

Research paradigms of contemporary knowledge management studies: 1998-2007

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Abstract

Purpose – The purpose of this paper is to explore the research paradigms of contemporary knowledge management studies in the past decade using citation and co-citation analysis.

Design/methodology/approach – Research in any academic area often clusters into informal networks that focus on common questions in common ways, and the accumulated knowledge often flows between members of these networks, revealed in patterns of citations. The research paradigms of a given field can be identified by analyzing corresponding knowledge flows and citation and co-citation process. The methods used in the study include citation analysis, co-citation analysis, and social network analysis.

Findings – The paper draws an intellectual map of knowledge flows between knowledge management scholars. Key research themes and concepts as well as their relationships in the field of knowledge management are identified.

Research limitations/implications – An in-depth analysis of the relationships between knowledge management research and industrial practices should be conducted in future in order to examine the impact of academic research on knowledge management and the management of knowledge accumulated in the practice.

Originality/value – The paper profiles knowledge management studies in the past decade and presents a solid foundation for a better understanding of different research paradigms in the area of knowledge management. It helps identify the invisible network of knowledge management studies that traces the evolution of knowledge management research, which thus provides a new perspective on knowledge management research.

Keywords Knowledge management, Research, Literature, Knowledge management

Paper type Research paper

The past decade has seen extensive research on knowledge and knowledge management (Bontis and Serenko, 2009; Marymalavi and Leidner, 2006; Serenko and Bontis, 2009). With the rapid growth of knowledge economy, knowledge management has gradually developed into an independent academic field and a large number of researchers have begun to examine knowledge management. Yet even though knowledge management has established itself as an academic discipline, its establishment is a slow process as researchers in this area prefer to publish their best work in more established journals. Another obstacle to the development of knowledge management lies in the subject's unusually high degree of interaction with other disciplines. This overlapping blurs the boundaries of knowledge management and, as a result, its distinct theoretical model and analytical tools are unjustly attributed to other competing fields. With limited resources contributing to the development of knowledge management, the cross-fertilization of ideas between scholars in knowledge management will be much more difficult to obtain. Consequently, while there is no doubt that there exists an academic field of knowledge management, the question remains somehow unclear on what it is, how good its work is, and what its prospects and needs are for future development.

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“Even though knowledge management has established itself as an academic discipline, its establishment is a slow process as researchers in this area prefer to publish their best work in more established journals.”

The objective of this study is to provide knowledge management researchers with a unique map to better understand knowledge management related publications in the last decade and to provide a systematic and objective mapping of different themes and concepts in the development of knowledge management field. This study also attempts to help identify the linkage among different publications and confirm their status and positions in their contribution to the development of knowledge management field. The principal methods used are citation and co-citation analysis, social network analysis, plus a factor analysis which is performed to identify the invisible network of knowledge generation within the knowledge management literature.

Studies of academic literature: citation and co-citation analysis

There are a number of techniques that can be used to study a body of literature. The most frequent is a simple literature review, where a highly subjective approach is used to structure historical work in a given field. Objective and quantitative techniques have recently become popular with more online databases available for use. These techniques adopt author citations, co-citations, and systematic review (Pilkington and Teichert, 2006) to examine the invisible knowledge network in the communication process by means of written and published works of a given field. These techniques are attractive because they are objective and unobtrusive (Garfield, 1979).

Among various quantitative methods developed in the last three decades, citation analysis is the earliest and the most widely applied method that can be used to quantify academic communication process. Merton (1979) claimed: “Citation indexing has been a standard of scientific bibliography for more than a decade but its sociological and historical research potentials have not yet been fully realized”. Within all academic disciplines, researchers typically cluster into informal networks that focus on common questions in common ways (Price, 1963). Within these networks, one scholar's ideas and results may be picked up by another, extended, tested, and refined. Therefore, the history of exchanges between members of these networks, revealed in patterns of citations, describes the intellectual structure of a field. When one scholar cites prior work of another, citation analysis provides a means of documenting this process. Citation analysis is based on the premise that authors cite papers they consider to be important to the development of their research. Consequently, heavily cited articles are likely to have exerted a greater influence on the subject than those less frequently cited (Culnan, 1986; Sharplin and Mabry, 1985).

Similarly, co-citation analysis of documents records the number of papers that have cited particular pairs of documents and then, this process is interpreted as a measure of similarity of the contents of two co-cited documents. This approach is instrumental in identifying groupings of authors, topics, or methods and can help us understand the way in which these clusters correlate with each other (Pilkington and Liston-Heyes, 1999).

