Winter 1-25-2020

Global Research Productivity in Knowledge Management: an Analysis of Scopus Database

Abdoulaye Kaba
Al Ain university, kaba_abdoulaye@yahoo.com

Chennupati K. Ramaiah
Pondicherry University

Global Research Productivity in Knowledge Management: an Analysis of Scopus Database

Abstract

The main objective of this study is to investigate and analyze global research productivity in knowledge management (KM) research published from 1960 to 2017 and indexed in Scopus database. It is the first scientometric study investigating and analyzing 56 years of KM literature indexed in Scopus. The study used scientometric approach to identify and analyze bibliographic information of 63474 documents retrieved, in August 2018, from Scopus database. KM research productivity has grown from a single digit in 1960 to four digits in 2003. The results of the study indicate that, for the past 20 years (1997-2017), KM research recorded 63141 documents compared to 333 documents in 36 years (1960-1996), and the year 2009 emerged as the most productive year. China appeared leading the world in respect to the institutional productivity and took the second position, after the USA, as the most productive country in KM research. Findings of the study showed conference proceedings leading the types of publications followed by the journals, and book series. The "Journal of Knowledge Management" leads the top 10 journals in the number of publications, while the journal of "Expert Systems with Applications" top the list in the number of citations. A total of 4134 unique contributors produced an average of 15.35 papers from 1960-2017; and the top three authors are from Australia, USA, and Norway. Findings of the study could be a useful report for knowledge workers, academic institutions, and government agencies who are interested in improving KM projects and scientific research.

Keywords - Knowledge management, KM, Scientometric, Research, Literature, Scopus

1. INTRODUCTION

Contemporary dictionaries define “knowledge” as synonym of facts, acquaintance, familiarity, awareness, understanding, comprehension, realization, experience, expertise, skills, and know how (Cambridge University Press, 2008; Oxford Student's Dictionary of English, 2001). Likewise, many writers and researchers have used the term data and information as synonym for “knowledge” (McElroy, 1999). Data is a collection of symbols, facts, numbers, raw materials; while information is a meaningful explanation of data. We produce and provide information through explanations and analysis of data. According to Thierauf (1999), data is an unstructured collection of facts and figures; information is structured data. For data to become information it must be contextualized, categorized, calculated and condensed (Davenport & Prusak 2000). Information thus paints a bigger picture; it is data with relevance and purpose (Bali, Wickramasinghe and Lehaney, 2009). It may convey a trend in the environment, or perhaps indicate a pattern of sales for a given period of time. Ackoff (1989, 1996) postulated that information is found by answering who, what, where, when, and how questions.

As part of epistemology, philosophers and scholars attempted earlier to understand the nature and characteristics of knowledge (Plato, 2007; Welbourne, 2001; Michelini, 2003). Plato, in his attempt defined knowledge as “justified true belief” (Schmitt, 1992; Welbourne, 2001; O’hara, 2001; Pardi, 2011). According to Nozick (1981, p.208) “Knowledge is not simply true belief”, justification of perceptions, ideas, believes, actions, and behavior are needed in order to turn a true belief into knowledge (David, 2001). Knowledge is associated with having or being able to generate an argument in defense of one’s beliefs. According to Foley (2001), some kind of knowledge requires justification while others do not. Suan Haack, an English philosopher, believes that it is always wrong to believe something without sufficient justification (Steup, 2001). Knowledge includes experience, values, insights, contextual information, and incorporation of new experiences, and the creation of new knowledge, and so forth (Adenfelt & Lagerström, 2006; Alipour, Idris, & Karimi, 2011; Crompton, 2002). Nonaka and Toyama (2003) believe that knowledge is not just a part of reality but it is a reality viewed from different angles.

The term Knowledge Management (KM) first appeared in the American literature in the late 1980s, but received considerable attention in the 1990s (McInerney & Koenig, 2011). According to Serenko (2013), KM emerged as a set of professional practices from the growing pressure on organizations to improve efficiency and competitiveness. Today, KM research and publications are found in all the disciplines and specializations such as computer sciences, engineering, business and management, medical sciences, social sciences, etc. The term refers to the coordination and exploitation of knowledge resources for creating benefits and competitive advantage (Drucker, 1999). It involves deliberate and systematic coordination of an organization’s people, technology, processes, and organizational structure in order to add value through reuse and innovation (Dalkir, 2011), and requires an organization to create, preserve, disseminate, and use knowledge as needed (Kaba & Ramaiah, 2017).

Scientometrics is a method or technique to study sciences (Leydesdorff and Milojević 2015). The method was initiated in 1960s to improve information retrieval (Serenko 2013). Today scientometrics is used for a variety of objectives and purposes such as tracking the history of disciplines, measuring the level of communications and collaborations among scientists; and identifying contribution of individuals,

institutions, and countries to scientific research (Hess, 1997). This study is using scientometric approach to investigate and analyze KM literature from 1960-2017. Results of the study should contribute to the improvement of KM research.

2. REVIEW OF LITERATURE

Scholars and experts have conducted many studies to analyze knowledge management literature. Some of these studies targeted single journals (Barik & Jena, 2013; Thanuskodi & Umamaheswari, 2013), or multiple journals (Serenko, Bontis, Booker, Sadeddin, & Hardie, 2010; Abdullah and Timan, 2010). Similarly, some of the previous studies used single database (Qiu & Lv, 2014; Sedighi & Jalalimanesh, 2014; Kokol, Zlahtic, Zlahtic, Zorman, & Podgorelec, 2015; Akhavan, Ebrahim, Fetrati, & Pezeshkan, 2016; Wang, Zhu, Song, Hou, & Zhang, 2018), while others used multiple databases (Ceballos, Fangmeyer, & Nathalı, 2017) in investigating research productivity on knowledge management.

Barik and Jena (2013) analyzed 180 research papers published from 2008-2012 in the *Journal of Knowledge Management Practice* published by *The Leadership Alliance* (TLA) in Canada. Findings of the study showed that USA led the countries or territory with 34 publications; single author produced more than 42% of the papers, and the papers had 19 average citations. Thanuskodi and Umamaheswari (2013) used the *Electronic Journal of Knowledge Management* (EJKM) published by the *Academic Conferences and Publishing International* in UK. The authors analyzed 197 articles appeared in the journal from 2007-2011. Findings of the study showed that multiple authors produced more than 62% of the papers, while single authors produced 37% of the papers. Another study by Sahoo, Meher and Mohanty (2017) analyzed papers published in the EJKM journal from 2003-2013. Results of the study reveal that multiple authors produced majority of the papers, recording 0.70 degree of collaboration among the authors. Recently, Gaviria-Marin, Merigo, and Popa (2018) used bibliometric approach to investigate performance and science mapping of Journal of Knoweldge Management. Findings of the study indicated a positive evolution in the number of publications, and the USA and the UK top the number of publications among countries.

