
Analysing and visualising the trends in knowledge management: towards a normative knowledge management framework

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Abstract: The purpose of this study was to analyse knowledge management research trends to understand the development of the field using a combination of scientometric, bibliometric, and visualisation techniques, subsequently developing a normative framework of knowledge management from the results. 282 articles between the years 2010–2015 were retrieved, analysed, and visualised to produce the state of knowledge management during the selected timeframe. The results of this study provide a visualisation of the current research trends to understand the development of the knowledge management discipline. There are signals that the literature about knowledge management is progressing towards academic maturity. This study is one of the first studies to combine bibliometric and scientometric methods to assess productivity along with visualisation, and subsequently provide a knowledge management framework drawing from the results of these methods.

Keywords: bibliometric; scientometric; visualisation; knowledge management framework; knowledge management; citation analysis; h-index; g-index

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1 Introduction

Looking at the literature, it can be said that the debate on knowledge management (KM) began in the mid-to-late 90s (Scarbrough, 2002; Scarbrough and Swan, 2001; Scarbrough et al., 2005). KM has received growing interest from researchers and practitioners alike, due to the rise in knowledge-intensive products and services as well as the rapid development of information technologies (Alavi and Leidner, 2001; Dwivedi et al., 2011; Lee and Chen, 2012). Since the first use of the KM term, a broad spectrum of definitions has emerged. KM is defined as “the art of creating value by leveraging the intangible assets” [Sveiby, (1997), p.35]. According to Darroch and McNaughton (2002), KM is a management function that creates, transfers, and ensures the effective and efficient utilisation of knowledge for the long-term benefit of the organisation. Predominantly, the KM term has been centred on competitive advantages, and more effective acquisition of knowledge (Scarbrough and Swan, 2001). A broad spectrum of definitions has emerged such as; “the collection of processes that govern the creation, dissemination and leveraging of knowledge to fulfil organizational objectives” [Lee and Yang, (2000), p.784], and “an approach to adding or creating value by more actively leveraging the know-how, experience, and judgement resident within and, in many cases, outside of an organization” [Ruggles, (1998), p.80]. Furthermore, KM has evolved from a spectrum of theories ranging from philosophy to computer science, and economics. Hence, it is considered a ‘mixed bag’ of idealistic theories without an intelligible theoretical base (Alvesson and Kärreman, 2001; Donaldson, 2001; Foss and Mahnke, 2002). The

accompanying conceptual plurality (Nonaka and Peltokorpi, 2006) makes it hard to define KM as a separate discipline.

The lack of consensus regarding the definition of KM allows disciplines and organisations to interpret and implement KM in various ways based on their perceptions and the underlying context (Fteimi, 2015). Studies such as Scarbrough and Swan (2001) have been conducted in order to provide evidence of the increasing popularity of KM and its dissemination in terms of the management fashion model, providing flexibility of interpretation. One of the most important studies on the management fashion model has been that of Eric Abrahamson (Fincham and Roslender, 2003). Abrahamson (1996, p.257) defines management fashion as being “a relatively transitory belief, disseminated by fashion setters, that a management technique leads to rational management progress”. Several studies infer from theory that KM is one of the most recent and widespread fashions (Scarbrough, 2002; Scarbrough et al., 2005; Fteimi, 2015; Kör and Mutlutürk, 2017). The other result of a lack of consensus on KM has led to the occurrence of a variety of different frameworks, thereby causing an absence of conceptual unification and a cumulative tradition (Guo and Sheffield, 2006). As of yet, there is no generally accepted framework for KM, except Kör (2017). Such a framework can be beneficial for both researchers and practitioners as the latter can rely on consistent methods and approaches in order to successfully implement KM in their firms (Fteimi, 2015) while it can guide and influence the former’s research activities (Serenko, 2013).

The focus of this study lies in revealing and visualising the current trends of KM and to determine its place on the path to becoming a normal science. This study also aims to present a general framework for KM in order to contribute to a consensus on the subject. Many studies have been conducted with the aim of mapping the current path KM is on and how it is being interpreted by other disciplines. Most studies conducted with the aim of reaching a general understanding of KM have stemmed from a lack of taxonomy regarding the subject. The most common of these methods is the use of citation classics which shed light on citation behaviour of scholars to better understand the topics KM reference and whether it has endured over the years. While many studies have taken place on the subject of KM, there is still ample room to explore and visualise the current trends as years progress (Serenko and Dumay, 2015a).

To address the research gap described above, the purpose of this study is to determine the stage of KM within the developmental life-cycle of a discipline (Serenko and Dumay, 2015a) by analysing KM citation classics and examining their characteristics using a combination of bibliometric and scientometric methods, visualising the outcomes, as well as presenting a normative framework of the field. To this end, not only bibliometric and scientometric methods, but also visualisations of bibliographic data are used to generate, disseminate, and utilise scientific information in order to contribute to the understanding of KM, as well as forecast the future of KM research. To the best of the authors’ knowledge, this study is one of the firsts to combine bibliometric and scientometric methods in order to assess productivity along with visualisation, and subsequently provide a framework drawing from the results of these methods. Most studies have only taken certain angles of productivity into account regarding the KM field. We present one of the first comprehensive evaluations of the KM field through a combination of different techniques providing scholars with a holistic view of the KM domain. This study contributes to the KM literature as a reference for researchers new to the field to become engaged and stimulate interest (Lee and Chen, 2012). The basis of this study is to establish current research trends of KM and its impact on other topics by analysing the

citation classics between the years of 2010–2015 and visualise the results by way of bibliometric mapping. This study is a complement to (rather than a substitute of) Serenko and Dumay (2015a, 2015b) and Mariano and Awazu's (2016) studies regarding research trends and future research directions of KM and its contribution to the KM discipline since we apply different aforementioned techniques. This study's main contribution is the development of a KM framework to provide a summary of the KM discipline as well as contributing to a shared understanding of methods used, terminology, and concepts (Fteimi, 2015). Another contribution is the visualisation of co-occurrence analysis, bibliographic coupling, and citation analysis. This study is also a five-year follow-up to the study of Serenko and Dumay (2015a, 2015b). The reasoning behind focusing on the KM domain is that it is one of the youngest management disciplines, and it is essential to establish the identity of a new field to ensure it will develop into a reference discipline (Serenko et al., 2008). Therefore, this study can contribute to the theory of whether KM is maturing into a science from its previously defined embryonic stage. Drawing from these statements, the study's research questions are:

RQ1 What do bibliometric and scientometric analyses tell us regarding the stage of KM as a discipline?

The rest of the paper is structured as follows: Section 2 focuses on the literature review. Section 3 contains the methodology. Tables and mapping results along with a KM framework are presented in the Section 4. Subsequently, conclusions and implications for further research are discussed in Section 5. In Section 6, limitations and future research directions are presented.

2 Literature review

2.1 Knowledge management

KM is in nature a multi-disciplinary field (Serenko and Bontis, 2013a). This can be inferred from the various interpretations of the term. While some definitions adopt a soft approach on KM, others use a harder approach (Giaglis, 2003). The soft-centric approach perceives knowledge as a process focusing on people and behavioural issues whereas the hard-centric approach perceives knowledge as a tool using an IT and engineering focus (Serenko and Dumay, 2015b).

The basis of many studies regarding KM has been to support the debate of whether KM is slowly maturing towards becoming a reference discipline (Serenko and Bontis, 2013a). A reference discipline is defined as an endemic scholarly field that provides theoretical and methodological foundations for other disciplines (Nambisan, 2003). If KM is indeed maturing into a reference discipline, studying its current position within the academic community is crucial. As many studies have used before in measuring the impact of scholarly works within the knowledge domain, visualising growth and identifying inter-disciplinary relationships (Lee and Chen, 2012), a bibliometric study can be conducted in order to gain insight into the evolution of KM. Bibliometric studies such as that of Subramani et al. (2003) and Ponzi (2002) have been conducted to investigate the intellectual structure of KM. Ponzi (2002) found four factors in the research between 1994–1998: KM; organisational learning; knowledge-based theories; and the role of tacit knowledge in organisations. Subramani et al.'s (2003) research based on the years

1990–2002 revealed eight factors: knowledge as a firm capability; organisational information processing and IT support for KM; knowledge communication, transfer and replication; situated learning and community of practice; the practice of KM; innovation and change; philosophy of knowledge; and organisational learning and learning organisations.