Several studies have used the citation and co-citation techniques to study the literature of management research (Ma *et al.*, 2008). For example, Ponzi (2002) explored the intellectual structure and interdisciplinary breadth of knowledge management in its early stage of development, using principle component analysis on an author co-citation frequency matrix; Serenko and Bontis (2009) further ranked the academic journals in knowledge management and intellectual capital; Etemad (2004) identified the most influential authors and studies in electronic commerce field by using citation analysis; Ramos-Rodriguez and Ruiz-Navarro

(2004) examined the intellectual structure change of strategic management research by conducting a bibliometric study of *Strategic Management Journal*; Acedo and Casillas (2005) explored the research paradigms of international management research by applying factorial analysis techniques in an author co-citation study. To the best of the authors' knowledge, no similar study has been conducted on contemporary knowledge management studies. Therefore this study aims to bridge the gap in knowledge management literature by applying citation and co-citation analysis to a representative sample of recent research on knowledge management collected by the Science Citation Index and the Social Sciences Citation Index.

Methodology

The citation data used in this study included journal articles, authors, publication journals, publication dates, and cited references. Based on the objective of this study, the authors explored the intellectual structure of knowledge management between 1998 and 2007. This time period was chosen because contemporary knowledge management studies of the last decade represent the most updated and probably also the most important research on knowledge management. Citation and co-citation analysis is the main method for this study. With citation and co-citation analysis, this research assumed three stages, each of which required different approaches to examining the development of knowledge management studies. First, the databases were identified as the sources of knowledge management publications. Then data collection and analysis techniques were designed to collect information about research topics, authors, and journals on knowledge management research.

In the second stage, the collected data were analyzed and systematized by sorting, screening, summing, sub-totaling, and ranking. After a series of operations, key nodes in the invisible network of knowledge in knowledge management were identified and the structures developed. In the final stage, the co-citation analysis was used and the intellectual knowledge network of knowledge management was mapped to describe the knowledge distribution process in knowledge management area.

In this study, the Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI) were used for analysis. SCI and SSCI are widely used databases, which include citations published in over 8,000 of the world's leading scholarly journals. While there are arguments that other online databases might also be used for such analysis, using SCI and SSCI provided the most comprehensive and the most accepted databases of knowledge management publications.

Unlike other prior studies, the data used in this study were not drawn from journals chosen by peer researchers (Walstrom and Leonard, 2000). Instead, the entire databases of SCI and SSCI from 1998 to 2007 served as the universe for analysis. In order to collect the data, the authors used "key word" method to search article titles and abstracts indexed SCI and SSCI. Using "knowledge management" as the key word, this study collected 1,230 journal articles which further cited 29,601 publications as references. The cited references in these papers included both books and journal articles.

Results

Citation analysis

To identify the major publications and scholars that have laid down the groundwork of knowledge management research, citation data were tabulated for each of the 1,230 source documents and 29,601 references using the Excel package. The citation analysis produced interesting background statistics, as shown in the following tables. Table I lists the most cited journals in the area of knowledge management in the last decade, among which *Organization Science*, *Harvard Business Review*, and *Strategic Management Journal* are the top three most cited journals, followed by *California Management Review* and *MIS Quarterly*. The knowledge management specific journal, *Journal of Knowledge Management*, is only

Table I The most cited journals

Journal	Total citations
<i>Organization Science</i>	612
<i>Harvard Business Review</i>	578
<i>Strategic Management Journal</i>	509
<i>California Management Review</i>	505
<i>MIS Quarterly</i>	371
<i>Sloan Management Review</i>	338
<i>Journal of Knowledge Management</i>	334
<i>Academy of Management Review</i>	270
<i>Communications of the ACM</i>	232
<i>Administrative Science Quarterly</i>	206
<i>Decision Support Systems</i>	206
<i>Management Science</i>	186
<i>Journal of Management Information Systems</i>	159
<i>Academy of Management Journal</i>	158
<i>Expert Systems with Applications</i>	151

ranked seventh in the knowledge management area. This result indicates, on the one hand, that several very prestigious organization and management journals such as *Organization Science* and *Strategic Management Journal* make the most important contribution to and remain the crucial communications forums for knowledge management studies. On the other hand, the majority of knowledge management research is published in non-knowledge management specific journals, and that there is still a long way before knowledge management develops into a fully-fledged field that can support its own knowledge generation and dissemination. The general pattern of the most cited journals shows that knowledge management research features organization- and general management-specific journals prominently, alongside the knowledge management-specific journals, with a cluster of information systems-focused titles also evident.

