systems. Non-IT topics include knowledge creation, tacit and explicit knowledge, knowledge transfer, research and development, and learning organization. The field suffers from a great degree of over-differentiation. The three over-arching areas are social capital, communities of practice, and intellectual capital
Desouza (2004)	Much of KM research is done in isolation. KM researchers should combine KM perspectives with other functional areas, including finance, accounting, innovation, marketing, and operations management. They should also demonstrate the practical application of their findings. More attention should be paid to the link between KM and organizational outcomes. The case study method, which is well suited for studying KM practices in organizational settings, is strongly recommended. Academic findings should be delivered to practitioners in the appropriate format
Gu (2004a)	86 percent of all KM authors published only one KM paper. The top authors are: D.A. Bell; N. Cercone; H.J. Hamilton; J. Liebowitz; S. Ohsuga; and N. Zhong. 30 percent of all articles are solo authored. The top institutions are: U. of Ulster; U. of Southern California; IBM Corp; U. of Regina; and Stanford U. The top countries are: the USA (36 percent); the UK (14 percent); Germany (7 percent); Japan (5 percent); Canada (5 percent). The most KM research is published in: *Expert Systems with Applications*; *International Journal of Technology Management*; *Principles of Data Mining and Knowledge Discovery*; *IEEE Transactions on Knowledge and Data Engineering*; and *Decision Support Systems*. KM has its origin in four disciplines: organizational information processing, business intelligence, organizational cognition, and organizational development. There is a trend towards interdisciplinary studies
Gu (2004b)	The top KM authors are: J. Liebowitz; C.W. Holsapple, and T. Davenport. 88 percent of all KM authors published only one paper. The most productive countries are: the USA; the UK; Germany; and The Netherlands. The most KM research is published in: *International Journal of Technology Management*; *Expert Systems with Applications*; and *Decision Support Systems*. These outlets represent computer science and IS journals
Scholl *et al.* (2004)	More empirical, interdisciplinary research focusing on human (i.e. non-IT) factors is required. Besides communities of practice, no commonly accepted practical KM approaches exist. The field lacks a well-developed theoretical base
Serenko and Bontis (2004)	The top countries are: the USA (32 percent); the UK (23 percent); Australia (7 percent); Canada (4 percent); and Spain (4 percent). The top institutions are: Cranfield U.; McMaster U.; U. of Warwick; Morgan State U.; and U. of Technology Sydney. The top authors are: Ganesh D. Bhatt; Nick Bontis; and Syed Z. Shariq. The most frequently cited works are: Nonaka and Takeuchi (1995), Davenport and Prusak (1998) and Stewart (1997). Almost half of all publications are sole-authored
Ferguson (2005)	To bridge the gap between research and practice, both sides need to better know each other, be patient, be respectful, embrace diversity, combine scientific knowledge with practical experience, foster a mutual frame of reference, build the partnership incrementally, ensure broad situational buy-in, establish equal commitment to the partnership, and allow for mistakes
Harman and Koohang (2005)	The publication volume of KM books and dissertations has been growing by following a similar pattern. There are, however, differences in topics. The most frequent topics for books and dissertations are leveraging IT and creating a knowledge-based strategy, respectively. The topic of intellectual capital management is dramatically under-represented in both books and dissertations
Hazlett *et al.* (2005)	KM is an interdisciplinary field. It is currently in a pre-science state, which lacks a clear and distinct paradigm. The two main KM paradigms are the scientific view and social view
Jashapara (2005)	Information sciences contributed little to the interdisciplinary, fragmented discourse of KM. The key pillars of KM are systems and technology, organizational learning, strategy, and culture

(*Continued*)