Serenko (2013) has broken down the evolution of KM into four generations of focus. The first generation was prior to the mid-1990s, the focus being more on management-driven, techno-centric processes that identify and store pre-possessed knowledge of employees. The second generation, existing till the mid-2000s, focused on human factors, tacit-explicit knowledge conversion, and organisational intellectual capital (IC). This generation considered technology as only a tool. The third generation, which contains the years 2000–2013, tries to accommodate both previous generations by focusing on strategic perspectives, social learning, the impact of KM practices and value creation. The fourth generation, which at the time of Serenko's (2013) study was considered the future generation said to start in 2014. Serenko (2013) predicted that the new generation may shift its focus on IC. As can be seen from our visualisation of the co-occurrence of keywords of KM, IC has gained significant momentum within the field of KM, proving Serenko's (2013) prediction to be right on point. Serenko (2013) also states that the four generations do not disregard one another rather that each generation builds on its predecessor's ideas making it a cumulative process. Serenko (2013) has divided the evolution of KM based on previous studies (Castañeda and Manrique, 2016) by summarising the key points of each work.

2.2 Citation analysis

Citations are both influential in the sense that they steer researchers to relevant work and symbolic in that they conceal praise for the author (Cronin, 2016). Citation analysis offers a measure of recording the process of a scholar's citation of another scholar's work (Ma and Yu, 2010). Citation analysis is used in bibliometrics to determine the quality and impact of an article (Brinn et al., 2000).

The term citation classic was first originated by Garfield (1977) and defined as "studies within a discipline that have been cited most frequently". Citations are the base of any field; therefore, they can provide a future area of research regarding a specific topic or topics based on a field. The quality of research is ordinarily evaluated in terms of ranking parameters which are based on the number of citations (Alguliyev et al., 2015). The use of citation metrics and indices in the assessment of research has become an inherent part of academia (Harzing and Alakangas, 2016). The Hirsch Index (Hirsch, 2005) is among the most popular of citation indices. One of the many advantages of this index is the simplicity and that it takes into account both the quantity and quality of a scholar's work (Alguliyev et al., 2015). Studies comparing the various indexes that have emerged from the h-index such as that of Bornmann et al. (2011) have shown that hardly any offer significantly different information. Sidiropoulos et al. (2007), claim that the h-index is not an adequate metric because researchers do not publish the same amount of work. Harzing et al. (2014) introduced the hI_{annual} index or hI_a for short which depicts the average annual increase in the individual h-index. This metric adjusts the h-index to accommodate the differences in career length and co-authorship patterns (Harzing and Alakangas, 2016). Another index, the hI_{norm} was introduced by Harzing and Alakangas (2016) which normalises the number of citations by the number of authors and calculates

the h-index of the normalised citation counts. This also accurately accounts for co-authorship effects.

Co-citation is a bibliometric method that researchers use to map the intellectual structure of a given field (Ma, and Yu, 2010). Co-citation analysis has become a common method for establishing authors in related fields (Egghe and Rousseau, 1990), as it can be inferred that there is a relationship between the two cited works in the same paper. By inserting a reference to a previous study in his/her publication, an author creates a relationship between the citing and cited works. Looking at this method on a larger scale (i.e., *research field*), the relationships between the citing and cited works become more complex and a whole co-citation network of relationships is created over time, as well as a large amount of data is accumulated. This data becomes comprehensible when the bibliometric analysis is conducted, and the networks are visualised.

The visualisation of bibliometric networks, also known as ‘scientific mapping’, has become an important matter since the rise of bibliometric research (van Eck and Waltman, 2014). Visualisation mapping is used to analyse large amounts of data and to acquire new insights by determining trends, or clusters within the data related to the field of study (Lee and Chen, 2012). Visualisation has become an effective means to analyse a large variety of bibliometric networks varying from networks of citation relationships between publications or journals to networks of co-authorship relationships between researchers or networks of co-occurrence relationships between keywords. The most common types of relationships are citation, keyword co-occurrence, and co-authorship relationships (Alfonzo et al., 2014).

3 Methodology

The authors have defined KM as the domain, as the aim of our study is to determine and visualise the trends of KM and subsequently present a normative framework contributing to a common understanding of KM. The KM classification framework summarised the common grounds in the domain of KM frameworks by including multiple KM dimensions and perspective. A systematic review approach was used in the study and was constructed in three stages.

The term ‘bibliometrics’ was first introduced by Alan Pritchard in 1969 as “the application of mathematics and statistical methods to books and other media of communication” (Pritchard, 1969). Since then, many definitions have arisen such as “the organisation, classification and quantitative evaluation of publication pattern of all macro and micro communications along with their authorship by mathematical and statistical calculus” [Sengupta, (1990), p.256]. Bibliometrics has been used to follow citation trails (Daim et al., 2006). Today, however, bibliometrics is used to comprehend the past data to determine trends or patterns in order to help researchers (Daim et al., 2006), and even potentially forecast the future of any research area (Morris et al., 2002).

Scientometrics has been defined as the application of bibliometric methods for the analysis and measurement of scientific publications (Behrens and Luksch, 2006; Vitzthum et al., 2010). Content and scope-wise, bibliometrics and scientometrics have been thought as overlapping by some authors (Broadus, 1987; Vinkler, 2010). Some even regard the terms as synonyms because they both directly measure knowledge (Glanzel, 2003; Hood and Wilson, 2001). Olijnyk (2014) suggested that scientometrics uses

bibliometric data along with other data to explore the structure and behaviour of science; however, bibliometrics need not focus on scientific analysis.

From a scholarly viewpoint, it is essential to assess all material produced within a research field in order to establish the current trends. This is usually executed using bibliometrics. There are other measures such as the h-index and g-index for analysing data (Merigo et al., 2016). Both bibliometric and scientometric studies can be carried out in order to evaluate the productivity of individual researchers, journals, countries as well as establish the productivity of a specific area (Andrés, 2009). The use of quantitative methods can give us an insight into the current state and core of the KM domain. In line with Abrahamson's management fashion theory, bibliographic research was used to model the relative strength and duration of fashion waves in KM research and practice (Van Rossem and Van Veen, 2011).

Organising the collected data involved the following steps for scientific mapping of KM literature. The publications to be analysed in this study were obtained from Google Scholar as of November 2016, by using Harzing's Publish or Perish software. Harzing's Publish or Perish software can calculate the h-index from Google Scholar data – with and without self-citations. In this study, Google Scholar was chosen as opposed to Web of Science or Scopus because it covers “all categories of publications, and counts citations from non-peer-reviewed works, such as practitioner magazines, government documents and newspapers” [Serenko and Bontis, (2013b), p.485]. Additionally, “there is considerable agreement that Google Scholar is a worthwhile alternative source of citation data, in particular in the social and information sciences” [Harzing and van der Wal, (2009), p.42]. According to Serenko and Dumay (2015a, p.406), “out of all citation indices and databases, Google Scholar provides the most comprehensive coverage, and its index has been growing at a stable rate”. Although Google Scholar might have the problem of non-scholarly citations and double counting, these problems are found to be fairly limited and attenuated by the use of robust citation metrics such as the h-index (Meho and Yang, 2007; Vaughan and Shaw, 2008; Harzing and van der Wal, 2009). After articles and their corresponding numbers of citations were extracted from peer-reviewed journals by using Harzing's Publish or Perish software tool, all downloaded articles were manually reviewed and necessary adjustments were made in order to account for the existence of erroneous or duplicate data.

To conduct this research, the term ‘knowledge management’ (between quotation marks) was used. The search of the knowledge management term was made in titles and keywords of publications. Years were entered as between 2010 and 2015 into the ‘year of publication between’ field. We selected all disciplines (i.e., all boxes that restrict the results to particular scholarly disciplines were checked). The ‘Lookup Direct’ function was utilised to retrieve the latest results directly from Google Scholar. Authors checked presence of the term ‘knowledge management’ in titles and keywords in the downloaded articles. Additionally, all articles were read entirely in order to identify research methods and theories used in the articles and the scholar information. After the dataset was developed, 20% of the dataset was double-checked and the results compared in order to check the author consistency. Authors that have a name using None-English characters were checked to determine any writing differences and therefore retrieved twice. The $h_{l,norm}$ and h_{la} index was used to cut off the articles at a specific count (43, 7.17). This count was calculated given all articles within the timeframe. The $h_{l,norm}$ and h_{la} were used to accurately account for differences in career length and co-authorship patterns. To add to the previous studies of Serenko and Dumay (2015a) on

citation classics, 282 articles were obtained from both KM and non-KM centric peer-review journals between the years 2010–2015. Duplications, book reviews, books, and conference proceedings were excluded from the analysis in order to work with high-quality peer-reviewed publications (Castañeda and Manrique, 2016). The multi-disciplinary nature of KM drawing for multiple subject areas (Girard and Girard, 2015) is the underlying reason behind the addition of non-KM centric peer-review journals to the study. Peer review journals have been acknowledged as having high and credibility, acceptance and impact on author's careers (Serenko and Bontis, 2013a).

