Conceptualizing 'Knowledge Management' in the Context of Library and Information Science Using the Core/Periphery Model

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Abstract

This study takes cognizance of the fact that the term 'knowledge management' lacks a universally accepted definition, and consequently sought to describe the term using the most common co-occurring terms in knowledge management literature as indexed in the Library, Information Science and Technology Abstracts (LISTA) database. Using a variety of approaches and analytic techniques (e.g. core/periphery analysis and co-occurrence of words as subject terms), data was analyzed using the core/periphery model and social networks through UCINET for Windows, TI, textSTAT and Bibexcel computer-aided software. The study identified the following as the compound terms with which KM co-occurs most frequently: information resources management, information science, information technology, information services, information retrieval, library science, management information systems, and libraries, among others. The core terms with which KM can be defined include resources, technology, libraries, systems, services, retrieval, storage, data and computers. The paper concludes by offering the LIS professionals' general perception of KM based on their use of terms, through which KM can be defined within the context of LIS.

Introduction

Knowledge management (KM) is an elusive term as far as its definition is concerned. To date, there is no single universally accepted definition of the term, yet KM is increasingly becoming popular in a variety of disciplines (business administration, computer science, library and information science/studies, etc) and institutions/organizations (universities, business enterprises, governments, etc). Previous studies (e.g. Onyancha & Ocholla, 2006; Jacobs, 2004; Ponzi, 2002:268) have noted that the term is multidisciplinary in nature. The three studies identified the following disciplines as being the greatest contributors to or users of the theories and methods of KM: computer science; business; management; library and information science; engineering; psychology; multidisciplinary science; energy and fuels; social sciences; operation research and management science; and planning and development. The different disciplines and sectors that contribute to the development of KM or use its theories and methods have, in our view, greatly contributed to the many definitions and perspectives of KM. From the business point of view, Wiig (1999) defines KM 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. Rowley sees KM as a field "concerned with the exploitation and development of the knowledge assets of an organization with a view to furthering the organization's objectives" (Rowley, 2000:9). In the same vein, Kim (2000:3) explains that knowledge management is a "discipline that promotes an integrated approach to identifying, managing and sharing all of an organization's knowledge assets including unarticulated expertise and experience resident in individual workers … it involves the identification and analysis of available and required knowledge, and the subsequent planning and control of actions to develop knowledge assets so as to fulfill organizational objectives".

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There is no clear classification of knowledge management within the field of library and information studies. For example, in the LIS Research Areas Classification Scheme (see: http://www.alise.org/mc/page.do?sitePageId=55727) produced by the influential Association for Library and Information Science Education [ALISE], which captures ninety research sub-themes within eight broad research categories, KM is classified under "Information Organization" instead of "Management/ Administration". We have also noted the absence of the concept 'knowledge" in the "information organization" category. To many library and information scientists, KM includes, but is not limited to, information management. According to Read-Smith, Ginn, & Kallaus et al (2002:317), KM is "an interdisciplinary field that is concerned with systematic, effective management and utilization of an organization's knowledge resources ... it encompasses creation, storage, retrieval, and distribution of an organization's knowledge – similar to records and information management". Read-Smith, Ginn, & Kallaus et al (2002) therefore consider the processes of KM as being similar to the processes that constitute records management or information management. In fact, Al-Hawamdeh (2003:21) states that information management is a part of KM, and proceeds to define KM as the "process of identifying, organizing and managing knowledge resources", in which case the resources include explicit knowledge (information), 'know-how' (learning capacity), 'know-who' (customer capacity) and tacit knowledge in the form of skills and competencies. Kim (2000) observes that managing books, journals, and other similar resources, and conducting searches in such resources for clients or arranging for the circulation of materials, is but a small part of KM. This explains, to some extent, why ALISE would classify KM under information organization (as alluded to earlier).

A subject content analysis of the periodicals in which KM research is published, as provided by Onyancha & Ocholla (2006), reveals that they cover subjects such as library and information science, business, management science, computer science, financial management, human resource management, management information systems, and information technology. Visibly, this wide range of coverage of KM complicates efforts of arriving at a uniform definition of the concept. Any attempt to come up with a uniform definition of KM is further complicated by the different titles given to KM courses or programmes at institutions of higher learning, a situation that reflects divergent views held by different people. For example, in a study conducted by Chaudhry & Higgins (2001) in order to investigate the state of KM education in selected universities in Australia, Canada, Singapore, UK and the USA, it was found that KM courses are known by different names, such as "*Knowledge Management and Decision Systems*"; "*Information Architecture and Knowledge Management*"; "*Intelligence Systems and Knowledge Management*"; "*Management of Information Systems and Services*"; "*Information and Knowledge Management*", and "*Knowledge Management in Health Services*". A long list of nomenclature purportedly referring to KM is likely to occur when an inclusive survey is conducted with a larger international sample. What is inherent in the titles sampled is the frequent occurrence of 'management' in the titles.