Table AI

Work	*Key findings*
Jennex and Croasdell (2005)	KM exhibits signs of a young academic discipline. The body of literature is rapidly expanding, but little common ontology exists. The most frequently cited KM publications are: Nonaka and Takeuchi (1995), Davenport and Prusak (1998) and Nonaka (1994)
Kulkarni and Raghu (2005)	KM articles fall into four categories: frameworks and theories; systems and methods; case studies; and evaluation and assessment. The number of paper submissions has been growing revealing an increasing interest in KM
Metaxiotis *et al.* (2005)	KM researchers disagree on the role of IT in KM as well as on elements, terminology and purpose of KM frameworks
O'Reilly *et al.* (2005)	The KM literature pertains to organizational learning, innovation, and change management. KM linkages to reference disciplines are weak. Qualitative, interdisciplinary team-based research should be encouraged. Academics should involve practitioners in their studies, use practitioner-friendly study names, publish in practitioner-focused journals, and apply theories to cases and examples
Peachey *et al.* (2005)	The most frequent research topics are: knowledge transfer (42 percent); knowledge storage and retrieval (21 percent); knowledge application (14 percent); and knowledge creation (13 percent). Most KM articles appeared in *Management Science*, *Decision Support Systems*, and *Journal of Management Information Systems*. Practitioner and academic journals differ in terms of KM topics
Scarbrough *et al.* (2005)	KM is a management fashion. IS outlets dominate human resources outlets with respect to KM topics. However, no negative competition exists between the IS and human resources groups. The IS discipline has been very successful in making KM its sub-discipline
Schwartz (2005)	KM is an independent discipline and is not part of the IS research stream. KM researchers reside within 29 different departments, including IS (45 percent), computer science (16 percent), library and information science (6 percent), and management (5 percent), which highlights the interdisciplinary nature of the domain. Authors reside in the USA (31 percent), the UK (10 percent), Italy (7 percent), Germany (6 percent), the Netherlands (6 percent), and Israel (6 percent). To succeed, KM researchers need to draw knowledge from various reference disciplines
Baskerville and Dulipovici (2006)	The theoretical foundations of KM include: (1) information economics (intellectual capital and intellectual property); (2) strategic management (core competencies and dynamic capabilities); (3) organizational culture; (4) organizational structure; (5) organizational behavior; (6) artificial intelligence (knowledge-based systems and data mining); (7) quality management (risk management and benchmarking); and (8) organizational performance management (financial performance measures). Many of these theories overarch and exhibit cohesion which is a sign of a solid, maturing academic discipline
Burman (2006)	Academics may improve the quality of their research by engaging in consulting projects. Joint academic-practitioner publications may narrow the gap between research and practice. The scientific method used in academia needs to be re-considered
Chen and Lee (2006)	There are several sub-areas that form the conceptual groundwork for KM, including semi-structured data, inductive learning and logic programming, efficient search and data structure of multi-dimensional objects, and deductive databases and logic programming. Overall, KM is inclined towards IT research
Dattero (2006)	The collaboration efforts of KM researchers are fragmented. Top researchers collaborate with various individuals, but not with the other major scholars. Overall, a lack of collaboration is observed, which happens because many schools or public/private organizations have a single researcher leading KM projects
Desouza (2006)	To advance the exponentially growing KM field, researchers should: (1) avoid repetition of research of well-explored issues; (2) embark on truly innovative, risky projects; (3) document and communicate the results of unsuccessful studies; (4) capitalize on the knowledge from reference disciplines; (5) explore knowledge dynamics at the societal and national levels; (6) determine the role of KM in the eradication of poverty; and (7) engage in industry-academia alliances
Jasimuddin (2006)	The KM field draws upon a wide range of reference disciplines, including IS, organization theory, strategic management, and human resources management. The KM discipline was officially formed in the 1990s, and its roots date back to the 1980s or even earlier
Mekhilef and Flock (2006)	The KM field is rich and very diverse. The key domains of KM, such as decision sciences, social sciences, engineering, computer science, medicine and health, and business and economics, lack a common concept, interconnection and shared understanding. The KM field cannot be considered a scientific discipline
Nonaka and Peltokorpi (2006)	A universal definition of KM does not exist. There is a lack of clear, unified KM foundations. Since KM has emerged from several disciplines, including philosophy, economics and psychology, conceptual plurality is the major discipline's challenge. The KM discipline should develop its own identity instead of mirroring other disciplines

(*Continued*)