The period of the current study and Serenko and Dumay's (2015a) the document selection method and data pre-processing were chosen in order to update the previous studies of Serenko and Dumay (2015a) and also due to the potential scientific obsolescence phenomenon. Obsolescence can be defined as the deterioration of an academic article's impact over a certain period measured using a longitudinal frequency distribution of citations (Serenko and Dumay, 2015b). The main principles of obsolescence state that with time, all scientific publications will eventually lose impact. A publication will become a source for new studies but gradually the rate of use will decline till it reaches zero. Thus, the number of citations will also decline accordingly. Lastly, a publication's half-life can be established by taking into account the number of years (t) the publication took to receive half of its total citation count from the time of publication (t_0) to the time of analysis (t_n) (Bayram, 1998). According to Garfield, (1999, p.979), half-life is "the number of retrospective years required to find 50% of the cited references". The timeframe Nakamoto (1988) introduced suggesting that a scientific article can only maintain significance for an average of four years was the foundation for the period set for this study. Parolo et al. (2015) also state that the number of citations for an article rises and peaks within an average of four years. Based on this, the average half-life and the citation peak of an article is two years, after which the citation frequency will decline (Nakamoto, 1988; Bayram, 1998).

The visualisation of the bibliographic data was performed using version 1.6.5 of VOSviewer. VOSviewer was chosen due to its viewing capabilities for maps accommodating at least 100 items (van Eck and Waltman, 2010), which is the case in this study. Co-citation network of authors and documents and co-occurrence network of keywords were visualised.

In the second stage, citation analysis, co-citation analysis, and bibliographic coupling were conducted. Subsequently, the resulting networks of KM were visualised. Citation analysis was conducted in order to determine the attributes of KM citation classics such as major publications, articles by year, research methods used, article theme, theories applied and scholars. The visualisation of the bibliographic data was performed using version 1.6.5 of VOSviewer. VOSviewer was chosen due to its viewing capabilities for maps accommodating at least 100 items (van Eck and Waltman, 2010), which is the case in this study. Co-citation network of authors and documents and co-occurrence network of keywords were visualised.

The final stage involved the presentation of a general KM framework rather than KM frameworks with a special focus on a concrete discipline or a concrete KM topic in order to contribute to a common KM understanding. The procedure is threefold: a literature review was conducted to explore and integrating existing KM framework. The focus of the literature review lies on determining KM perspective and categories in order to develop a classification schema. After the authors adapted existing KM framework classifications that introduced by Heisig (2009), Fteimi (2015) and Kör and Mutlutürk

(2017), the results of citation analysis and co-citation analysis have been integrated to the categories resulting in a normative classification schema.

4 Results

4.1 Citation analysis

As can be seen in Figure 1, the number of publications is significantly lower in 2015, the reason being that the minimum cut-off citation count was 7.17 and older articles have a longer period to be cited (Kör, 2017). Regardless of the shorter period, articles published after 2012 have attained significant citations, about 40% of the entire sample. The results presented in Table 1 depict the research methods used in the articles. Forty-six studies used multiple research methods, hence the total exceeding 282. Given the results, the survey is the most prevalent research method, followed by literature reviews and case studies. When compared to the previous analysis of Serenko and Dumay (2015a), it is evident that there is a significant rise in the use of surveys as a research method between the years 2010–2015. The number of articles that are neither empirical nor use present literature backing displaying the author's point of view known as viewpoints have declined significantly compared to results obtained before 2010 in Serenko and Dumay's (2015a) study. The survey method, being empirical as opposed to normative represents the majority of the citation classics.

Figure 1 Articles by year (see online version for colours)

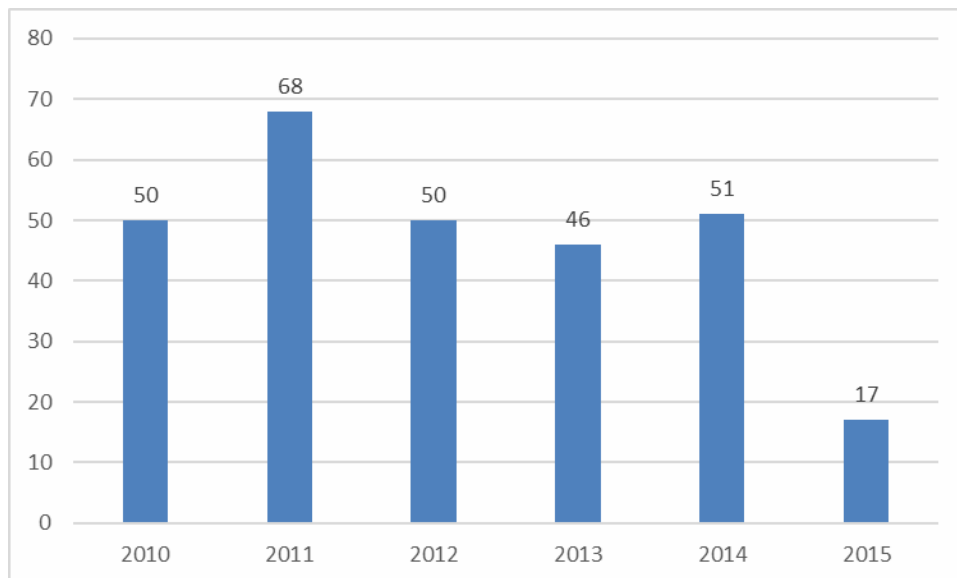
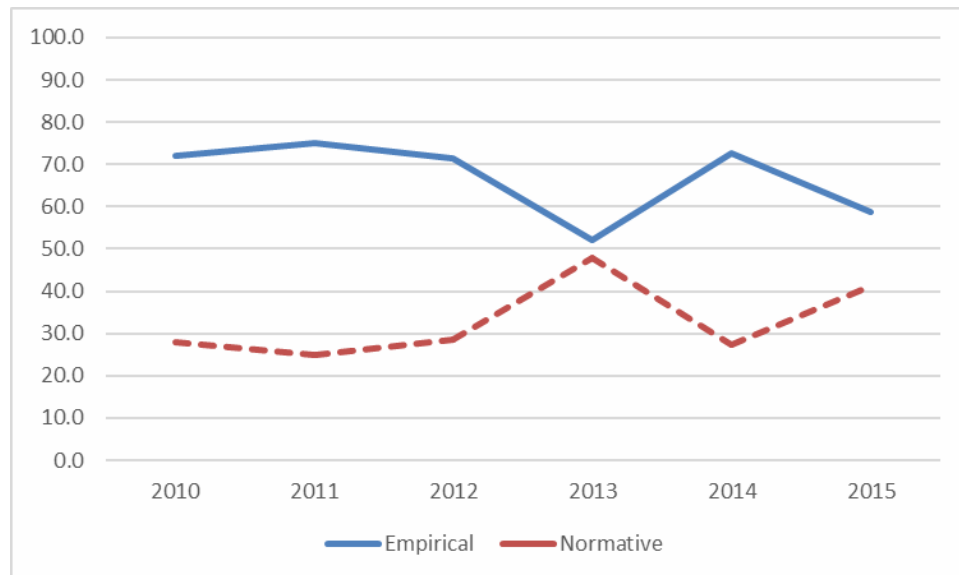


Table 1 Research methods used

<i>Method</i>	<i>No. of article</i>
Survey	123
Literature review (work is based on existing literature)	56
Case study	42
Interview	36
Conceptual framework	27
Data mining	22
Modelling tools(an analytical or descriptive tool/ model for the phenomena under investigation)	10
Other qualitative (epistemology, ethnography, examination of texts or documents)	10
Theoretical framework	7
Exploratory	7
Experiments	6
Observation	6
Viewpoint	5
Content analysis	3
Focus group	2
Meta-analysis	2
Action research	1
Total	364

Figure 2 Empirical versus normative citation classics in KM (see online version for colours)

The results presented in Figure 2 reveal the steady increase in the use of empirical research methods between the years 2013–2014 in place of normative research methods. Therefore, we can gather that KM is shifting from theoretical development onto the practice stage (Bedford and Lewis, 2015).