The most influential documents and the most influential scholars were then identified by their total counts of citation within the selected journal articles. As shown in Table II, the most cited knowledge management publication between 1998 and 2002 (the first five years) was Nonaka and Takeuchi's (1995) book *The Knowledge-creating Company: How Japanese Companies Create the Dynamics of Innovation*, followed by Davenport and Prusak's (1998) book *Working Knowledge: How Organizations Manage What They Know*, and Nonaka's (1994) paper "A dynamic theory of organizational knowledge creation" (see Table II). For the second five years (2003-2007), the first two most cited knowledge management publications

Table II Highly cited documents: 1998-2002

Frequency	Full citation index for document
104	NONAKA I, 1995, KNOWLEDGE CREATING C
71	DAVENPORT TH, 1998, WORKING KNOWLEDGE OR
44	NONAKA I, 1994, ORGAN SCI, V5, P14
29	POLANYI M, 1966, TACIT DIMENSION
26	DAVENPORT TH, 1998, SLOAN MANAGE REV, V39, P43
26	LEONARDBARTON D, 1995, WELLSPRINGS KNOWLEDG
21	RUGGLES R, 1998, CALIF MANAGE REV, V40, P80
20	HUBER GP, 1991, ORGAN SCI, V2, P88
20	NONAKA I, 1998, CALIF MANAGE REV, V40, P40
20	QUINN JB, 1992, INTELLIGENT ENTERPRI
20	STEWART TA, 1997, INTELLECTUAL CAPITAL
19	ARGYRIS C, 1978, ORG LEARNING THEORY
18	BROWN JS, 1998, CALIF MANAGE REV, V40, P90
18	COHEN WM, 1990, ADMIN SCI QUART, V35, P128
17	GRANT RM, 1996, ORGAN SCI, V7, P375
17	LAVE J, 1991, SITUATED LEARNING LE

were the same as in the first five years. The third most cited was Alavi and Leidner's (2001) paper "Knowledge management and knowledge management systems: conceptual foundations and research issues" (see Table III).

Journal articles and books combined, the top five most cited scholars between 1998 and 2002 (the first five years) were Nonaka, Davenport, Polanyi, Leonard-Barton, and Brown (see Table IV). For the second five years, the status of the most important scholars changed. The top five most cited scholars were Nonaka, Davenport, Alavi, Hansen, and Grant (see Table V). These scholars have the most influence in the development of knowledge management field and thus collectively define this field. Their contributions represent the main research focus in the field and thus give us an indication of the popularity of certain knowledge management topics as well as their historical values.

Although the citation analysis does not eliminate the bias against younger scholars, a paper-based ranking (as in Tables II and III) places more emphasis on the quality (as opposed to the quantity) of the documents produced by a given scholar than a ranking of authors based on the frequency with which a particular author has been cited (as in Tables IV and V). In addition, Tables II and III represent the key research themes in a field and give us an indication of the popularity of certain knowledge management topics. The readers can find high citations are associated to what can be termed field-defining titles and they lay down the ground work for the understanding of knowledge management as a distinct phenomenon.

Table III Highly cited documents: 2003-2007

<i>Frequency</i>	<i>Full citation index for document</i>
143	NONAKA I, 1995, KNOWLEDGE CREATING C
105	DAVENPORT TH, 1998, WORKING KNOWLEDGE OR
74	ALAVI M, 2001, MIS QUART, V25, P107
51	NONAKA I, 1994, ORGAN SCI, V5, P14
37	HANSEN MT, 1999, HARVARD BUS REV, V77, P106
32	COHEN WM, 1990, ADMIN SCI QUART, V35, P128
32	DAVENPORT TH, 1998, SLOAN MANAGE REV, V39, P43
28	GRANT RM, 1996, STRATEGIC MANAGE J, V17, P109
27	POLANYI M, 1966, TACIT DIMENSION
24	DAVENPORT T, 1998, WORKING KNOWLEDGE OR
24	LAVE J, 1991, SITUATED LEARNING LE
22	KOGUT B, 1992, ORGAN SCI, V3, P383
22	NAHAPIET J, 1998, ACAD MANAGE REV, V23, P242
22	SZULANSKI G, 1996, STRATEGIC MANAGE J, V17, P27
22	WENGER E, 1998, COMMUNITIES PRACTICE

Table IV Highly cited authors: 1998-2002

<i>Author</i>	<i>Frequency</i>
NONAKA I	201
DAVENPORT T	127
POLANYI M	57
LEONARDBARTON D	45
BROWN JS	41
GRANT RM	39
SENGE P	35
STEWART TA	30
HANSEN MT	29
WIIG KM	29
DRUCKER P	28
DRUCKER PF	27
KOGUT B	25
QUINN JB	25
RUGGLES R	25

Table V Highly cited authors: 2003-2007

<i>Author</i>	<i>Frequency</i>
NONAKA I	281
DAVENPORT TH	158
ALAVI M	78
HANSEN MT	66
GRANT RM	55
HOLSAPPLE CW	50
POLANYI M	49
BROWN JS	47
TEECE DJ	43
WENGER E	43
ZACK MH	40
LIEBOWITZ J	36
COHEN WM	32
RUGGLES R	31
KOGUT B	30
SPENDER JC	30

A comparison between Tables II and III reveals some interesting patterns from the first five years (1998-2002) to the second five years (2003-2007). First, the two most influential publications in the last decade remain the same, indicating their dominant status for the past decade in knowledge management studies. This is also true for the two most influential scholars in the last decade.