Table AI

Work	*Key findings*
Prakasan *et al.* (2006)	Journals that publish the most KM research are: the *Journal of Knowledge Management*; *International Journal of Information Technology and Management*; *Knowledge Management Research & Practice*; *International Journal of Technology Management*; and *Australian Journal of Information Systems*. Conference papers represent 59 percent of all KM publications, followed by journals (40 percent). 80 percent of all KM works are published in *Computers and Control Technologies* outlets. The volume of KM literature has been continuously growing. 94 percent of all KM works appeared in English, followed by German, Chinese, Japanese and Italian. 64 percent of all papers are multi-authored. The most productive authors are: A. Abecker; S.Y.W. Su; J. Liebowitz; C.W. Holsapple; and P. Gottschalk. The most productive countries are: the USA; the UK; Germany; France; and China. The observed Lotka's Law alpha = 2.8. Each KM publication contains 16 references on average
Harp *et al.* (2007)	The leading topics are knowledge transfer, knowledge storage and retrieval, knowledge creation, and learning outcomes, as well as influences of resources, management, and environment. All KM journals differ from one another with respect to topic coverage
Keen and Tan (2007)	A link between traditional KM research and KM practice must be established. More attention should be paid to the demand side of KM research
Lee and Chen (2007)	Research trends include semantic web, agent systems, electronic commerce, ontology, human-computer interaction, distributed knowledge representation, and reasoning systems
Nie *et al.* (2007)	The ontological structure of the KM discipline includes: systems science (e.g. complex systems and systems methods); computer science; KM (e.g. SECI model, project management, strategy, information management, and human resources management); knowledge creation; knowledge itself; and information support systems
Örtenblad (2007)rtenblad (2007)	KM ideas were first mentioned in scholarly literature in the 1960s under the labels of ''the management of knowledge,'' ''knowledge managers,'' ''knowledge administrators,'' and ''information use policies.'' These ideas were initially documented in the political science (specifically, public administration) and information management domains, which formed the foundation for the later ''soft'' and ''hard'' aspects of KM. The old KM literature is rarely mentioned in contemporary KM works
Peng *et al.* (2007)	KM research is China is at a very early stage
Prusak and Weiss (2007)	The KM field emerged in the early 1990s from the works of practitioners. The early KM initiatives focused on knowledge strategy, knowledge codification, and organizational culture. KM is unlikely to fade away in the future
Schultze (2007)	First KM approaches and tools were introduced in organizations in the 1970s. In the 1990s, KM emerged as a solution to organizational pressures, and it started progressing towards maturity in the mid-2000s. KM is at the ascendance stage. IT played a central role in KM discourse, but its influence has been gradually diminishing. At the same time, the role of human issues, knowledge workers, and culture has increased. The future development of the field, however, is unpredictable. The use of the ''KM'' label to describe knowledge work may need to be reconsidered
Bjørnson and Dingsøyr (2008)	The KM field is represented by both technocratic (systems and engineering focus) and behavioral (organizational and strategic focus) schools. KM research methods are: case study (56 percent); field study (20 percent); action research (12 percent); ethnography (8 percent); and experiment (4 percent)
Booker *et al.* (2008)	There is misalignment between KM theory and practice. Practitioners perceive KM research as very useful. Even though practitioners do not read peer-reviewed articles, they receive academic knowledge through indirect knowledge dissemination channels
Chan and Chau (2008)	There is a gap between the theoretical foundations of KM and its practical implementations
Ekbia and Hara (2008)	The professional and scholarly KM literatures dramatically differ in terms of researchers' orientation (practitioner vs academic), type of evidence, research questions, perspectives, and methods used
Guo and Sheffield (2008)	Journals publishing the most KM research are: *Organization Science*; *Management Science*; and *Decision Support Systems*. The KM field is interdisciplinary since 59 and 41 percent of articles appear in management and IS journals, respectively. The percentage of empirical studies is large and has been growing. 77, 22, and 1 percent used a positivist, interpretive, and critical research paradigms, respectively. KM research methods are: survey (60 percent); theory building and literature review (39 percent); field study (37 percent); design science (12 percent); and laboratory experiment (10 percent). KM research in IS journals differs from that in management journals
Hallin and Marnburg (2008)	Empirical KM research findings in the hospitality and tourism area are inconclusive, are not generalizable, and are generally unreliable. More rigorous investigations employing sound scientific methods are warranted
Holsapple and Wu (2008)	The KM discipline is a substantial field of study which is based on diverse reference disciplines. It has much to offer and is relevant to modern business practices. To advance the success of the KM discipline, a link between KM practices and organizational performance should be further investigated. The major journals devoted to KM are: *International Journal of Knowledge Management*; *Journal of Knowledge Management*; and *Knowledge Management Research & Practice*