Serenko et al. (2010) examined 11 major journals on knowledge management and intellectual capital from 1994-2008. The authors identified 3,109 unique authors from 1,450 unique institutions. Findings of the study showed that the top five universities and academics generated only 2.5% of the total research output. On the other hand, during 1994-2004 and 2005-2008 periods, the number of single-authored papers dropped from 45% to 34%. The five leading countries; the USA, the UK, Australia, Spain and Canada; generated 57% of the entire research output. Twenty-one percent of all research was generated by the USA. According to the authors, this indicate that nations do not have equal contributions to knowledge management research. Abdullah and Timan (2010) examined 184 papers appeared in three knowledge management journals from 2003-2008. The authors identified 350 authors from 46 countries. Majority of the authors are from Europe, US, Australia, and Canada.

On the other hand, a number of researchers have used single database in analyzing knowledge management. Surulinathi, Amsaveni, Maheswaran, and Srinivasaraghavan (M. et al., 2009) used Scopus database to analyzed the growth and development of knowledge management in India. They identified 51 papers produced by researchers from 1999-2007. The authors identified five authors with zero

contribution, and more than 5 authors contributed to less than one paper. Moreover, the publication behavior indicated that Knowledge management researchers were very selective in publishing knowledge management papers. Similarly, Kokol et al. (2015) used Scopus database in mapping approach to determine the main research topics and the contexts in knowledge management research from 1977-2014. The authors found 2007–2011 the most productive period, while the USA, the UK, and China were the most productive countries.

In addition to Scopus database, a number of researchers have used Web of Science database in analyzing knoweldge management research. Qiu and Lv (2014) used Web of Science (WOS) database to investigate scientific output on knowledge management from 1993-2012. Findings of the study revealed an increase from 1993-2009 in publication outputs, publications name, and authors. The USA, China, the UK, and Germany were the top productive countries, while Hong Kong Polytechnic University and National Cheng Kung University were the top productive institutions. Collaborations among the top productive institutions were infrequent. Sedighi and Jalalimanesh (2014) also used Web of Science (WoS) in mapping research trends in the field of knowledge management. The authors analyzed 50,862 research articles published from 2001 to 2010. Findings of the study indicated 10.9% of yearly growth for KM publications, while the subject areas of knowledge management changed and expanded from 2004-2010. In addition, Akhavan et al. (2016) used Web of Science (WoS) in discovering major trends in knowledge management research, while Wang et al. (2018) used it in visualizing knowledge management as an academic discipline.

In regards to multiple databases, Ceballos et al. (2017) used both Current Research Information System (CRIS) and Web of Science databases to investigate the Mexican a university research productivity, from 2000-2014, in knowledge management. Results of the study showed an increase in scientific collaboration among the authors from 2003 to 2014. The current study uses Scopus database to investigate knowledge management literature published from 1960 to 2017. It is one of the largest study to be conducted on knowledge management research. Findings of the study should contribute to research productivity on knowledge management. Table 1 summarizes review of literature.

Table 1: Summary of Literature Review

			Number of Publications Used		Number of Databases Used	
S.N.	Author(s)	Method Used	Single Publication	Multiple Publications	Single Database	Multiple Databases
1.	Surulinathi et al. (2009)	Scientometric	X	√	√	X
2.	Serenko et al. (2010)	Scientometric	X	√	X	X
3.	Abdullah & Timan (2010)	Bibliometric	X	√	X	X
4.	Serenko (2013)	Scientometric	X	√	X	√
5.	Barik & Jena (2013)	Bibliometric	√	X	X	X
6.	Thanuskodi & Umamaheswari (2013)	Bibliometric	√	X	X	X
7.	Qiu & Lv (2014)	Bibliometric	X	√	√	X

8.	Sedighi & Jalalimanesh (2014)	Scientometric	X	√	√	X
9.	Kokol et al. (2015)	Bibliometric	X	√	√	X
10.	Akhavan et al. (2016)	Bibliometric	X	√	√	X
11.	Ceballos et al. (2017)	Scientometric	X	√	X	√
12.	Sahoo et al. (2017)	Bibliometric	√	X	X	X
13.	Wang et al. (2018)	Bibliometric	X	√	√	X
14.	Gaviria-Marin et al. (2018)	Bibliometric	√	X	X	X

Note: √ symbol means the author (s) used that item, and X means the author (s) did not used that item.

3. RESEARCH OBJECTIVES

The main purpose of this study is to investigate and analyze global research productivity in knowledge management research based on documents indexed in Scopus database from 1960 to 2017. The paper intends to achieve the following objectives:

1. To highlight the Growth Pattern of Knowledge Management Research
2. To identify the most productive authors in knowledge management research
3. To identify the most productive institutions in knowledge management research
4. To identify the most productive counties in knowledge management research

4. DATA COLLECTION

Data were collected from Scopus in August 2018. The researchers used "knowledge management" term as search option for the field of title, abstract, keyword and timespan 1960-2017 to retrieve relevant documents. The search strategy matches 63474 documents containing the term "knowledge management". The retrieved documents were divided among sixteen document types. The top three document types are conference paper (59.70%), followed by article (31.46%), and book chapter (2.89%). On the other hand, three types of documents, i.e. abstract report, business article, and retracted recorded the lowest number of documents. Table 2 summarizes document types of knowledge management research literature in Scopus database from 1960 to 2017. The retrieved documents were downloaded and processed to identify characteristics of publication, growth pattern, subject categories, institutional productivity, author productivity and collaboration.