LIS professionals and scholars view KM as an extension of what they have always done – managing information. There are different views on the scope and exact meaning of KM (see DiMattia & Order, 1997). This study is therefore an attempt to provide a meaningful insight into how KM is understood in the context of LIS. It endeavours to answer some of the following inter-related questions: What are the processes mostly associated with KM within the context of LIS? What are the core terms (in LIS) with which KM can be defined? Which terms can be used to describe KM processes and activities within the context of LIS? Which departments or sectors or professions associated with LIS ascribe to or practice KM? Which

LIS activities fall within the scope of KM? In short, what are the LIS professionals' perceptions of KM?

Methodology

Broadly, this study employs informetric approaches to examine the terms that can be used to describe KM in the context of LIS. Specifically, a content analysis of KM literature as indexed in the Library and Information Science and Technology Abstracts (LISTA) was conducted to find out identify the most commonly used indexing terms to describe KM; the growth rate of terms associated with KM in the context of LIS; and the core terms with which KM can be described; all in an attempt to contextualize KM within the broader field/discipline of library and information science/studies. In order to extract relevant data from the database, a search of DE "Knowledge Management" was conducted within the subject field, where DE denotes subject descriptor. The search was limited to the years 1981 to 2007, split into 5 five-year and 1 two-year periods. Only two types of articles, namely magazine and journal articles were considered. The inclusion of magazine articles was deemed important because we felt that some of them (e.g. UNESCO Bulletin) publish high quality articles on KM. After all, our major focus was on the subject terms that are associated with KM and not necessarily on research articles. Having downloaded the relevant data, different computer-aided software was used to analyze the data. Notepad was used to clean the data of irrelevant information and duplicates and to prepare the data for analysis. In order to prepare the data for Bibexcel, each subject in each record was entered in its own line, e.g.

INFORMATION resources management
INFORMATION science
INFORMATION technology
RESEARCH institutes
KNOWLEDGE management

Using this data, Bibexcel counted the number of times each subject appeared in each record for all records and returned the sum total of each subject's frequency. The subjects that recorded the highest number of appearances were deemed to be the most commonly used terms to describe KM literature. Partly, these subject terms provided a picture of how LIS professionals viewed KM. In other words, they answered what LIS professionals associate KM with in their line of activities.

As the above mentioned analysis provided only the frequencies of co-occurrence of KM with other compound subject terms, there was a need to measure the strength of their relationships as well as identify the single terms with which KM is defined by LIS professionals. It was assumed that the associatedness of single terms derived from the compound subject terms could further assist in identifying the core terms with which to describe KM. To achieve this, a simple core/periphery model analysis was applied on 90 selected terms (excluding *knowledge* and *information)* that recorded the highest frequency counts of occurrence in the compound subjects. According to Borgatti & Everett (1999) and Borgatti, Everett & Freeman (2002), the function simultaneously fits a core/periphery model to the data network, and identifies which actors belong in the core and which belong in the periphery. As this analysis requires a co-occurrence matrix with which to work, we first identified one-word terms with high frequencies by subjecting the data mentioned above to further analysis using the textSTAT software. Two files (i.e. *text.txt* and *words.txt*) were created and subjected to analysis using TI software, which was also used to prepare both the raw and normalized co-occurrence matrices named COOCC.DBF and COSINE.DBF respectively. Finally, the data

contained in the COSINE.DBF file was imported into UCINET for Windows version 6 for further analysis so that the core terms that describe KM could be determined. The process produced the terms that are the core in describing KM within the context of LIS as well as those in the periphery. It was assumed that the further the terms are from the core terms, the less of a relationship they have with KM. This relationship is further demonstrated in Figures 2, 4 and 6, which were prepared using Pajek software. Developed by Vladimir Batagelj (Department of Mathematics, University of Ljubljana, Slovenia) and Andrej Mrvar (Faculty of Social Sciences, University of Ljubljana, Slovenia), the program is Windows-based and is capable of analyzing and illustrating large networks containing thousands or even millions of vertices. It is freeware software (used for academic purposes), and can be downloaded from http://vlado.fmf.uni-lj.si/pub/networks/pajek/. The file format accepted by Pajek provides information on *vertices*, *arcs* (directed edges), and undirected *edges.* Visualization of the relationships between and among the selected single terms was done in order to supplement the information provided in the core/periphery models as the models did not reveal the relationships of all the terms. The graphics of the core/periphery models could not fit into the MS Word template, thereby dictating the provision of only core single terms used to describe KM. Furthermore, clustering of the terms using sociograms assisted in identifying those terms that belong in various clusters of core or periphery terms. Whereas the core/periphery model provides two clusters (i.e. core and periphery), the sociograms reveal more clusters, even within the two categories of terms.