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Table AI

Work	*Key findings*
Jones (2008)	KM is a multidisciplinary field. IS is a dominant theme in KM research, followed by strategy, organizational learning, and communication
Koenig and Neveroski (2008)	KM roots date back to the thirteenth century. The term ''KM'' was coined in the 1980s, and it became part of professional vocabulary in the mid-1990s. KM emerged from the non-academic sector, including consulting companies, government intelligence, and policy management. Its major antecedents are developments in the areas of intellectual capital and online technologies. Over time, the definition of KM has become very comprehensive. KM is not a management fad
Lane and Snaith (2008)	The benefits of KM have been over-sold by the IT sector. KM has not met the expectations of health care practitioners. KM is a fad, but it has some potential
Mearns (2008)	KM dissertations employ qualitative or mixed-method approaches. Open-ended questionnaires and interviews are predominant techniques, followed by secondary data and focus groups. No quantitative research is done. Case studies constitute almost 50 percent of all methods. Most dissertations did not specify a research paradigm but relied on an existing theory borrowed from a different domain, including management, humanities, and social sciences
Rebelo and Gomes (2008)	To ensure the successful future development of the organizational learning concept, more empirical research is needed to identify factors promoting and facilitating organizational learning and to establish a causal link between learning and organizational performance. The introduction or improvement of general models and frameworks should be discouraged
Spender (2008)	KM researchers should return to the deep historical roots of the discipline and consider managers' experiences and practices
Timonen and Paloheimo (2008)	The most frequently cited KM works are: Nonaka and Takeuchi (1995), Nonaka (1994) and Senge (1990). There are three periods of the diffusion of the knowledge work concept: emergence (1974-1993); first diffusion period (1994-1999); and second diffusion period (2000-2003)
Vasconcelos (2008)	The KM field is interdisciplinary in nature, including organizational behavior, strategic management, and economic- and accountancy-based perspectives, which raise irreconcilable dilemmas and ambiguities
Zhong and Song (2008)	The intellectual structure of KM consists of the following areas: (1) KM strategy (knowledge, competitive advantage, capability, resource-based view, etc.); (2) organizational change (innovation, environment, coordination, evolution, etc.); (3) KM process (management, firm, organization, behavior, organizational memory, etc.); (4) KM application (organizational performance, research and development, etc.); and (5) KM technology (model, system, information, IT, etc.) The KM field shows signs of a healthy scientific discipline. Early KM studies focused on IT issues, whereas contemporary research concentrates on soft issues, such as organizational learning and knowledge worker. Future research is likely to focus on absorptive capacity, knowledge-based competitive advantage, and strategic alliances
Zhong *et al.* (2008)	In China and the rest of the world, research differs in terms of overall output, studied topics, reference disciplines, methods, and units of analysis. For KM research published in international journals, reference disciplines are: social and behavioral science (23 percent); management (23 percent); IS (14 percent); and cognitive science (5 percent). Research methods are: survey (25 percent); viewpoint (18 percent); conceptual model (12 percent); secondary data (11 percent); case study (9 percent); and framework (4 percent). The units of analysis are: organization (45 percent); industry (11 percent); system (10 percent); individual (8 percent); and abstract (8 percent)
Bontis and Serenko (2009)	The top five KM-centric journals are: *Journal of Knowledge Management*; *Journal of Intellectual Capital*; *The Learning Organization*; *Knowledge and Process Management*; and *Knowledge Management Research & Practice*
Edwards *et al.* (2009)	Operational research has contributed to the development of the KM discipline, but its role has never been explicitly recognized
Ergazakis *et al.* (2009)	KM is an important tool for small and medium enterprises. However, research on KM for small and medium enterprises has been somewhat insufficient with respect to the development of frameworks, models, methods, and tools
Ferreira (2009)	KM is a major contributor to the emerging field of *Knowledge Management for Development*, which focuses on managing knowledge of development agencies. (The purpose of development agencies is to help poor countries and disadvantaged groups improve their quality of lives
Heisig (2009)	Despite inconsistencies in terminology used in 160 KM frameworks, there is some degree of consensus regarding critical KM success factors and basic KM activities. The key term ''knowledge'' is in need of further development