Table 2: Distribution of document types

S. No.	Document Type	Rank	Number of Document	Share of Total Document
1.	Conference Paper	1	37899	59.701%
2.	Article	2	19974	31.468%
3.	Book Chapter	3	1837	2.894%
4.	Review	4	1827	2.878%
5.	Conference Review	5	899	1.416%
6.	Editorial	6	374	0.589%
7.	Book	7	341	0.537%

8.	Note	8	106	0.166%
9.	Short Survey	9	105	0.165%
10.	Article in Press	10	64	0.100%
11.	Letter	11	34	0.053%
12.	Erratum	12	7	0.011%
13.	Report	13	4	0.006%
14.	Abstract Report	14	1	0.001%
15.	Business Article		1	0.001%
16.	Retracted		1	0.001%
		Total :	63474	100%

5. FINDINGS

5.1 Growth of Knowledge Management Research

Table 3 presents research growth of "knowledge management" from 1960 to 2017. The table shows that out of 63474 publications, the highest number of research out (11% of documents) were published in 2009, followed by 2010 (10% of documents), and 2011 (9% of documents). On the other hand, no single document was published on knowledge management in 1961, 1963-1965, 1967, 1970, 1972, 1974-1976, and from 1978 to 1979. Similarly, only one publication was published in 1960, 1962, 1966, 1968, 1971, 1973, and 1981. On the other hand, the highest number of citation was recorded in 2016 with 6402 citations, followed by 2017 with 6394 citations, and 2015 with 6184 citations (see Figure 1). The average citation per document, total citation divided by total documents, is 0.88 from 1960-2017.

Table 3: Global Research Output in Knowledge Management

Year of Publication	Number of Document	Share of Total Documents	Number of Citation	Year of Publication	Number of Document	Share of Total Documents	Number of Citation
1960	1	0.001%	0	1996	45	0.070%	8
1962	1	0.001%	0	1997	139	0.218%	10
1966	1	0.001%	0	1998	149	0.234%	11
1968	1	0.001%	0	1999	334	0.526%	23
1971	1	0.001%	0	2000	546	0.860%	53
1973	1	0.001%	0	2001	737	1.161%	134
1977	2	0.003%	0	2002	991	1.561%	301
1980	4	0.006%	0	2003	1376	2.167%	519
1981	1	0.001%	0	2004	1367	2.153%	622
1982	6	0.009%	0	2005	2148	3.384%	1356
1983	4	0.006%	0	2006	2387	3.760%	1709
1984	5	0.007%	0	2007	3701	5.830%	2183
1985	8	0.012%	0	2008	5567	8.770%	2770
1986	17	0.026%	0	2009	6983	11.001%	3518
1987	18	0.028%	1	2010	6406	10.092%	3843
1988	22	0.034%	0	2011	6242	9.833%	4063
1989	45	0.070%	0	2012	4383	6.905%	4686

1990	27	0.042%	0	**2013**	4213	6.637%	5402
1991	13	0.020%	3	**2014**	3879	6.111%	5889
1992	17	0.026%	2	**2015**	4106	6.468%	6184
1993	30	0.047%	3	**2016**	3803	5.991%	6402
1994	33	0.051%	4	**2017**	3684	5.803%	6394
1995	30	0.047%	7				

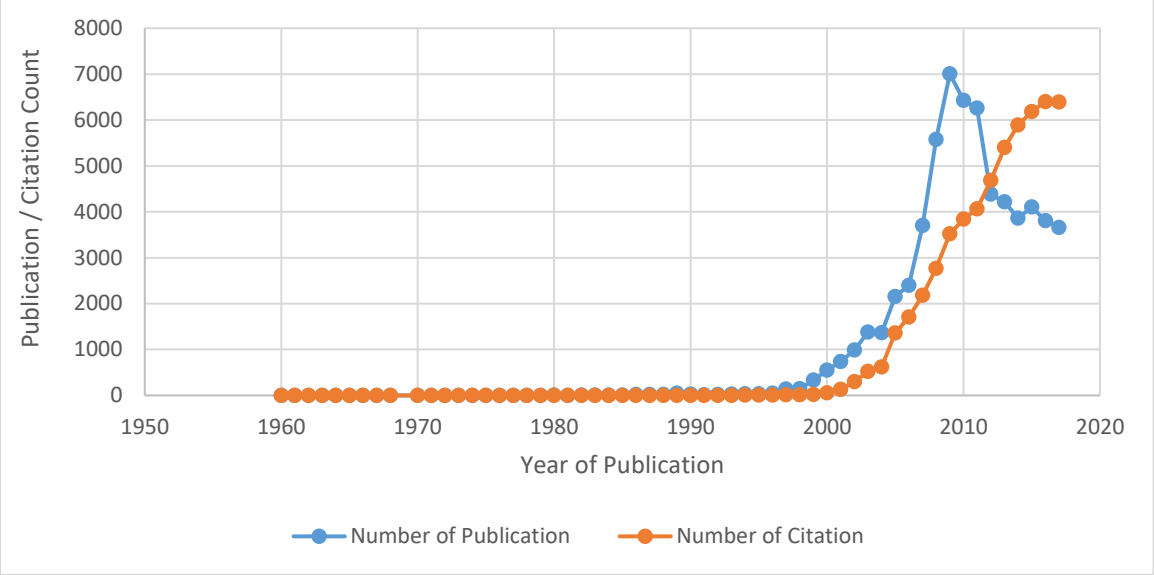

Figure 1. Comparing the Growth with the Number of Citation in KM Research

5.2 Types of Publications

Scopus database classifies the publications of knowledge management research into six source types. The six sources are books, book series, journals, conference proceedings, reports, and trade publications. Conference proceedings leads the list with 31503 documents appeared in 37 proceedings, followed by journals with 21332 documents appeared in 159 journals. Book series occupied the third position with 8126 documents appeared in 100 book series, followed by books with 2150 documents appeared in 159 books, and trade publications 354 documents appeared in 166 publications. Reports are in the sixth and last position with only three documents appeared in one report entitled "HP Laboratories Technical Report". Six documents were not included in any types of documents. Figure 2 illustrates that researchers and experts of knowledge management around the world produced within 18 years (2000 – 2017) a total of 62492 documents. The highest number of documents were published during the 8 years period (2010-2017).