Figure 3 Theories applied (see online version for colours)

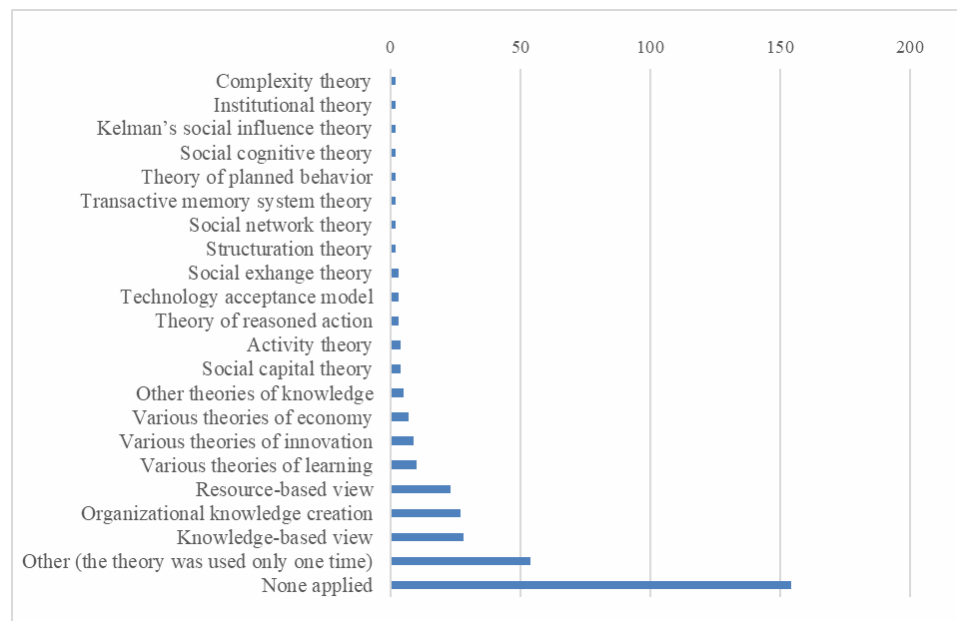


Figure 3 depicts the theories applied within the analysed articles. This category is relevant to our main goal of determining the stage of maturity of KM by determining whether the majority of articles applied existing theories or were atheoretical (Serenko and Dumay, 2015a). As is clear from Figure 3, the majority of articles used no existing theories. Other dominant theories include resource-based view, knowledge-based view and organisational knowledge creation (or dynamic theory of organisational knowledge creation) which are based on the works of Nonaka (1994), Nonaka and Takeuchi (1995) and Nonaka and Von Krogh (2009). Following these theories are various theories of economy (e.g., economy theory, microeconomic theory, social and economic theory, the theory of economics and information and endogenous growth theory), various theories of learning (e.g., learning theory, social constructivist learning theory, mobile learning theory and organisational learning theory) and various theories of innovation (e.g., diffusion of innovations theory, the theory of disruptive innovation and the system of innovation theory). Additionally, the findings (in Figure 3) are consistent with the conclusion of Serenko and Dumay's (2015a) study.

Table 2 gives us the top journals that the articles are published in and their respective counts. This, in turn, gives us the distribution of KM throughout various topics such as computer science and decision sciences. The area/type of journals for the grouping of KM/IC was based on the works of Serenko et al. (2010) and Serenko and Bontis (2013a). The remaining categories were determined by reviewing the subject area and category in the *Schimago Journal & Country Rank*.

Table 2 Top journals count

<i>Journal name</i>	<i>Count</i>	<i>Subject area/category</i>
<i>Journal of Knowledge Management</i>	56	KM/IC
<i>Expert Systems with Applications</i>	14	Computer science – engineering
<i>International Journal of Information Management</i>	8	Computer science
<i>Journal of Business Research</i>	8	Business, management and accounting
<i>Computers in Human Behaviour</i>	6	Computer science
<i>International Journal of Project Management</i>	5	Business, management and accounting
<i>VINE: The Journal of Information and Knowledge Management Systems</i>	5	KM/IC
<i>Applied Soft Computing</i>	4	Computer science
<i>Computers & Education</i>	4	Computer science –social sciences
<i>Decision Support Systems</i>	3	Computer science – decision sciences
<i>Electronic Journal of Knowledge Management</i>	3	KM/IC
<i>Information & Management</i>	3	Computer science – decision sciences
<i>Journal of Strategic Information Systems</i>	3	Computer science – decision sciences
<i>Knowledge and Process Management</i>	3	KM/IC
<i>Knowledge-Based Systems</i>	3	KM/IC

Table 3 Number of authors per paper

<i>No of authors</i>	<i>No of articles</i>
1	45
2	105
3	75
4	31
5	16
6	4
8	1
9	1
11	1
12	1
31	1
32	1
Total	282

Table 3 shows the authorship distribution by the number of authors per article. Almost 16 percent of the articles are written by a single author. The majority of the articles are

co-authored (37%). Many of the articles involve the collaboration of researchers and/or practitioners. Figure 4 gives us a longitudinal authorship pattern analysis. A clear increase in the number of authors per article can be seen in the years 2010–2011 which is followed by a decrease between 2011–2012. Following this pattern, it rests at three to four authors per paper in 2015. Table 4 presents the authors who have contributed the most to the area. Alexander Serenko has made the largest contribution to KM within the years 2010–2015, having published five papers.

Figure 4 Median number of authors per article (see online version for colours)

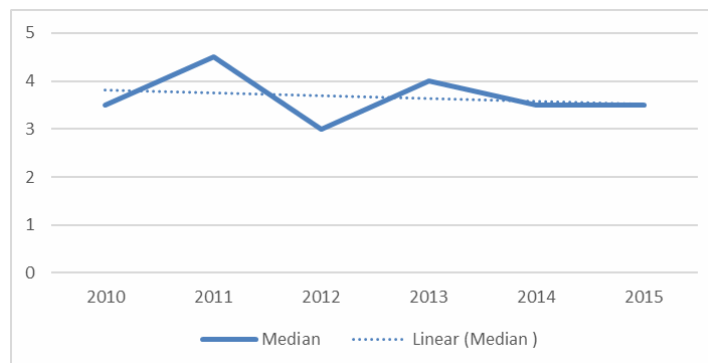


Table 4 Top KM classics authors

<i>Name</i>	<i>No of articles</i>
Serenko, A	5
Durst, S	4
Bontis, N	3
De Pablos, Po	3
Donate, Mj	3
Li, M	3
Middleton, B	3
Ooi, Kb	3
Schmitt, U	3
Tseng, Ml	3
Wong, Ky	3
Wong, Wp	3
Wright, A	3

Table 5 gives us the number of articles and the degree of collaboration of the authors. Single authors have been excluded from this table as collaboration can only be measured if there is more than one author. No collaboration gives us the number of articles that have authors from the same institution. National collaboration depicts authors that are from the same country but different institutions. Lastly, international collaboration gives us the number of articles that have been written by authors from different countries. A total of 237 articles are included in this table from the original 282, as single-authored articles were exempt. The total exceeding the number of articles included is due to the

fact that articles having more than two authors may have both national and international collaboration, so they have been entered twice.

Table 5 Author collaboration on articles

	<i>No collaboration</i>	<i>National collaboration</i>	<i>International collaboration</i>
2010	15	14	21
2011	23	17	26
2012	17	25	19
2013	16	14	18
2014	17	16	14
2015	6	3	8

Figure 5 Percentage of author collaboration on articles by year (see online version for colours)

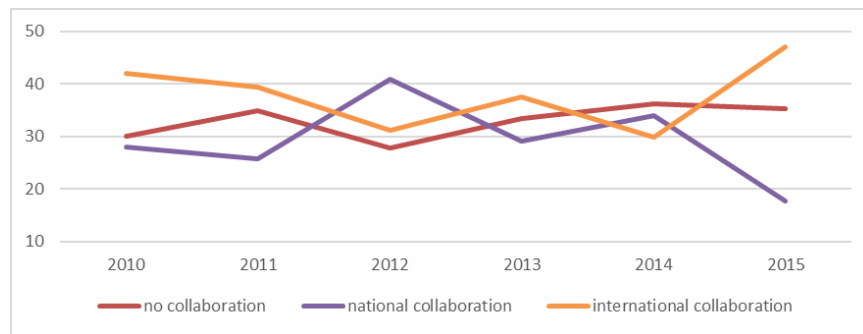


Figure 5 is a visualisation of Table 5. Looking at this chart, we can see that international collaboration was the highest in most years except for 2012 and 2014, where a change in collaboration pattern can be seen as the shift was made to national collaboration in 2012 and no collaboration in 2014.