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Work	*Key findings*
Kraaijenbrink (2009)	In terms of the use of well-defined theory, convincing justification, suitable assumptions, generalizable conclusions, and contribution, most KM studies contain significant flaws
Mehrizi and Bontis (2009)	There is a lack of research on unlearning, non-profit organizations, and the role of organizational size. There are two major, independent clusters of KM research: technology-centered and human-focused
Nie *et al.* (2009)	KM initiatives resulted from external (e.g. economic and globalization) and internal (e.g. cultural) organizational challenges to improve organizational performance. There is strategy-, human-, information-, and process-oriented knowledge. Both soft (e.g. knowledge workers and CKOs) and hard (e.g. KM systems) methods have been applied to KM. The most frequent keywords in KM research are: KM, innovation, intellectual capital, learning organization, information, knowledge worker, learning, tacit knowledge, and management. The most frequent co-occurrences are: KM and innovation, and KM and intellectual capital
Onyancha and Ochalla (2009)	Library and information science scholars view KM as: information resources management; information science; information technology; information services; information retrieval; library science; management information systems; organizational learning; and data mining
Paucar-Caceres and Pagano (2009)	Systemic theories and methodologies, such as systems dynamics, complexity theory, soft systems methodology, viable systems model, and critical systems, have been used in a small number of KM studies. They may be also beneficial in future empirical KM investigations
Serenko and Bontis (2009)	The top five KM-centric journals are: *Journal of Knowledge Management*; *Journal of Intellectual Capital*; *Knowledge Management Research and Practice*; *International Journal of Knowledge Management*; and *The Learning Organization*
Serenko *et al.* (2009)	The most productive KM researchers are: J. Falconer; J.M.V. Marti; S. Erickson; P. Ordonez de Pablos; and D. Andriessen. The top countries are: the USA; Canada; the UK; Spain; and Australia. The top schools are: U. of Calgary; Polytechnic U. of Catalonia; and Universidad de Oviedo. 73 percent of all authors published only one work. KM research methods are: case study (24 percent); framework development (21 percent); literature review (20 percent); survey (13 percent); and secondary data (12 percent). There are 1.73 authors per manuscript on average. KM researchers publish more single-authored works than their colleagues in the other domains
Abdullah and Timan (2010)	Journals publishing KM research differ in their productivity. *Electronic Journal of Knowledge Management* is the most productive KM journal. Topics include: KM theory and practice (34 percent); business process and management (32 percent); IS/IT (24 percent); and information management (6 percent). The number of authors is: 2-42 percent; 1-36 percent; 3-17 percent; and 4-3.26 percent. The most productive authors are: M. Kennedy; D. Blackman; I.T. Lopes; M. do Rosario Martins; and P. Sharp. The most productive countries are: the UK (14 percent); Australia (13 percent); the USA (13 percent); Canada (7 percent); and Finland (5 percent)
Hislop (2010)	Most KM articles appear in business management (50 percent), KM (19 percent), and IS/IT/Information Management/Library Studies (13 percent) journals. Given a steadily growing interest in KM research, the field cannot be regarded as a management fad or fashion. However, global consultancies and professional service firms have been exhibiting less interest in KM
Kebede (2010)	IS researchers do not sufficiently contribute to the development of the KM discipline. They should take a more active, proactive, and visible role in advancing KM research
Landrum *et al.* (2010)	The most frequently cited types of work are: articles (71 percent); books (22 percent); and book chapters (7 percent). Citations are spread very unevenly; KM researchers heavily cite a few seminal works published over 15 years ago, and rarely cite recent publications. KM research methods are: framework/model development (30 percent); empirical study (30 percent); case study (30 percent); testing a framework/model (6 percent); and theoretical exploration (4 percent)
Ma and Yu (2010)	The most frequently cited journals publishing KM papers are: *Organization Science*; *Harvard Business Review*; *Strategic Management Journal*; *California Management Review*; and *MIS Quarterly*. The most frequently cited KM publications (1998-2002) are: Nonaka and Takeuchi (1995), Davenport and Prusak (1998) and Nonaka (1994). The most highly cited authors (1998-2002) are I. Nonaka, T. Davenport, and M. Polanyi. KM sub-fields are KM essentials, knowledge-based theory on organization and innovation, KM strategy, and organizational learning. KM is a legitimate academic field
Onions (2010)	KM topics include: performance (25 percent); implementation (19 percent); processes (14 percent); value (14 percent); and general discussion (10 percent). None of the existing models and frameworks comprehensively describes KM. KM is a general term encompassing a wide range of concepts, theories, solutions, and approaches