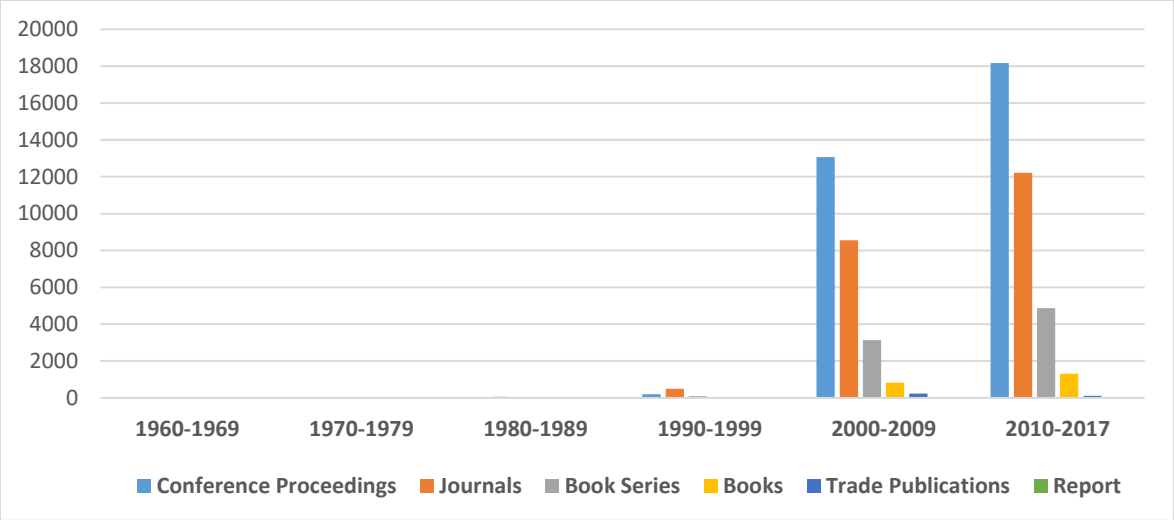

Figure2: Distribution of Publication Type

5.3 Top 10 Journals

As stated in the previous section, Scopus database categorizes knowledge management documents into six groups. The groups are books, book series, journals, conference proceedings, reports, and trade publications. By considering the number of documents, journals take the second position after conference proceedings and before book series. A total of 159 journals published 21339 documents. Table 4 presents the top 10 journals of knowledge management based on the number of documents from 1960 to 2017, and the journal performance report in 2017.

According to the number of documents, the "Journal of Knowledge Management" top the list with 857 documents, followed by "Expert Systems with Applications" (290 documents), and "Journal of Information and Knowledge Management" (267 documents). However, in respect to the number of citations, the journal of "Expert Systems with Applications" top the list with 11226 citations for 290 documents, indicating 38.71 average citation per paper. The "International Journal of Information Management" takes the second positions with 1573 citation for 143 papers, recoding 11 average citation per paper; while the "Journal of Knowledge Management" comes in third position with 631 citation for 857 papers, registering 0.73 citation per paper.

Moreover, by looking at the citation scores of the top 10 journals, the "International Journal of Information Management" leads the list with 5.78 scores (SJR = 1.373, SNIP = 2.824), followed by the journal of "Expert Systems with Applications" with 5.22 scores (SJR = 1.271, SNIP = 2.449), and the "Journal of Knowledge Management" with 3.2 scores (SJR = 0.922, SNIP = 1.746). From the bottom list of the top 10 journals, "Journal of Information and Knowledge Management" recorded 0.60 as the lowest citation score (SJR = 0.190, SNIP = 0.560), followed by "International Journal of Knowledge Management" (Citation Score = 0.87, SJR = 0.261, SNIP = 0.681), and journal of "Technology and Process Management" (Citation Score = 1.10, SJR = 0.328, SNIP = 0.802).

Table 4: Top 10 Journals

Rank	Journal	Total Paper	Total Citation	Average Citation	Citation Score	SJR	SNIP
1.	Journal Of Knowledge Management	857	631	0.73	3.12	0.922	1.746
2.	Expert Systems With Applications	290	11226	38.71	5.22	1.271	2.449
3.	Journal Of Information And Knowledge Management	267	71	0.26	0.60	0.190	0.560
4.	Vine: Journal of Information and Knowledge Management Systems*	255	83	0.32	1.12	NA	NA
5.	Knowledge Management Research And Practice	232	168	0.72	1.51	0.445	0.813
6.	International Journal Of Technology Management	180	180	1.00	1.31	0.411	0.698
7.	Knowledge And Process Management	161	56	0.34	1.10	0.328	0.802
8.	International Journal Of Knowledge Management	146	45	0.30	0.87	0.261	0.681
9.	International Journal Of Information Management	143	1573	11.00	5.78	1.373	2.824
10.	Learning Organization	133	81	0.60	1.11	0.345	1.024

JR = SCImago Journal Rank, SNIP = Source Normalized Impact per Paper * Based on 2015 report

5.4 Subject and Keyword Frequencies

Knowledge management research can be related to many disciplines and specializations. Table 5 contains subject area frequencies related to knowledge management research indexed in Scopus database. Based on the Scopus outputs, computer science recorded the highest subject area in knowledge management research (31.36%), followed by business, management, and accounting (15.97%), and engineering (12.86%). Meanwhile, a total of 160 keywords are used in Scopus for identifying knowledge management documents. The keywords appeared 252728 times with knowledge management research. Figure 3 illustrates the keywords used for indexing KM documents in Scopus. According to the findings "knowledge management" top the list with 21.96%, followed by "information management" (2.89%), and "knowledge based systems" (2.27%). On the other hand, the keyword "industry" recorded the lowest use with knowledge management documents (0.099%), followed by both "research" and "information retrieval" keywords by achieving only 1% of total keywords.

Table 5: Subject Area of Knowledge Management Research

Subject Area	Total Papers (%)	Subject Area	Total Papers (%)
Computer Science	33107(31.36)	Physics and Astronomy	607(0.57)
Business, Management and Accounting	16865(15.97)	Biochemistry, Genetics and Molecular Biology	583(0.55)
Engineering	13578(12.86)	Agricultural and Biological Sciences	537(0.50)
Decision Sciences	12216(11.57)	Health Professions	509(0.48)
Social Sciences	8624(8.17)	Chemical Engineering	414(0.39)
Mathematics	8151(7.72)	Pharmacology, Toxicology and Pharmaceutics	292(0.27)
Medicine	2207(2.09)	Nursing	222(0.21)
Environmental Science	1582(1.49)	Multidisciplinary	218(0.20)
Economics, Econometrics and Finance	1558(1.47)	Chemistry	216(0.20)
Arts and Humanities	874(0.82)	Neuroscience	143(0.13)
Energy	868(0.82)	Immunology and Microbiology	76(0.07)
Earth and Planetary Sciences	748(0.70)	Veterinary	14(0.01)
Materials Science	684(0.64)	Dentistry	12(0.01)
Psychology	637(0.60)		