Second, the most cited publications in the first five years have relatively smaller number of citations, comparing with the publications in the second five years. The gradual increase in total citations supports the evolving process of knowledge management research as an academic field and the process of gaining more recognition in the literature. Third, the most influential papers in the first five years and the second five years do not change much. For example, among the top five most cited publications, three of them were the same, even though the rankings were slightly different. In particular, the publications of Nonaka and Davenport took four spots in the top five most cited publications in the first five years; and similarly they took three spots in the top five most cited publications in the second five years. This indicates the development in knowledge management is slow and a few classical works and influential authors still dominate knowledge management research. More efforts and theoretical breakthroughs are thus needed in order to further advance the development of knowledge management research.

Co-citation analysis

In this stage, data mapping was conducted and an intellectual structure of current knowledge management studies was revealed. Co-citation analysis is a bibliometric technique that information scientists use to map the intellectual structure of an academic field. It involves counting documents from a chosen field – paired or co-cited documents. Co-citation analysis compiles co-citation counts in matrix form and statistically scales them to capture a snapshot at a distinct point in time of what is actually a changing and evolving structure of knowledge generation (Small, 1993).

Co-citations were tabulated for each source document using the Excel package. Many of the authors had very few co-citations that were either unlikely to have had a significant impact on the development of the field or were too new to have had time to impact on the literature. To facilitate the analysis and to improve the probability of success, included in the final analysis are authors that had at least 15 citations in the first five years and 20 in the second five years. Based on the total number of citations in the selected journals, the top scholars were identified, and then a co-citation matrix was built before a pictorial map was drawn to describe the correlations among different scholars. In doing so, the authors followed the procedures recommended by White and Griffith (1981).

Social network analysis techniques were used to graph the relationships in the co-citation matrix and identify the strongest links and the core areas of interest in knowledge management (Pilkington and Teichert, 2006). Figures 1 and 2 show the core research themes in knowledge management studies, based on sampled articles with links of greater than or equal to ten co-citations shown in the network. This was produced using UCINET software (Borgatti *et al.*, 2002) and shows graphically the core areas of interest. Different

Figure 1 Key research themes in knowledge management (1998-2002)