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Table AI

Work	*Key findings*
Serenko *et al.* (2010)	KM is a continuously growing, diverse discipline. Recently, it has started exhibiting signs of academic maturity. Practitioners were actively involved in early KM research, but their role has gradually diminished. The most productive institutions are: Cranfield U.; Copenhagen Business School; Macquarie U.; U. of Oviedo; and McMaster U. The top countries are: the USA; the UK; Australia; Spain; and Canada. The top authors are: P. Ordonez de Pablos; H. Muller-Merbach; P.A.C. Smith; N. Bontis, and A. Wensley. KM research methods are: framework development (32 percent); case study (24 percent); literature review (11 percent); survey (10 percent); secondary data (8 percent); and interviews (7 percent). 80 percent of all authors published only one article. Scholarly KM output contributes to the national wealth
Wei and Nakamori (2010)	Most KM publications are in the areas of computer science, engineering, business, economics, and medical science. Research on communities of practice has reached maturity
Curado *et al.* (2011)	The overall number of KM articles has been growing. The most productive journal is *International Journal of Information Management*. The number of authors is: 1-23 percent; 2-41 percent; 3-24 percent; and 4-8 percent. There are signs of increasing inter-institutional collaboration among researchers. The most productive countries are: the USA (39 percent); the UK (11 percent); Taiwan (11 percent); and South Africa (5 percent). 77 percent of all articles are empirical, and their number has been growing signifying the maturity of the field. The research methods are: survey (43 percent); case study (30 percent); and experiment (10 percent). The most frequent keywords describing KM are: KM; knowledge sharing; KM system; knowledge transfer; and knowledge. KM research focuses on knowledge processes (49 percent), knowledge technologies (40 percent), and people (11 percent)
Dwivedi *et al.* (2011)	Most KM papers appear in computer science, IS, and management journals. There is an emerging trend towards multi-disciplinary studies. The largest number of KM articles appeared in: *International Journal of Technology Management*; *Journal of Universal Computer Science*; *Expert Systems with Applications*; *Journal of Computer Information Systems*; and *Decision Support Systems*. The most productive countries are: the USA; the UK; Germany; Taiwan; and Canada. The most productive authors are: T. Davenport; Y.M. Chen, P. Gottschalk, and J. Liebowitz. There are many individual, sporadic, and non-collaborative research projects. The most productive institutions are: National Cheng Kung U.; Napier U.; and U. of Karlsruhe. 96 percent of all KM works appeared in English, followed by German and Japanese. KM research methods are: multi-method (27 percent); literature analysis (24 percent); case study (15 percent); survey (9 percent); and field experiment (6 percent). Topics focus on: KM Systems (39 percent); KM Environment (23 percent); and KM Processes (17 percent)
Eijkman (2011)	*The Learning Organization* journal lost its practical relevance. The concept of learning organization should be re-considered. The journal should refocus on work-integrated action learning, the role of culture, and critical analysis to develop a unique edge
Ergazakis and Metaxiotis (2011)	There are four major research areas in Knowledge-Based Development (KBD): (1) the development of comprehensive approaches for the practical formulation of citizen-centric KBD strategies; (2) knowledge-based urban planning; (3) the introduction of KBD metrics; and (4) the investigation of the practical aspects of the implementation of KBD approaches
Grant (2011)	KM is not a fad; it is a continued managerial activity with no apparent decline. There is a conflict between the preferences and interests of academics and practitioners
Griffiths and Evans (2011)	There are deficiencies in the KM literature. There is no common theory or framework that may be applied consistently in all six key disciplines of KM, such as business and management, medicine and health, social sciences, computer sciences, engineering, and decision sciences. Practitioners are dissatisfied with KM tools. A shared understanding of KM between researchers and practitioners should be developed
Jakubik (2011)	There is a need for a paradigm shift in the knowledge development theory. More multidisciplinary research focusing on role of history, past experience, culture, religion, language, and politics is required. Researchers should shift their focus from IT to human factors in knowledge creation
Lambe (2011)	KM concepts, theories, and approaches existed over 50 years ago. However, the KM field lacks an integrated theoretical base because it generally ignores the early works. KM suffers of collective amnesia and lacks a historical connection to the parallel disciplines. KM researchers and practitioners should return to the seminal publications in the reference disciplines, such as economics, sociology, and information management
Nold (2011)	More empirical research is required to establish a link between trust and firm performance, KM and firm performance, and KM and culture
Serenko *et al.* (2011a)	KM research reaches practitioners and students (i.e. future practitioners) through books, which serve as knowledge translation channels. The claims that scholarly KM research has made little practical impact are unwarranted
Serenko *et al.* (2011b)	KM is a very young, healthy, and attractive academic discipline that welcomes contributions from a variety of academics and practitioners. In their paper acceptance decisions, KM journal editors exhibit no bias in favor of well-known KM authors. KM research is mostly driven by academics than by practitioners
Tuzhilin (2011)	KM may be sustained through the continuous improvement of KM technologies