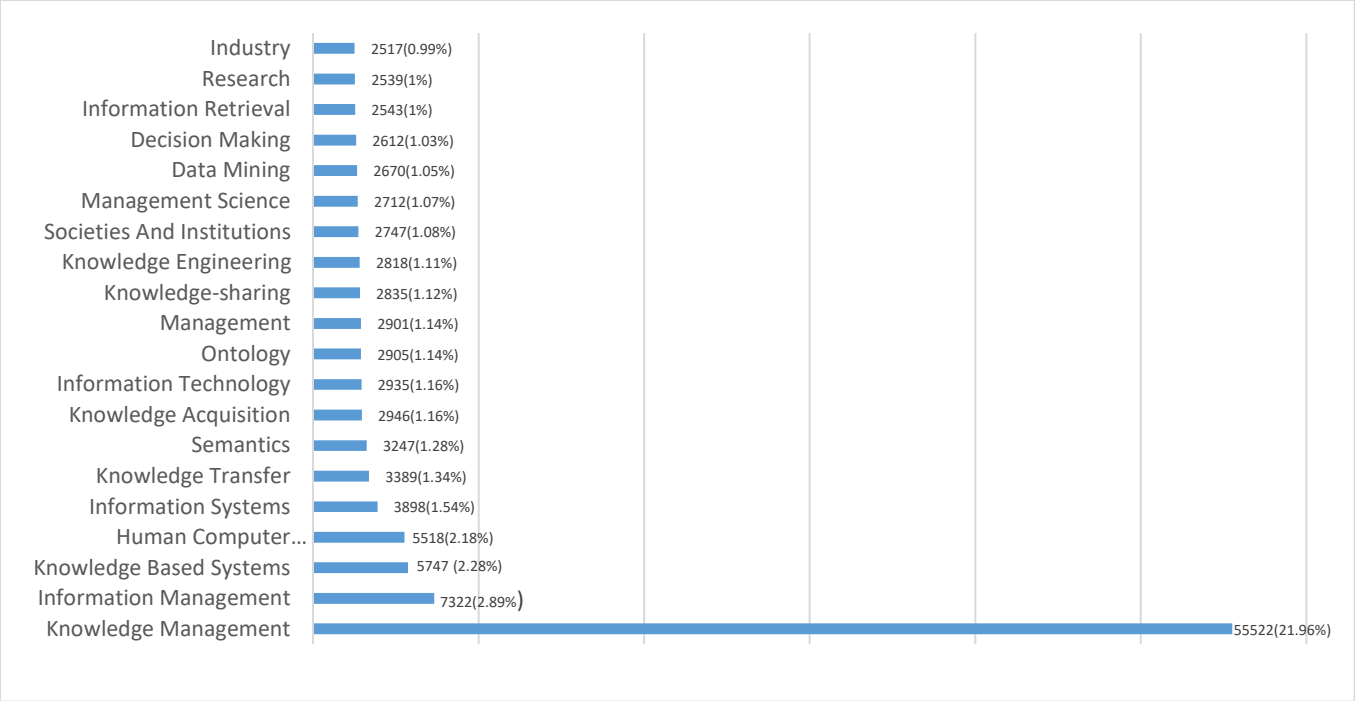

Figure 3: Keywords Used for Indexing KM Documents

5.5 Top 10 Productive Authors

The bibliographical data of retrieved documents are analyzed to determine the number and names of the authors and contributors. A total of 4134 unique and no duplicated authors contributed to knowledge management research. This indicates an average of 15.35 papers produced by a single author from 1960-2017. It is noteworthy to know that this average does not include 1103 documents identified in Scopus with unknown authors. Furthermore, of the 4134 unique authors identified, 13 names shared tp 10 positions as contributors to knowledge management research by producing at least 43 publications each. As presented in Table 6, two of the top 10 authors are from USA and UK, and from each of Australia, Austria, Canada, , Iran, Italy, France, Norway, Malaysia, and Spain.

Moreover, the most productive top five authors are Wickramasinghe from Deakin University, Australia (73 documents), Jennex from San Diego State University, USA (65 documents), Gottschalk from Handelshoyskolen BI, Norway (57 documents), Maier from University of Innsbruck, Austria (53 documents), and Bali from Coventry University, UK (52 documents). However, by looking at the number of citations for the documents published by the top authors, Bontis from Canada top the list with 33.02 average citation per paper, followed by Desouza from the USA with 28.2 average citation per paper, and Maier from Austria with 15.69 average citations per paper. The fourth position went to Edwards from UK with 9.93 average citations, while Jennex from the USA took the fifth position with 8.76 average citation.

Table 6: Top 10 Productive Authors

S. No.	Author	Intuition	Country/ Territory	Rank	TP*	TC*	ACP*
1.	Wickramasinghe, N.	Deakin University	Australia	1	73	448	6.13
2.	Jennex, M.E.	San Diego State University	USA	2	65	570	8.76
3.	Gottschalk, P.	Handelshoyskolen BI	Norway	3	57	442	7.75
4.	Maier, R.	University of Innsbruck	Austria	4	53	832	15.69
5.	Bali, R.K.	Coventry University	UK	5	52	225	4.32
6.	Akhavan, P.	Malek Ashtar University of Technology	Iran	6	50	382	7.64
7.	Abdullah, R.	Universiti Putra Malaysia	Malaysia	7	49	89	1.81
8.	Bolisani, E.	Universita degli Studi di Padova	Italy	8	45	253	5.622
9.	Desouza, K.C.	Arizona State University at the Downtown Phoenix Campus	USA		45	1269	28.2
10.	Bontis, N.	McMaster University	Canada	9	44	1453	33.02
11.	Edwards, J.S.	Aston University, Birmingham	UK	10	43	427	9.93
12.	García-Peñalvo, F.J.	Universidad de Salamanca, Salamanca	Spain		43	237	5.51
13.	Matta, N.	Universite de Technologie de Troyes	France		43	95	2.20
*TP = Total Papers, TC= Total Citations, ACP=Average Citation Per Paper.				Total	1519	19040	489.292

5.6 Top 10 Productive Institutions

Findings of the study indicate that authors affiliated to 160 academic institutions produced 23500 out of 63474 documents, while contributors from non-academic instantons produced the remaining documents. Six out of 160 institutions have publication outputs of more than 250 documents. Table 7 lists the top 10 institutions based on the total of publication outputs, including single and multiple author papers. Five of the top 10 intuitions are from China and Hong Kong, two from the USA, and only one institution from the remaining countries. The most productive two institutions are “Chinese Academy of Sciences” with 423 documents and “Tsinghua University” with 366 documents. Both Hong Kong Polytechnic and National University of Singapore share the third position with 289 documents for each. From the bottom list, “National Cheng Kung University” recorded the lowest contribution with 235 papers, followed by “Wuhan University” with 236 papers, and “Carnegie Mellon University” with 242 papers.