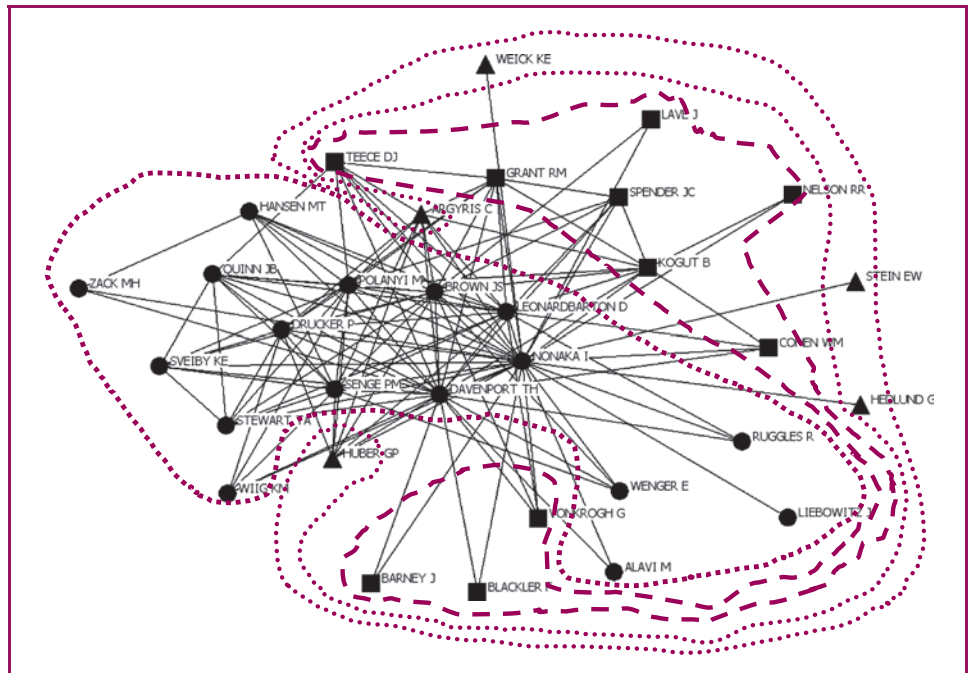
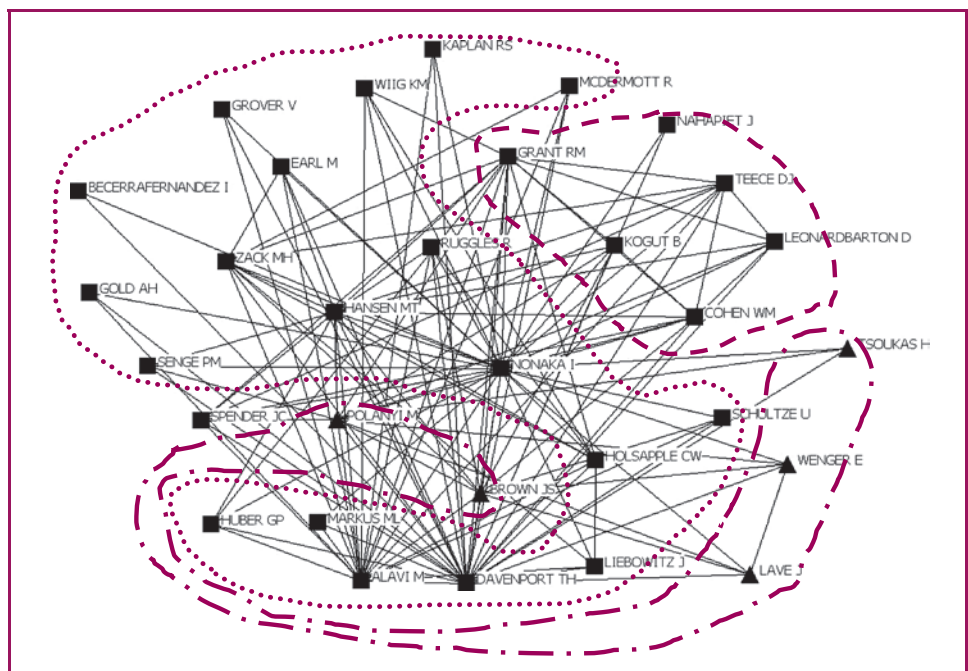


Figure 2 Key research themes in knowledge management (2003-2007)



shapes of the nodes resulted from performing a faction study of these authors and they represented different research clusters in knowledge management studies.

This method sought to group elements in a network based on the sharing of common links to each other. The diagrams showed that current research in knowledge management is concentrating on the interactions of the essentials of knowledge management, organizational learning, strategy of knowledge management, and knowledge-based theory on organizational and innovation. The few scholars in Figures 1 and 2 with the most links (co-citation) are the superstars in knowledge management research. Their heavy citations and intensive interlinks with each other clearly indicate their prestigious status in knowledge management research and their publications and research work collectively define the future research directions of knowledge management studies.

While the diagrams in Figures 1 and 2 provide a clear picture, their foci are only on the very core areas and only a limited amount of information is revealed. By taking the co-citation matrix and grouping authors using factor analysis on the correlations between the entries, it can be determined which authors are grouped together and therefore share a common element. According to this, the closeness of author points on such maps is algorithmically related to their similarity as perceived by citers. Pearson's *R* is used as a measure of similarity between author pairs and it registers the likeness in shape of their co-citation profiles over all other authors in the set (White and McCain, 1998).

The co-citation correlation matrix was factor analyzed using Varimax rotation, a commonly used procedure, which attempts to fit (or load) the maximum number of authors on the minimum number of factors. The diagonals were considered missing data and were applied the criterion of omitting the two cases (McCain, 1990). The results of factor analysis for the past two five-year periods are listed in Tables VI and VII, respectively.