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Work	*Key findings*
Uzunboylu *et al.* (2011)	94 percent of all publications are in English, followed by German (4 percent), French (2 percent) and Turkish (1 percent). The volume of KM topics in education publications and citations has been growing. Most publications are co-authored. The most productive countries are: the USA (39 percent); the UK (11 percent); Canada (9 percent); Germany (9 percent); and Spain (7 percent)
Wallace *et al.* (2011)	The KM literature conforms to the Bradford distribution, and it is within the scholarly literature norms. KM research methods are: case study (27 percent); survey (17 percent); literature review (15 percent); framework (15 percent); interview (12 percent); mathematical model (5 percent); content analysis (3 percent); and field study (2 percent). Over 25 percent of all articles used no identifiable methodology (e.g. expert opinion and summary of practice). The most productive journals are: *Journal of Knowledge Management*; *KM Review*; and *Knowledge Management Research & Practice*
Booker *et al.* (2012)	Academic research on business valuation is relevant to business practitioners. The knowledge market perspective offers a useful approach to the study of the academic research relevance topic. Efficient market intermediaries in the form of knowledge translation mechanisms provide a solution to the academic relevance problem
Lee and Chen (2012)	KM is an evolving, growing discipline with a lot of potential. Cross-disciplinary KM subject areas include information retrieval, software engineering, machine learning, distributed databases, multi-agent systems, and data mining. Computer science plays an important role in KM development. KM research has not reached academic maturity. The top cited article is by Alavi and Leidner (2001)
Metaxiotis (2012)	The KM discipline has substantially contributed to the development of the KBD field, and it may be considered a reference discipline from the KBD's perspective. *Journal of Knowledge Management* has played a key role in the dissemination of KBD research
Serenko *et al.* (2012)	Academic KM research has made an impact on the state of KM practice. The body of knowledge existing in peer-reviewed publications is delivered to practitioners by means of books and textbooks

About the author

Dr Alexander Serenko is an Associate Professor of Management Information Systems in the Faculty of Business Administration at Lakehead University, Canada. Dr Serenko holds a PhD in Management Information Systems from McMaster University. His research interests pertain to scientometrics, knowledge management, and technology addiction. Alexander has published over 60 articles in refereed journals, including *MIS Quarterly*, *Information & Management*, *Communications of the ACM*, *Journal of Informetrics*, and *Journal of Knowledge Management*. He has also won awards at several Canadian, American and international conferences. In 2007, Dr Serenko received the Lakehead Contribution to Research Award which recognizes him as one of the university's leading researchers. Alexander Serenko can be contacted at: aserenko@lakeheadu.ca