In regards to the collaboration among the authors affiliated to the top 10 institutions, authors from both “Tsinghua University” and “National Cheng Kung University” lead the list with an average of 0.97 collaboration per paper, followed by “Chinese Academy of Sciences” (0.96 average collaboration per paper). For the third position, both the “Centre National de la Recherche Scientifique” and “Zhejiang University” recorded 0.95 average collaboration per paper.

On the other hand, the lowest collaboration is observed with both "Multimedia University" from Malaysia and "Wuhan University" from China. These two universities recorded 0.88 average collaboration per paper, followed by "Loughborough University" from the UK, with 0.90 average collaboration per paper, and "Hong Kong Polytechnic University" which recorded 0.92 average collaborating per paper. "

Table 7: Top 10 Productive Institutions

S. No.	Institution	Country / Territory	Rank	TP*	SAP*	MAP*	Average Collaboration Per Paper
1.	Chinese Academy of Sciences	China	1	423	16	407	0.96
2.	Tsinghua University	China	2	366	9	357	0.97
3.	National University of Singapore	Singapore	3	289	15	274	0.94
4.	Hong Kong Polytechnic University	Hong Kong		289	23	266	0.92
5.	Centre National de la Recherche Scientifique	France	4	260	11	249	0.95
6.	Multimedia University	Malaysia	5	255	30	225	0.88
7.	Zhejiang University	China	6	249	11	238	0.95
8.	Pennsylvania State University	USA		249	17	232	0.93
9.	Loughborough University	UK	7	244	22	222	0.90
10.	Carnegie Mellon University	USA	8	242	14	228	0.94
11.	Wuhan University	China	9	236	26	210	0.88
12.	National Cheng Kung University	Taiwan	10	235	6	229	0.97

*TP = Total Papers, SAP= Number of Single Author Papers, MAP= Number of Multiple Authors' Papers

5.7 Top 10 Productive Countries

A total of 167 countries and territories are linked to knowledge management research; however, 10 countries or territories top the list with more than 70% of global output. The total share of these countries varied from 3% to 18% of global outputs. The USA leads the world with 18.91%, followed by China (12.42%), U.K (8.56%), Germany (7.40%), and Australia (4.30). It is interesting to know that, the contributions of researchers affiliated to these top five countries account for more than 50% of global share (Table 8).

Results of the study indicate collaboration in knowledge management research among the top 10 productive countries. The findings showed that 18335 (28.88%) of the global outputs (63474 documents) are published as local and international collaboration among authors. Again, researchers from the USA top the list with 4479 collaborative publications, followed by UK with 3027 collaborative publications, and Germany with 2234 collaborative publications. Further analysis revealed that researchers from the USA and China lead the list of interaction with 533 papers, followed by researchers from UK and USA with 431

papers, and researchers from Germany and UK with 259 publications (see Table 8). In general, of the top 10 countries, scientists from the USA interacted with scientists from six countries, scientists from UK interacted with other scientist from five countries.

Table 8. Top 10 Productive Countries

S.N0	Country	Total Papers (%)	Collaboration (%)	Top Collaborated Country (no./%)
1.	USA	12022(18.91)	4479(37.25)	China (533/4.34)
2.	China	7928(12.47)	1733(21.85)	USA(533/6.57)
3.	UK	5440(8.56)	3027(55.64)	USA(431/7.75)
4.	Germany	4708(7.40)	2234(47.45)	UK(259/5.40)
5.	Australia	2736(4.30)	1338(48.90)	USA(203/7.22)
6.	France	2453(3.86)	1413(57.60)	UK(139/5.52)
7.	Italy	2413(3.79)	1229(50.93)	UK(168/6.78)
8.	Spain	2325(3.65)	1335(57.41)	UK(156/6.46)
9.	Canada	2155(3.39)	1219(56.56)	USA(310/14.09)
10.	Taiwan	1940(3.05)	328(16.90)	USA(142/7.23)
	Total	32098 (50.47)	18335 (57.12%)	

6. DISCUSSION

The main objective of this study was to investigate and analyze global research productivity in knowledge management based on literature indexed in Scopus database from 1960 to 2017. The paper has reported the growth pattern of knowledge management research, frequency of keywords and subject terms, types of publications, level of productivity for authors, institutions, and countries. Findings of the study showed that, KM research productivity has grown from a single digit in 1960 to four digits in 2003. As found by the previous studies (Akhavan et al., 2016, Qiu & Lv, 2014), the year 2009 emerged as the most prolific year in terms of the number of document. Moreover, our analysis revealed that for the past 20 years, i.e. from 1997 to 2017, KM research recorded 63141 documents compared to 333 documents recorded during 36 years, i.e. from 1960 to 1996. This indicates how KM research has become popular in the world. Beside individual scholars and researchers, the discipline has attracted the attention of many countries (Biygautane & Al-yahya, 2011), industries and organizations(Nonaka, Byosiere, Borucki, & Konno, 1994; Pástor, Šipikal, & Rehák, 2013), and academic institutions (Kaba & Ramaiah, 2018; Abdulla, Djebarni, & Mellahi, 2011) resulting in continues and significant growth of the discipline.

Findings of the study found conference proceedings leading the types of publications followed by the journals. The finding is in line with the previous studies (Qiu & Lv, 2014; Ceballos et al., 2017; Kokol et al., 2015). Of course, publishing in conference proceedings is relatively easier than publishing in scholarly journals. In addition, conference proceedings take less time to publish as compared to journals. However, journals are expected to publish and produce quality papers than conference proceedings. Therefore, it is

not surprising to find conference proceedings with the highest number of documents produced in knowledge management research.

Results of the study indicate that 159 journals published 21339 documents and "Journal of Knowledge Management" top the list with 857 documents. However, in respect to the number of citations, the journal of "Expert Systems with Applications" top the list with 11226 citations for 290 documents. By considering the citation scores of the top 20 journals, the "International Journal of Information Management" leads the list with 5.78 scores (SJR = 1.373, SNIP = 2.824). These findings indicate that no single journal is dominating the publication of knowledge management research. Different journals have different performance in regards to the number of documents, number of citations, and level of citation scores. Therefore, citation databases, such as Scopus and WoS, are using these criteria in rating the KM journals.