Three factors were extracted from the data in the first five years (1998-2002) and together they explained over 86 percent of the variance in the correlation matrix. Table VI lists the three most important factors along with the authors that had a factor loading of at least 0.4. As is usual in this type of analysis, authors with a loading of less than 0.4 or with cross-loadings were dropped from the final results (White and Griffith, 1981). Descriptive names were tentatively assigned to the factors on the basis of the interpretation of the authors with high loadings. The analysis results show that knowledge management research in this period is composed of at least three different sub-fields:

Table VI Author factor loadings: 1998-2002

<i>Factor 1: Essential of knowledge management</i>	<i>74.3 percent variance</i>	<i>Factor 2: Knowledge-based organization and innovation</i>	<i>8.8 percent variance</i>	<i>Factor 3: Organization learning</i>	<i>3.8 percent variance</i>
ZACK MH	0.882	KOGUT B	0.892	WEICK KE	0.807
NONAKA I	0.867	COHEN WM	0.873	HUBER GP	0.673
HANSEN MT	0.863	NELSON RR	0.860	STEIN EW	0.652
WIIG K	0.863	SPENDER JC	0.841	ARGYRIS C	0.651
LIEBOWITZ J	0.858	VON KROGH G	0.826	HEDLUND G	0.647
ALAVI M	0.850	GRANT RM	0.785	WENGER E	0.547
DAVENPORT T	0.828	BARNEY J	0.760	LAVE J	0.427
QUINN JB	0.807	TEECE DJ	0.668		
DRUCKER P	0.803	BLACKLER F	0.665		
SVEIBY KE	0.796				
STEWART TA	0.789				
POLANYI M	0.766				
RUGGLES R	0.750				
SENGE PM	0.742				
LEONARD-BARTON D	0.691				
BROWN JS	0.635				
WENGER E	0.590				

Table VII Author factor loadings: 2003-2007

<i>Factor 1: Strategy of knowledge management</i>	<i>75.6 percent variance</i>	<i>Factor 2: Organization learning</i>	<i>8.8 percent variance</i>	<i>Factor 3: Knowledge-based organization and innovation</i>	<i>4.9 percent variance</i>
HOLSAPPLE CW	0.900	LAVE J	0.921	COHEN WM	0.851
LIEBOWITZ	0.886	WENGER E	0.873	SPENDER JC	0.808
EARL M	0.857	TSOUKAS H	0.823	LEONARD-BARTON D	0.780
ALAVI M	0.852	BROWN JS	0.702	GRANT RM	0.772
GROVER V	0.839	POLANYI M	0.635	KOGUT B	0.759
RUGGLES R	0.831			TEECE DJ	0.759
KAPLAN RS	0.826			NAHAPIET J	0.700
WIIG KM	0.817			HUBER GP	0.589
ZACK MH	0.797			POLANYI M	0.565
GRUBER TR	0.784				
GOLD AH	0.760				
MARKUS ML	0.752				
DAVENPORT T	0.746				
MCDERMOTT R	0.746				
HANSEN MT	0.715				
SCHULTZE U	0.713				
NONAKA I	0.703				
BECERRA-FERNANDEZ I	0.692				
SENGE PM	0.672				
HUBER GP	0.641				

1. essential of knowledge management;
2. knowledge-based theory on organization and innovation;; and
3. organizational learning (see Figure 1).

No attempt was made to interpret the remaining factors due to their small eigenvalues. They have also been excluded from Table VI.

Similarly, studies on knowledge management also clustered on different research themes between 2003 and 2007 and together they explained over 89 percent of the variance in the correlation matrix of the second five years, as pictured in Figure 2. Table VII lists the three most important factors along with the authors who had a factor loading of at least 0.4. Descriptive names were also tentatively assigned to the factors on the basis of the interpretation of the authors with high associated loadings. The analysis results show that knowledge management research at this stage is also composed of at least three key sub-fields:

1. strategy of knowledge management;
2. organizational learning; and
3. knowledge-based theory on innovation and organization.

Figure 1 and Table VI clearly indicate that the most influential authors in knowledge management studies between 1998 and 2002 clustered together. The main research focused on the essentials of knowledge management with an attempt to define this emerging field and help distinguish this new field from other related yet distinct fields. Within this cluster of research, knowledge management is defined as a systematic process of gathering, organizing, sharing, and analyzing knowledge in terms of resources, documents, and people skills within and across an organization (Davenport and Prusak, 1998; Nonaka, 1994). Textual data, such as articles, reports, manuals, and know-how documents are treated as valuable and explicit knowledge; thus, effective documentation and its management is especially important for knowledge management (Nonaka, 1994). In addition, Zack (1999) proposed that knowledge is the fundamental factor of competition and companies with superior knowledge are better equipped to coordinate and combine their

resources and capabilities in such creative and unique ways that they provide higher values to their customers. Similarly, Wiig (1997) defined knowledge management as the systematic, explicit, and deliberate building, renewal, and application of knowledge to maximize an enterprise's knowledge-related effectiveness and returns from its knowledge assets. Moreover, knowledge management is the systematic and organizationally specified process of acquiring, organizing, and communicating knowledge so that employees can use it to become more effective and productive at their work (Alavi and Leidner, 1999).