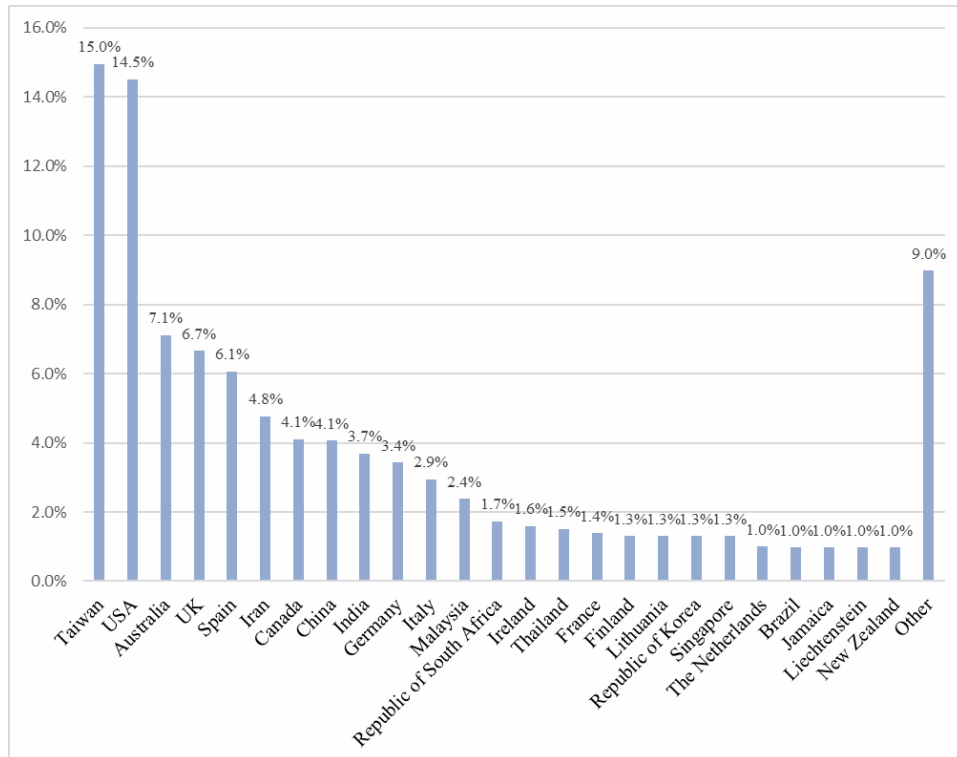
Below is a list of the top organisations that have contributed to the KM discipline by the total number of documents. There are a total of 264 different organisations that all authors within the examined publications have affiliated themselves with, 45 of which are practitioner organisations (e.g., Deutsche Bundesbank, Dell, Elsaesser Consulting, Korea Information System Consulting and Audit, Naples Municipality, Partner Healthcare Systems).

Based on the number of documents, the organisations are;

- 1 Lakehead University, Canada, (5)
- 2 University of Padua, Italy, (5)
- 3 University of Tehran, Iran, (4)
- 4 Asia University, Taiwan, (3)
- 5 Cardiff University, UK, (3)
- 6 Chang Jung Christian University, Taiwan, (3)
- 7 I-Shou University, Taiwan, (3)

- 8 Islamic Azad University, Iran, (3)
- 9 Linton University College, Malaysia, (3)
- 10 Loughborough University, UK, (3)
- 11 Macquarie University, Australia, (3)
- 12 McMaster University, Canada, (3)
- 13 Nanyang Technological University, Singapore, (3)
- 14 National Cheng Kung University, Taiwan, (3)
- 15 National Chung Cheng, Taiwan, (3)
- 16 Simon Fraser University, Canada, (3)
- 17 University of Leeds, UK, (3)
- 18 University of Oviedo, Spain, (3)
- 19 Universiti Sains Malaysia, Malaysia, (3)
- 20 University of Sao Paulo, Brazil, (3)
- 21 University of Valencia, Spain, (3)
- 22 University of Wollongong (UOW), Australia, (3).

Figure 6 Author country of origin (see online version for colours)



Articles were classified based on the author's country of origin which is shown in Figure 6. Other countries in Figure 6 includes but is not limited to Austria, Botswana, Israel, Jordan, Scotland, Switzerland, Thailand, and Wales.

As opposed to the study of Serenko and Dumay (2015a) where developing countries were non-existent, the majority of citation classics authors are located in the USA and Taiwan. These two countries account for 30% of citation classics authors. Other developing countries such as Iran and India also take place on the list of highest scoring KM publications.

The keywords associated with each article were examined to explore a more detailed level of research topics (Romano and Fjermestad, 2001). Kevork and Vrechopoulos (2009, p.61) stated that topics should be predetermined and dependent on what the authors themselves have decided indirectly through the keywords of their articles rather than an interpretation.

Figure 7 Distribution of the top 15 keywords with their frequency counts (see online version for colours)

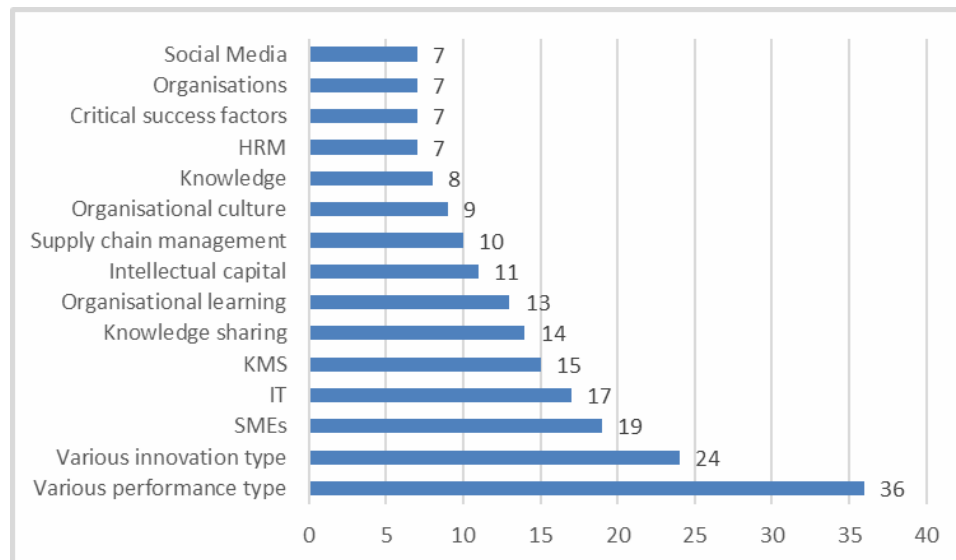


Figure 7 presents the most popular keywords. The list of individual keywords was drawn out from 282 articles, and 653 keywords were found. Firstly, the keyword dataset was absolved from overlaps and redundancies. For example, singular and plural forms of the same word (e.g., system and systems), different ways to express the same issue (e.g., IT and information technology), language versions of the same word (e.g., organisation and organisation) and presentational differences of the same keyword (e.g., organisation culture and organisational culture or data mining and data mining). Additionally, the keyword 'knowledge management' was excluded from the search, as it is the original search word for the articles. After purifying the dataset, 582 keywords, 416 of these being unique, were left. Keyword analysis showed that various performance types (i.e., organisational, economic, financial, job, management, project, strategy, and team financial performance), various innovation types (i.e., organisational, product,

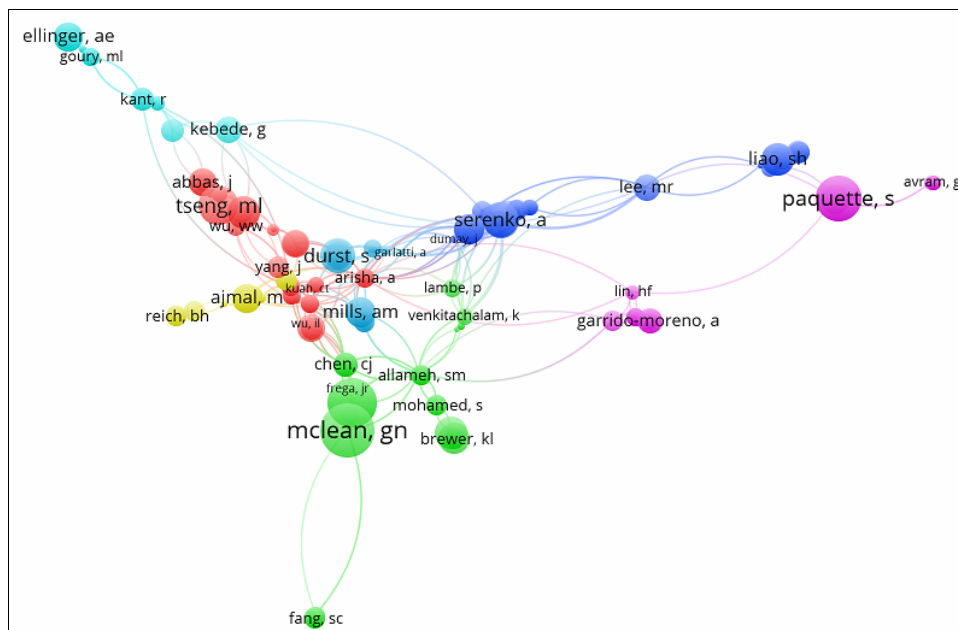
administrative, disruptive, open, process, strategy and technical innovation), SMEs and IT were the most frequently used keywords.

4.2 Mapping KM

In order to establish the difference between using citation relations rather than co-citation and bibliographic coupling, all three networks have been visualised in the study. The disadvantage of bibliographic coupling and co-citation relations is that they are indirect relations, therefore are expected to provide less precise information regarding relatedness of articles; although the advantage of citation relations regarding this issue is based on the period of analysis. This especially causes a problem when the period of the analysis is short, as some publications may not have direct citation relations with other publications during this period. This problem is not the case with bibliographic coupling and co-citation relations (van Eck and Waltman, 2017).