Like other indexing databases, Scopus database uses subject and keyword terms to identify and retrieve documents. As found by Kokol et al. (2015), the majority of research in knowledge management are related to computer science. This is proven by finding the term "computer science" on the top of the list of subject terms for knowledge management documents. For the keywords, "knowledge management" top the list with 21.96%. These two terms are essential in retrieving KM documents. Therefore, researchers should use them in identifying and retrieving documents related to knowledge management.

In regards to authors' contributions, findings of the study identified 4134 unique authors with an average of 15.07 research papers' contributions for each author. This average is higher than the averages reported in similar studies (Akhavan et al., 2016; Wang et al., 2018; Ceballos et al., 2017). This may be because the types of documents, number of documents, and the number of years investigated in this study are different from that investigated by other researchers. Meanwhile, results of the study found Professor Nilmini Wickramasinghe of Deakin University (Australia) top the list of authors with 73 papers, followed by Dr. Murray Jennex of San Diego State University (USA), and Professor Petter Gottschalk of Handelshoyskolen BI (Norway). However, by looking at the number of citations for the documents published by the top 10 authors, Professor Nick Bontis of McMaster University (Canada) top the list with 33.02 average citation per paper, followed by Kevin C. Desouza from the USA with 28.2 average citation per paper, and Ronald K. Maier from Austria with 15.69 average citations per paper. Based on these findings, no single author is absolutely leading the contributions to knowledge management research.

In term of institutional affiliations, findings of the study revealed that the most productive institutions is "Chinese Academy of Sciences", followed by "Tsinghua University". Both Hong Kong Polytechnic and National University of Singapore share the third position. This finding is in contrast with Serenko et al. findings (2010) in which the top three institutions were from UK, Denmark, and Australia. In regards to the collaboration among the authors affiliated to the top 24 institutions, authors from both "Tsinghua University" and "National Cheng Kung University" lead the list with an average of 0.97 collaboration per paper, followed by "Chinese Academy of Sciences", and "Beihang University", and Universiti Teknologi Malaysia. These three institutions share the second positon with an average of 0.96 collaboration per paper for each. Unlike the academic institution affiliation, the analysis of country affiliation found the USA leading the world in contributions to knowledge management research. The finding is in line with the results of the previous studies (Serenko et al., 2010; Serenko, 2013; Qiu & Lv, 2014; Gaviria-Marin et al., 2018). Similarly,

researchers from the USA top the list with 4479 collaborative publications, followed by UK with 3027 collaborative publications, and Germany with 2234 collaborative publications.

However, it is interesting to see Chinese academic institutions leading the Americans and the Europeans in knowledge management research. It is not clear how and why this is happening? Is it because of an increase in knowledge management research in China or multiple institutional affiliations among Chinese scholars and researchers? However, a study by Huang, Chang, and Chen (2012) reported a great progress in paper production and citation impact in China. The report also indicated a rapid growth in patents over the past years in Taiwan and Korea. Future studies may investigate possible reasons behind China leadership in knowledge management research.

7. CONCLUSION

This study has successfully investigated and analyzed global research in knowledge management literature indexed in Scopus database from 1960 to 2017. The paper has reported the growth of knowledge management research, frequency of keywords and subject terms, types of publications, level of productivity for authors, institutions, and countries. Followings are the major concluding statements:

1. The research productivity of knowledge management has grown from a single digit in 1960 to four digits in 2003. The year 2009 emerged as the most prolific year in terms of the number of document, and conference proceedings dominated the types of publications.
2. Different journals have different performance in regards to the number of documents, number of citations, and level of citation scores.
3. It is necessary to use "computer science" and "knowledge management" in identifying and retrieving documents related to knowledge management since a large majority of KM documents are indexed under these two terms.
4. It is possible to get different findings from different scientometric or bibliometric studies because of differences in the types of documents, number of documents, and the number of years investigated in each study.
5. The number of publications and citations are important indicators to identify authors' contributions in research productivity. By considering the two criteria, no single author found leading the contributions to knowledge management research.
6. The level of productivity in knowledge management research has grown dramatically in China for the past 20 years. The country together with the related territories led the world in respect to the institutional affiliations, also took the second position as the most productive country in the world.

References

Abdullah, S. and Timan, H. (2010), Knowledge management: a bibliometric analysis of open access journals, Proceedings of the International Conference on Information Retrieval & Knowledge Management, IEEE, Shah Alam

Abdulla, J., Djebarni, R., & Mellahi, K. (2011). Determinants of job satisfaction in the UAE: A case study of the Dubai police. Personnel Riview, 40(1), 126–146. http://doi.org/10.1108/00483481111095555

Ackoff, R. (1989). From data to wisdom. Journal of Applied Systems Analysis, 16: 3-9.

Ackoff, R. (1996). On learning and systems that facilitate it. Center for Quality of Management Journal, 5(2): 27-35

Adenfelt, M., & Lagerström, K. (2006). Enabling knowledge creation and sharing in transnational projects. International Journal of Project Management, 24(3), 191–198. https://doi.org/10.1016/j.ijproman.2005.09.003

Alipour, F., Idris, K., & Karimi, R. (2011). Knowledge creation and transfer: Role of learning organization. International Journal of Business Administration, 2(3), 61–67. https://doi.org/10.5430/ijba.v2n3p61

Akhavan, P., Ebrahim, N. A., Fetrati, M. A., & Pezeshkan, A. (2016). Major trends in knowledge management research: a bibliometric study. Scientometrics, 107(3), 1249–1264. http://doi.org/10.1007/s11192-016-1938-x

Bali, R. K.I, Wickramasinghe, N., & Lehaney, B. (2009). Knowledge management primer. London: Routledge

Barik, N., & Jena, P. (2013). Bibliometric Analysis of Journal of Knowledge Management Practice, 2008-2012. Library Philosophy and Practice (e-Journal), e-journal(1020), 1–10. Retrieved from http://digitalcommons.unl.edu/libphilprachttp://digitalcommons.unl.edu/libphilprac/1020

Dalkir, K. (2011). Knowledge management in theory and practice. Cambridge, MA: MIT Press.