Others suggested that knowledge management may be understood as the practice of capturing and developing individual and collective knowledge within an organization for the purpose of promoting innovation through the transfer of knowledge and continuous learning (Nonaka, 1991; Quinn *et al.*, 1996). An alternative of socio-technical view of knowledge management is the "contingency" framework proposed by Hansen *et al.* (1999) who suggested that, if the primary task can be easily routinized or standardized, the technical solutions are more appropriate for managing knowledge; but if tasks cannot be easily routinized, then the human solutions are preferable in knowledge management.

As shown in Figure 1 and Table VI, the knowledge-based theory on organization and innovation attracts authors in the second group. The knowledge-based view (KBV) of the firm emerges from the resource-based view (RBV). This theory focuses on intangible assets as the un-tradable resources that define what firms are and what they can do (Kogut and Zander, 1992; Grant, 1996a; Spender, 1996; Kogut, 2000). Central to the rise of knowledge-based organization is the focus on knowledge as the most significant asset and resource of the firm. Spender (1996) argued that a KBV can yield insights beyond the production-function and resource-based theories of the firm by creating a new view of the firm as a dynamic, evolving, quasi-autonomous system of knowledge production and application. Knowledge is an intangible asset that is difficult to imitate, socially complex and heterogeneous, and therefore a potential source of long-term superior performance (Grant, 1996b). However, rather than treating knowledge as a generic source, as is in the RBV, the KBV pays more attention to the tacit nature of knowledge, and the way it becomes embedded in the social fabric of firms.

On the knowledge-based innovation side, in many aspects, the development of innovation thinking has been influenced by the significance of the economic role of "knowledge". Nelson and Winter (1982) introduced the environmental concept of tacit-explicit knowledge into the innovation management literature. They claimed that the mechanism of innovation process is an evolutionary system, and named it as innovation evolutionism based on the theory of biological evolution. The innovation intensity controls partially for the absorptive capacity of a firm. However, as Cohen and Levinthal (1990) have argued, a firm's absorptive capacity is also dependent on its employee's absorptive capacity in knowledge management.

The organization learning theory permeates the authors in the third group. Argyris and Schön (1978) claimed that organizational learning occurs when members of an organization act as learning agents for the organization, responding to changes in internal and external environment of the organization. Generally speaking, the conceptualization of organization learning consists of two facets: some scholars emphasize concrete information generation and dissemination systems as the mechanism through which learning takes place (Huber,

"The general pattern of the most cited journals shows that knowledge management research features organization- and general management-specific journals prominently, alongside the knowledge management-specific journals; with a cluster of information systems-focused titles also evident."

1991), while others consider firms “cognitive enterprises” and call for a shared mental model, a shared organizational vision, and an open-minded problem solving (Senge, 1990). Organizational learning is referred to as knowledge acquisition in the former view, and value acquisition in the latter. Employees play an important role in the organization learning, where their safety and reliability can be achieved through what Weick and Roberts (1993) termed as “collective mind”, in which distributed information processing becomes proactive and “heedful interrelating” forms an ongoing accurate representation of an unfolding situation.

For the second five years, Figure 2 and Table VII clearly indicated that the most influential authors in knowledge management studies between 2003 and 2007 also clustered together. The main research focused on the strategy of knowledge management. There is a growing recognition by researchers and practitioners about the importance of managing knowledge as a critical source of competitive advantage. Holsapple and Joshi (2001) argue that organization is the aggregation of all kinds of knowledge. According to knowledge chain model (Holsapple and Singh, 2001), the five primary and four secondary knowledge management activities involved in the knowledge chain model lead to organizational learning and projection. Evidence is provided from the literature illustrating each activity's role in adding value to an organization to increase its competitiveness through improved productivity, agility, reputation, and innovation (Holsapple and Singh, 2001). Furthermore, knowledge sharing has been portrayed as the key component of successful knowledge management practices (Alavi and Leidner, 2001; Earl, 2001). Knowledge sharing and learning behaviors are believed to be key contributors to process and product innovation and have long been praised as important practices vital to improvement in firm performance (Earl, 2001).

On the other hand, the knowledge management literature has frequently adopted a technical approach to disseminating and leveraging knowledge in order to enhance organizational performance. Information-communication technologies are central to such discussions, even though knowledge management does extend beyond that and can be best defined as the process of creating value from an organization's intangible assets (Liebowitz, 1999, 2000; Liebowitz and Beckman, 1998).

As shown in Figure 2 and Table VII, the organization learning theory permeates the authors in the second group in the second five years. Lave, Wenger, and Tsoukas are the emerging scholars who play a leading role in contributing to this sub-field. Organization learning in this context is explored from two perspectives:

1. the acquisition perspective; and
2. the participation perspective (Lave and Wenger, 1991).