From the visualisation of citation relations between authors shown below, we can deduce that Mclean has received the most citations among the authors. Each circle depicts an author, the larger the size of the circle, the more citations the author has received (see Figure 8). The different colours of the circles represent different clusters. The closer the circles are to each other, the stronger their relation in terms of citations. The curved lines (i.e., links) also represent the strength of the relationship between authors. The bolder the line, the more links between the two items.

Figure 8 Citation relation of authors (see online version for colours)



In the map presented in Figure 9, each circle represents an author. The larger the circle of an author, the more publications they have. The closer two circles (authors) are to one another, the stronger they are related to each other based on bibliographic coupling (van Eck and Waltman, 2014). That is to say, authors located closer together in the

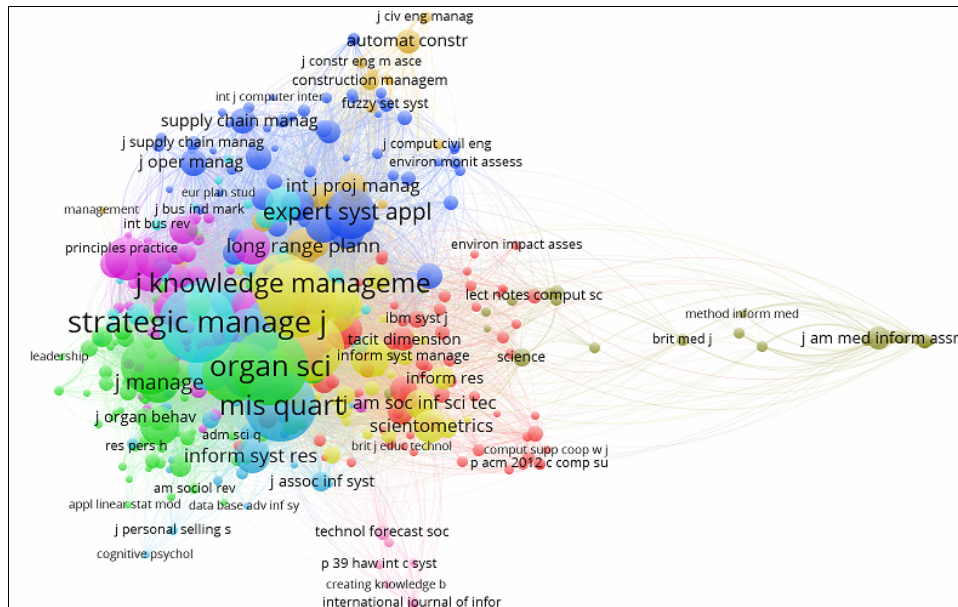
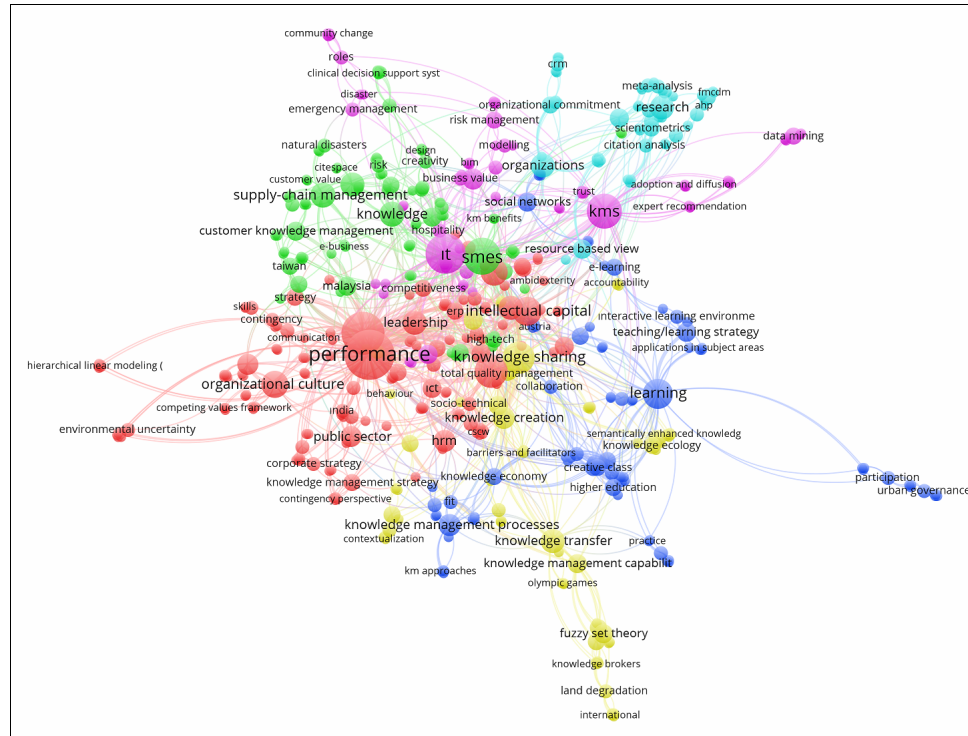
Figure 11 Co-citation analysis of sources (see online version for colours)

Figure 11 gives us the visualisation of the most cited journals. Scientific journals play a crucial role in the communication of knowledge as they are the main outlet of validation and dissemination of knowledge within the research community. The impact factor (IF) is widely used as an indicator of journal prestige by researchers, publishers and is the first quantifiable assessment of the quality of scientific journals (Lluch, 2005). The journal IF is produced regularly by the Institute for Scientific Information (ISI) and published in the Journal Citation Reports (JSR). The IF of a specific journal is used as an indicator of the quality and expected impact of papers published in it (Bordons et al., 2002). The Social Sciences Citation Index (SSCI) and Science Citation Index (SCI) are classified under ISI-JCR databases. As it is clear, the *Journal of Knowledge Management* is among one of the most-cited journals, this is to be expected as it is a KM-based journal. The most prominent journals that can be seen on the map (e.g., *Journal of Knowledge Management*, *MIS Quarterly*, *Expert Systems and Application*, and *Strategic Management Journal*) all being SCI or SSCI indexed journals might support consideration of KM as a serious discipline on its own.

Presented in Figure 12 is a co-occurrence map of keywords. 'Knowledge management' was excluded from the keywords as it was the original search criterion in our data query. The keywords were also double-checked for spelling differences and erroneous information. This map shows both the trend of KM based articles and the profile of the journals that they are published in. The large circles on the map depict the keywords that have occurred the most in KM-related publications. Performance, IC, innovation, IT, knowledge sharing, KMS and SMEs can be said to be the most frequent keywords as they have the largest size. An alignment with the keywords shown in Figure 7 can be seen, as the previously mentioned top keywords, all appear in the chart.

Figure 12 Co-occurrence of keywords (see online version for colours)



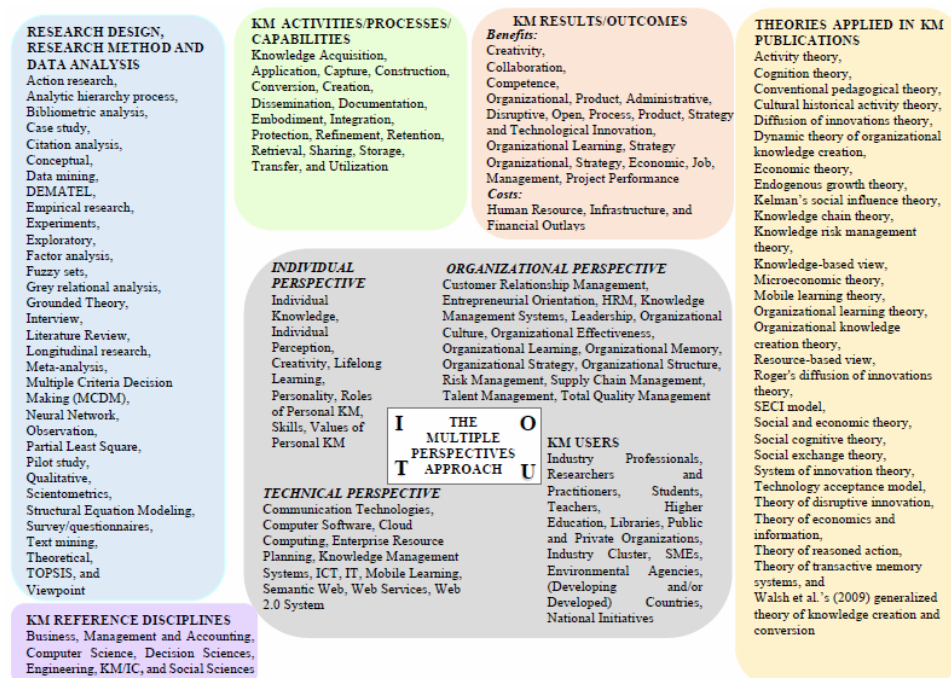
The Vosviewer software has assigned the keywords into six clusters. These clusters have been named accordingly:

- learning perspective of KM (dark blue cluster)
- knowledge and KM processes/capabilities/activities (yellow cluster)
- critical success factors and results of KM (red cluster)
- KMS and the role of IT (pink cluster)
- managerial and social issues in KM and measurement (light blue cluster)
- dynamic capabilities and KM environment (green cluster).