Davenport, T. H. &Prusak, L. (2000).Working knowledge: How organizations manage what they know. Boston, MA: Harvard Business School Press.

David, M. (2001).Truth as epistemic goal. In Mathias Steup (ed.), knowledge, truth, and duty: Essays on epistemic justification, responsibility, and virtue. Oxford: Oxford University Press.

Drucker, P. F. (1999). Management challenges for the 21 Century. New York: Harper Collins.

Foley, R. (2001). Intellectual trust in oneself and others. UK: Cambridge University Press.

Cambridge University Press. (2008). Cambridge advanced learner's dictionary (3rd. ed.). Cambridge University Press.

Ceballos, H. G., Jr., J. F., Galeano, N., Juarez, E., & Cantu-Ortiz, F. J. (2017). Impelling research productivity and impact through collaboration : a scientometric case study of knowledge management. Knowledge Management Research & Practice, (15), 346–355. http://doi.org/10.1057/s41275-017-0064-8

Crompton, H. (2002). Knowledge production and management in the 21st century (No. WPS045). Manchester: Manchester Metropolitan University. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.104.412&rep=rep1&type=pdf

Gaviria-Marin, M., Merigo, J. M., & Popa, S. (2018). Twenty years of the Journal of Knowledge Management: a bibliometric analysis", Journal of Knowledge Management, 22 (8),1655-1687. https://doi.org/10.1108/JKM-10-2017-0497

Hess, D. J. (1997). Science Studies: An advanced introduction. New York: New York University Press.

Huang, M. H., Chang, H. W., & Chen, D. Z. (2012). The trend of concentration in scientific research and technological innovation: A reduction of the predominant role of the U.S. in world research & technology. Journal of Informetrics, 6(4), 457–468. http://doi.org/10.1016/j.joi.2012.03.003

Kaba, A., and C.K. Ramaiah. 2018. "Investigating Knowledge Acquisition among Faculty Members." Interdisciplinary Journal of Information, Knowledge, and Management 13. https://doi.org/10.28945/3940.

Kokol, P., Zlahtic, B., Zlahtic, G., Zorman, M., & Podgorelec, V. (2015). Knowledge Management in Organizations: A Bibliometric Analysis of Research Trends (Vol. 224, pp. 3–14). http://doi.org/10.1007/978-3-319-21009-4

Leydesdorff, L., & Milojević, S. (2015). Scientometrics. In International Encyclopedia of the Social & Behavioral Sciences: Second Edition (pp. 322–327). http://doi.org/10.1016/B978-0-08-097086-8.85030-8

M, S., N, A., K, M., & Srinivasaraghavan, S. (2009). Scientometric Dimensions of Knowledge Management Research in India : A Study based on Scopus database. Sri Lankan Journal of Librarianship and Information Management, 2(2), 13–24.

McElroy, M. W. (1999). The knowledge life cycle. A paper presented in ICM conference on Knowledge Management, Miami, Florida, April 1999.

Michelini, A. N. (Editor). (2003). Plato as author: the rhetoric of philosophy. Leiden, NLD: Brill Academic.

McInerney, Claire R. & Koenig, Michael E. D. (2011) Knowledge Management (KM) Processes in Organizations: Theoretical Foundations and Practice. Williston, USA: Morgan & Claypool

Nonaka, I., & Toyama, R. (2003). The knowledge-creating theory revisited: Knowledge creation as a synthesizing process. Knowledge Management Research & Practice, 1, 2-10. https://doi.org/10.1057/palgrave.kmrp.8500001

Nozick, R. (1981). Philosophical explanations. Cambridge, MA: Harvard University Press.

Pardi, P. (22 Sept., 2011). What is knowledge? Philosophy News. Retrieved March 18, 2012 from: http://www.philosophynews.com/post/2011/09/22/What-is-Knowledge.aspx

Plato; Benardete, S. (Translated by). (2007). Being of the beautiful: Plato's theaetetus, Sophist, and Statesman. Chicago, IL, USA: University of Chicago Press.

Pástor, R., Šipikal, M., & Rehák, Š. (2013). Knowledge creation and knowledge acquisition in the software industry in Slovakia: the case study of Košice region. Regional Science Policy & Practice, 5(4), 401–

415. http://doi.org/10.1111/rsp3.12018

Qiu, J., & Lv, H. (2014). An overview of knowledge management research viewed through the web of science (1993-2012). Aslib Journal of Information, 66(4), 424–442. http://doi.org/10.1108/AJIM-12-2013-0133

Sahoo, J. ;, Meher, G. ;, & Mohanty, B. (2017). Electronic Journal of Knowledge Management: A Bibliometric Analysis. Retrieved from http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=4689&context=libphilprac

Sedighi, M., & Jalalimanesh, A. (2014). Mapping research trends in the field of knowledge management, 19(1), 71–85.

Serenko, A. (2013). Meta-analysis of scientometric research of knowledge management : discovering the identity of the discipline. Journal of Knowledge Management, 17(5), 773–812. http://doi.org/10.1108/JKM-05-2013-0166

Serenko, A., Bontis, N., Booker, L., Sadeddin, K., & Hardie, T. (2010). A scientometric analysis of knowledge management and intellectual capital academic literature (1994-2008). Journal of Knowledge Management, 14(1), 3–23. http://doi.org/10.1108/13673271011015534

Schmitt, F. F. (1992). Knowledge and belief. Florence, KY, USA: Routledge.

Steup, M. (Editor). (2001). Knowledge, Truth, and duty: essays on epistemic justification, responsibility, and virtue. Cary, NC, USA: Oxford University Press.

O'Hara, K. (2001). Plato and the Internet. London: Icon Books.

Oxford University Press (2001). Oxford Student's Dictionary of English. Oxford, UK: Oxford University Press.

Thanuskodi, S., & Umamaheswari, P. (2013). Bibliometric Analysis of Electronic Journal of Knowledge Management. International Journal of Advanced Library and Information Science, 1(1), 23–32. Retrieved from http://scientific.cloud-journals.com/index.php/IJALIS/article/view/Sci-101

Thierauf, R. J. (1999). Knowledge management systems for business. Westport: Greenwood

Wang, P., Zhu, F. W., Song, H. Y., Hou, J. H., & Zhang, J. L. (2018). Visualizing the academic discipline of knowledge management. Sustainability (Switzerland), 10(3), 1–28. http://doi.org/10.3390/su10030682

Welbourne, M. (2001).Knowledge. Durham, Great Britain: Acumen