In the acquisition perspective, learning is seen as the transfer and addition of substance to the mind, while the participation perspective derives from studies of learning in which learning is understood as participation in communities of practice (Lave and Wenger, 1991). Wenger's indicators of “communities of practice” explicitly refer to mutual relationships and a rapid flow of information among community members. He further explores community members' practices, the meanings they make possible, and the identities they open before he explores the implications of this framework for the design of organization systems for learning (Wenger, 1998).

Meanwhile, some scholars in this group focus their research topics on organization knowledge. An organization's lack of knowledge about its lack of knowledge is called radical uncertainty by Tsoukas (1996), or put in other words, organizations with radical uncertainty do not, and they also cannot, know what they need to know. Nevertheless, the development and production of complex products require the application of a wide range of knowledge (Tsoukas, 1996). Implicitly, Polanyi (1996) and Tsoukas (1996) highlighted the fact that much of professional knowledge is deeply embedded and implicit within, and inseparable from, human practices and activities of the professional group. Unlike explicit knowledge, tacit knowledge is difficult to articulate and even more difficult to codify into a report or document. Consequently, a knowledge management system such as the National Reporting and

“Journal articles and books combined, the top five most cited scholars between 1998 and 2002 were Nonaka, Davenport, Polanyi, Leonard-Barton and Brown.”

Learning System (NRLS), even when supported by sophisticated information and communications technology, merely captures the explicit dimension of professional knowledge and can never convey the richness of the context in which the knowledge is applied (Tsoukas and Vladimirou, 2001).

The knowledge-based theory on organization and innovation permeates the authors in the third group, yet this cluster is relatively steady, and there is not much change in its key research topics between the first five years and the second five years. As the main research topics in this subfield have been discussed in the previous section, they will not be repeated here. Yet the change in its explained variance (from 8.8 percent in the first five years to 4.9 percent in the second five years, lower than that of organization learning research) indicates that the studies of knowledge-based theory on organization and innovation have somehow lost their popularity to organization learning theory in the second five years, where studies of strategy of knowledge management have dominated the knowledge management research.

Put together, especially by comparing Figure 1 (for the first five years) and Figure 2 (for the second five years), it is easy to see that there are more key nodes in Figure 2. While there is no major paradigm change in the past decade in knowledge management research, closer ties and more associations among knowledge management scholars have been built in the past years. The density of the correlations between different scholars has greatly increased and the inter-linkage between scholars has strengthened.

The appearance of new and relevant theoretical and conceptual frameworks helps strengthen the core themes when newly attracted scholars start to use them to build even stronger theories or theoretical frameworks, which in turn helps the knowledge management field to deal with more complex questions and concerns. The consequence of more thinkers and scholars perusing their own interests advances the state of previous research ideas. In turn, this process helps to further the depth and breadth of the field, which is bound to attract even more scholars and practitioners to the continuously enriched theoretical cores, and may simultaneously lead to stronger conceptual frameworks or theoretical paradigms. As a result, the core themes of the knowledge management field are expanded and its knowledge network's foundations are consolidated. With this increasing dynamism, the emergence of a continuously consolidating paradigm to lead both the academic inquiry and industrial practice, and through such an evolving process, the area of knowledge management is growing and its invisible network of knowledge production is developing.

Conclusion

The past decades have seen extensive research on knowledge management. This study investigates knowledge management research using citation and co-citation data published in SCI and SSCI between 1998 and 2007. With a factor analysis of co-citation data, this study maps the intellectual structure of knowledge management research, and shows that the contemporary knowledge management research is organized along different concentrations of interests: essential of knowledge management, knowledge-based theory on organization and innovation, organization learning and strategy of knowledge management.

The mapping of the intellectual structure of knowledge management studies indicates that knowledge management has somehow created its own literature and that it has gained the reputation as a legitimate academic field, with knowledge management specific journals

gaining the status required for an independent research field, such as *Journal of Knowledge Management*. Given that knowledge management is still young and this study has shown knowledge management has an evolving structure, it is believed that knowledge management publication outlets will gain more of the popularity and prestige that are required to become a more prominent academic field when more is learned about current paradigms and key research themes in knowledge management studies, how they relate, and what they stand for. Future research should also focus on the relationship between knowledge management research and industrial practices in order to examine the impact of academic research on knowledge management and the management of knowledge accumulated in the research. With more scholars and more resources contributing to knowledge management research, a better academic environment conducive for research ideas' cross-fertilizing will be formed and knowledge management, as a field, will gain more momentum for further development.

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Further reading

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