Overall, as Figure 12 demonstrates, this map produces the six major themes present within the KM literature between the years 2010–2015. The learning perspective of KM cluster, the name taken from Fteimi (2015) and Lytras and Pouloudi (2006), contains the keywords teaching/learning strategy, interactive learning environment, higher education among others. The knowledge and KM processes/capabilities/activities cluster, taken from Alavi and Leidner (2001) and Fteimi (2015), involve the keywords knowledge sharing, knowledge creation, knowledge transfer, KM process, KM capabilities to name a few. The critical success factors taken from Heisig (2009) and Fteimi (2015) and results are taken from Chauvel and Despres (2002) holds keywords such as organisational aspects of KM, performance, organisational learning, organisational culture, leadership and KM strategy. The KMS and the role of the IT cluster were named accordingly from

Ragab and Arisha (2013) contains the keywords technology diffusion, IS alignment, IS implementation, and socio-technical change. The managerial and social issues in KM and measurement cluster taken from Ragab and Arisha (2013) includes the keywords TOPSIS, AHP, research, bibliometric analysis, HR, CRM, social network, organisations, organisational commitment and resource-based view along with many others. Lastly, after examining the categories related to KM within the study of Cepeda and Vera (2007), the cluster containing the keywords SMEs, e-business, customer KM, creativity, social capital and supply-chain management was named dynamic capabilities and KM environment.

Figure 13 The KM classification framework (see online version for colours)



Source: Adapted from Kör and Mutlutürk (2017)

4.3 KM framework

Frameworks define the relevant objects and their consistency as well as providing a structure for aspects that have to be considered (Pawlowski and Bick, 2015) during the normative and empirical views of KM. They also provide an outline of the different circumstantial aspects, IF as well as outcomes (Pawlowski and Bick, 2015). The framework, in this study, covers different topics and insights in KM discipline rather than referring a single special KM topic (e.g., theories, models and environment) or a single KM perspective. The KM framework gives a summary of research design, method and data analysis (based on Fteimi, 2015; Kör and Mutlutürk, 2017), KM activities/processes/capabilities (based on Mishra and Uday Bhaskar, 2011; Sandhawalia and Dalcher, 2011; Seleim and Khalil, 2011; Kör and Mutlutürk, 2017), KM results/outcomes

(based on Chauvel and Despres, 2002; Fteimi, 2015; Kör and Mutlutürk, 2017), theories applied in KM publications (Tzortzaki and Mihiotis, 2014; Fteimi, 2015; Kör and Mutlutürk, 2017), and KM reference disciplines (based on Fteimi, 2015; Kör and Mutlutürk, 2017). In addition, this study introduces a KM framework drawing upon Linstone's (1984, 1999) multiple-perspectives approach integrating the technical, organisational and personal perspectives and KM users (based on Fteimi, 2015; Pawlowski and Bick, 2015; Serenko, 2013) which form the heart of the framework. The technical perspective (T) reflects the scientific method as found in science and engineering and takes a rational approach to problem-solving (Mitroff and Linstone, 1993). "The organisational (O) and personal (P) perspectives reflect the respective subjective views of the groups and individuals involved" [Turpin et al., (2009), p.28]. KM users (U) reflect the unit of KM processes. The perspectives and categories were assembled from various works and were filled with the literature review, keyword and topic dataset resulting from the bibliometric and scientometric methods conducted in this study.

5 Conclusions and implications for further research

The purpose of this study was to determine the stage of KM within the developmental life-cycle of a discipline (Serenko and Dumay, 2015a) by analysing KM citation classics and examining their characteristics using a combination of bibliometric and scientometric methods, visualising the outcomes, as well as presenting a normative framework of the field. The study was carried out by essentially obtaining the most cited 282 articles from KM and non-KM centric journals according to Google Scholar using Harzing's Publish and Perish software.

Based on the findings of our study, several implications arise that should be explored further:

Implication #1 The KM discipline is progressing towards normal science and academic maturity.

Within the findings of this study, there are indicators that KM is progressing toward a normal science. The term progressing is used to underline the fact that while some findings point towards maturity, others let us conclude that the KM discipline is still evolving. The studies of Serenko and Dumay (2015a, 2015b) and Bedford and Lewis (2015) support this claim. Indicators that point to maturity within the results are the increase in co-authored articles, the addition of new topics (e.g., social network, mobile learning, e-learning, social media and distance education), the existence of developing countries within citation classic authors and KM based articles appearing in non-KM centric journals. Although there is no significant theory in the KM domain, Nonaka being in the centre of the map of co-citation analysis shows that a majority of authors have cited Nonaka in KM-related publications. This, in turn, presents the organisational knowledge creation (or dynamic theory of organisational knowledge creation) theory of Nonaka to be used commonly throughout these publications, which might be an indicator of the maturity of the KM discipline.

Serenko and Dumay (2015a), state that the KM discipline is at the pre-science stage but has been gradually progressing towards academic maturity. Based on the argument that critical works related to empirical evidence should be given more weight than

normative studies, we can infer that should the citation count of empirical citation classic articles be higher than that of normative studies, the field in question has matured into a normal science. In conclusion, it can be said that studying the methods chosen from works regarding KM can give insight into the maturity level of a field. It can be inferred that KM is progressing towards maturity due to the fact that articles based on empirical studies have drawn more attention than normative studies as is the case in well-established scholarly fields according to Serenko and Dumay (2015b). The increase in empirical studies gives us a sense that KM is progressing towards maturity compared to the years before 2010 in Serenko and Dumay's (2015a) study where normative studies were the majority. Although seemingly heading in the right direction, KM still has a way to go in regards to becoming an advanced scholarly discipline. It is concluded that the superstar effect does not exist within the KM publications examining within this study. Many authors are publishing a single paper then would be if the superstar effect were present (Serenko et al., 2011). Few authors (e.g., Serenko and Durst) publishing more than one paper supports the absence of the superstar effect during the investigation period. The lack of the superstar effect also known as the Matthew effect which is the occurrence of disproportionate distribution of citations among a small percentage of scholars or organisations who produce a large number of works within a field (Serenko and Dumay, 2015a), allows us to conclude that KM has not yet reached the final stage of maturity. This conclusion can be traced to a variety of factors. An example of one of these factors is that the KM field has a global appeal, also accepting publications from international authors as opposed to only the dominant countries (i.e., UK and USA).

Implication #2 KM scholars should be more engaged in international collaboration.

The clear trend towards multi-authored publications supports the theory that KM is maturing as Serenko and Dumay (2015a) and Lipetz (1999) claim that there is a positive relationship between the number of authors per article and a field's maturity. This theory stems from the notion that as a domain matures, competition for journal publications increase and acceptance rates decline. This, in turn, leads to authors coming together in order to produce more quality publications in hopes to ensure their acceptance (Akhavan et al., 2016; Serenko et al., 2010). The results of this study support this claim as a trend towards multiple-authored works can be seen. Given the results of this study, the conclusion that KM is not a fad, but a clear trend in progress (Tzortzaki and Mihiotis, 2014) can be drawn.

From the results of collaboration within our study (see Table 5 and Figure 5), the percentage of international collaboration between authors is generally higher than the percentage of no collaboration during the investigation period. According to Serenko and Dumay (2015a), for KM to develop effectively, there is need for union of different points of view. Additionally, it is clear that the importance of international collaboration has been understood by researchers because it has been shown that international collaboration publications are cited more than non-collaboration articles (Glänzel, 2001; Narin et al., 1991; van Raan, 1998). International collaboration can help bring new aspects of KM to life; therefore, researchers need to collaborate on an international scale.

Implication # 3 KM is a diverse discipline spanning across a broad spectrum of concepts.

The results of our keyword visualisation reflect the key concepts within the KM domain. It can be seen that KM publications span a broad spectrum of disciplines. The clusters

spread across the map but some are also intertwined on some items which may imply that KM is gradually focusing on dominant fields but it may also imply that the research trend in KM is still evolving (Lee and Chen, 2012).

In evaluating the six clusters from the keyword co-occurrence map and subsequently naming them in accordance with their items, we can conclude that there are six main themes dominant in examined KM publications: learning perspective of KM, knowledge and KM processes/capabilities/activities, critical success factors and results of KM, KMS and the role of IT, managerial and social issues in KM and measurement, dynamic capabilities and KM environment. The keywords also support the theory that the KM discipline touches upon human and behavioural issues (soft approach) and technological issues (hard approach), subsequently supporting Serenko's (2013) belief that KM research will shift to soft issues as can be seen by the appearance of keywords such as IC, organisational learning, leadership and performance in the visualisation of keyword co-occurrences (see Figure 12). As can be seen from our visualisation of the co-occurrence of keywords of KM, IC has gained significant momentum within the field of KM, again proving Serenko's (2013) prediction that the future generation of KM may shift its focus on to IC to be right on point. The diversity of KM can also be seen when looking at the visualisation of the top journals that the KM articles have been published in. The significant presence of the *Journal of Strategic Management* tells us that institution based work has grown stronger as is said to be the case between the years 2000–2013, known as the third generation (Serenko, 2013), said to accommodate previous generations by focusing on the strategic perspective. The pictorial representation of the capability development established by Chatterjee (2016) shows that both technological capability and business-domain capability enhance firm performance. This is parallel to the visualisation of the keywords in this study as performance, IT, learning, IC and business capabilities are present and relatively at a near distance to each other.

The absence of the philosophy of knowledge both within the keyword co-occurrences and after Serenko's (2013) study paves the way to the conclusion that the concept of knowledge, which constitutes the basis of the KM domain, has been progressively comprehended and disseminated within the field showing signs of maturity.

Implication #4 Developing countries have joined the ranks as the most productive countries having the most significant impact on the development of KM.

As indicated in Figure 6, Taiwan along with the USA accounts for 30% of citation classics authors. Other developing countries such as Iran and India also take place on the list of highest scoring KM publications. This outcome differs from that of other studies such as Serenko and Dumay (2015a) where no developing countries were present. The presence of developing countries such as China, India, Taiwan, South Korea, Thailand, Malaysia and Iran on the list of top ten organisations with the highest document count to calculate institutional and country productivity may suggest that KM may potentially offer a competitive advantage and help develop knowledge-intensive economies (Serenko et al., 2010). These countries are non-English speaking countries but have contributed to KM research in English language journals. Therefore, it is safe to say that these authors have also published non-English publications related to KM and that their overall output may be significantly higher than that recorded in this study.

Focusing on the issue of KM becomes a critical challenge for Arab countries to enhance their advantage in the global economy (Sabri, 2005). Still, addressing the issue

of KM proves a challenge in Arab countries due to their strong linkage to their managerial and organisational capabilities and the quality of their IC and workforces which are embedded within a predominant bureaucratic organisational structure and power corporate culture (Dadfar, 1993; Hofstede, 1991; Muna, 1980). Furthermore, Al-Khatib (2001), and Shihabeddin (2002), argue that Arab countries lag in knowledge attainment (research and development) and knowledge acquisition (education and training) causing a knowledge gap between them and developed countries (as cited in Sabri, 2005). Looking at the top ten organisations within this study, it can be said that the knowledge gap between Arab nations and other developed countries is gradually closing as the Islamic Azad University (Iran) is the second most productive organisation in terms of KM publications.

Shie and Meer (2010a, 2010b) asserted that the fields like innovations, KM and IC gain momentum in the knowledge-intensive era where knowledge plays a critical role in this new epoch. In accordance with the implications of the knowledge role including the conversion of regulations, organisations and institutes, developing countries should move toward the knowledge-based economy (Shie and Meer, 2010a, 2010b). South Korea and Taiwan (i.e., East Asian tiger economies) and China and India (i.e., the two largest emerging economies) are succeeding in their manoeuvring in both the hardware and software sectors that indicate Asia's rise in the knowledge-based economy (Shie and Meer, 2010a). Additionally, Thailand was not present in Serenko and Dumay's (2015a) study, but it can be seen within this study under the 'others' category. In this context, Huang et al. (2007, p.13) stated that "Thai government has attempted to refocus its economic development initiatives in the direction of building an information- and knowledge-intensive economy", and the agrarian-based economic structure of Thailand gradually altered to an information-based economy in the late 20th century (Huang et al., 2007; Intarakumnerd and Panthawi, 2003; Kojima, 2004). Based on the previous discussions, it may sound reasonable that these countries are the most productive countries for KM research (as seen in Figure 6). Regarding the presence of countries such as China, South Korea, Taiwan, and India on the list of the top contributors to the KM discipline, these countries are generally regarded as having achieved success in high-tech industries which presents the question whether collective learning has equipped Asian countries to compete in the knowledge-based economy (Huang et al., 2007; Shie and Meer, 2010a).

Implication #5 The KM discipline is driven more by academics than by practitioners.

KM has received growing interest from researchers and practitioners parallel with the requirement of knowledge-intensive products and services and the rapid development of technologies of information (Alavi and Leidner, 2001; Dwivedi et al., 2011; Lee and Chen, 2012).

All authors published their articles under the affiliation of a total of 264 different organisations, 45 of which are practitioner organisations (e.g., Deutsche Bundesbank, Dell, Korea Information System Consulting and Audit, Naples Municipality, Partner Healthcare Systems ...) have been found as a result of the examination of the publications within this research. Therefore, it can be said that an average practitioner-researcher contributes less frequently than an average academic researcher to the KM body of knowledge as only 17% of all authors published their articles under the affiliation of practitioner organisations. Serenko et al. (2011) claim this to be a sign that the discipline has been moving towards academic maturity. It has been suggested that, as

the KM discipline continuous to advance towards academic maturity, the role of practitioners will inevitably decline, and the gap between academia and practice will grow uniformly (Serenko, 2013). Even though practitioners rarely read academic papers to utilise scientific findings (Serenko, 2013), knowledge existing in peer-reviewed journals is delivered to practitioners through indirect knowledge dissemination channels (Booker et al., 2008).

Implication #6 A normative framework giving a summary of the KM discipline may guide researchers on where to focus on future research.

The framework presented in this study gives a summary of the common grounds of the various frameworks within the KM domain and contributes to a mutual understanding of terminology, concepts, activities and methods used in KM. This assigns direction to researchers on where to focus future research efforts. Additionally, it helps to identify the potentially relevant topics that have not yet been considered (Fteimi, 2015).

As the purpose of the framework needed in the current situation is to be able to map all existing and future research within the KM discipline, the framework refers to the sum of different KM perspectives and their interplay, as well as encompasses all aspects of the KM discipline as established from bibliometric and scientometric methods. The root of the framework is also characterised by the multiple-perspectives approach (i.e., technical, organisational and personal perspectives), which is based on Linstone's (1984, 1999) multiple-perspectives approach. These perspectives are related to several other items and cover different topics or insights like KM environments, stakeholders, theories, methods, as well as KM results and outcomes, including cost and benefits. In doing so, the framework summarises the common grounds in the KM discipline. This framework can be used as the foundation towards the harmonisation of the KM discipline because it provides a holistic view of and integrates the bibliometric and scientometric and visualisation findings. The holistic view of the KM discipline may guide researchers on where to focus their future research by revealing the core of the field (Fteimi, 2015).

With regard to the practical implication, businesses can use the framework as an overview of the current variety of frameworks, their main issues, and the themes covered by the research. This, in turn, can simplify the search process for suitable solutions for any given problem which may occur during the implementation of KM to their businesses (Fteimi, 2015).

The above-mentioned implications create the motivation for this bibliometric and scientometric analysis. Our main aim was to understand the identity and structure of the KM domain by looking at its maturity level through an assessment of its institutional performance, reputational structure and knowledge growth. To the best of the author's knowledge, there is a gap regarding using both bibliometric and scientometric methods, subsequently visualising the outcome and developing a general framework of KM. We believe that we have responded to this gap in the literature and produced an overview of the current trends of the KM domain.

6 Limitations and future research directions

As with all studies, there are a few limitations. Therefore, the results should be viewed in light of these limitations. Firstly, only works published in English peer-reviewed journals were taken into account. Books, proceedings and professional journal works were

excluded as well as works published in languages other than English. Another limitation stems from using co-citation analysis. Newly published articles may not have ample time to receive citations. In addition to these limitations, the number of publications is significantly lower in 2015, because of the minimum cut-off citation count and short period of time to be cited. Most importantly, it should not be forgotten that this study is aimed to be in keeping with that of Serenko and Dumay (2015a), hence the small time frame (i.e., 2010–2015) as a means to depict whether the studies of KM have continued to progress the way they have claimed after their specific time frame, which is 1997–2009. Therefore, these implications are limited within the time frame of our study and should be viewed in this context. However, this study may be useful for researchers and practitioners as for the former, it can help them gain useful insights into the field of KM early in their career. Future studies in this field may use other analytical approaches and compare the results (Sedighi and Jalalimanesh, 2014). Lastly, this study reflects the view of the authors and their interpretation of the dataset. Thus, other visualisations such as topic classification to citations could be added to enrich the study. The authors hope that this study will be beneficial to all stakeholders of the KM discipline and that other researchers may further expand this study and provide an update.

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