Limitations of the study

As mentioned above, this paper describes KM from the point of view of the LIS profession. In other words, we examine the perceptions of KM by LIS professionals using subject terms of the published KM literature as indexed in LISTA. The core terms with which KM is described as provided in the results section are those emanating from LIS research only. The study therefore does not provide a generalized view of KM as the term is multidisciplinary.

Results and discussion

Subject terms used to describe KM literature

An analysis of the terms that appear the most in KM literature may give an indication of the LIS scholars' perceptions of KM. The underlying theoretical basis is that two or more terms have got a relationship if they co-occur in a given text. The more frequently two or more terms co-occur in a text(s) or document(s), the stronger their relationship (Krsul, 2002). Table 1 provides the top 100 compound subject terms which co-occurred 13 or more times with KM. The leading term is information resources management, which recorded a frequency count of 547, followed by information science, information technology, information services, information retrieval, library science, management information systems, libraries, management, and information resources [just to name the top 10].

If we classify the 100 terms into various categories describing different aspects of KM, the terms that describe the **management function** would comprise: information resources management; management; industrial management; records management; information services management; database management; personnel management; document management; resource management; and library administration. The list of terms also comprises **activities** or **processes** associated with KM as perceived by LIS professionals, e.g.: information retrieval; organizational learning; data mining; electronic data processing; database searching; knowledge acquisition [expert systems]; information organization; documentation; knowledge

representation [information theory]; libraries – automation; information sharing; library cooperation; classification; and website development.

Table 1: Top 100 subject terms used to describe KM literature

No.	LISTA Subject	Articles	No.	LISTA Subject	Articles
1	Information resources management	547	51	Expert systems (Computer science)	28
2	Information science	385	52	Database searching	28
3	Information technology	368	53	Knowledge acquisition (Expert systems)	27
4	Information services	179	54	Intellectual property	26
5	Information retrieval	153	55	Information organization	25
6	Library science	125	56	Computer systems	25
7	Management information systems	124	57	Documentation	24
8	Libraries	113	58	Metadata	24
9	Management	109	59	Academic libraries	23
10	Information resources	99	60	Knowledge representation (Information theory)	22
11	Organizational learning	77	61	Knowledge, Theory of	20
12	Data mining	76	62	Education	20
13	Intellectual capital	73	63	Surveys	20
14	Information storage & retrieval systems	71	64	Employees	19
15	Knowledge workers	69	65	Information services -- Management	19
16	Associations, institutions, etc	67	66	Executives	19
17	Information professionals	66	67	Libraries -- automation	19
18	Corporate culture	66	68	Database management	19
19	Business enterprises	65	69	Personnel management	19
20	Industrial management	59	70	Information scientists	19
21	Librarians	58	71	Human capital	18
22	Electronic data processing	57	72	Electronic commerce	18
23	Congresses & conventions	55	73	Document management	18
24	Digital libraries	55	74	Organizational behavior	18
25	WEB sites	54	75	Computer networks	18
26	Information theory	53	76	Web portals	17
27	Research	51	77	Computer science	17
28	Electronic information resources	48	78	World wide web	17
29	Information architecture	44	79	Information sharing	17
30	Concepts	42	80	Library employees	17
31	Decision making	41	81	Library cooperation	17
32	Computer software	39	82	Classification	17
33	Organization	38	83	Resource management	16
34	Technological innovations	37	84	Communication	16
35	Information literacy	37	85	Library administration	16
36	Internet	35	86	Organizational structure	15
37	Business intelligence	35	87	Information society	15
38	Associations, institutions, etc.	34	88	Web site development	15
39	Technology	33	89	Electronic systems	15
40	Computer network resources	33	90	Medical care	14
41	Universities & colleges	33	91	Methodology	14
42	Strategic planning	32	92	Business planning	14
43	Learning	32	93	Business information services	14
44	Artificial intelligence	32	94	Competitive advantage	14
45	Intranets (Computer networks)	30	95	Work environment	14
46	Business	30	96	Competition	13
47	Records – management	29	97	Archives	13
48	Management science	29	98	Taxonomy	13
49	Databases	29	99	SEARCH engines	13
50	Online information services	28	100	Administrative agencies	13

The **resources** or **systems** or **services** that are managed include: information technology; information services; management information systems; libraries; information resources; intellectual capital; information storage & retrieval systems; business enterprises; digital libraries; websites; electronic information resources; computer software; Internet; computer network resources; intranets (computer networks); databases; online information services;

expert systems; computer systems; academic libraries; human capital; computer networks; web portals; World Wide Web; electronic systems; business information services; and archives. **Knowledge managers** are variously referred to in the Table as: knowledge workers; information professionals; librarians; executives; employees; information scientists; and library employees. The Table also provides the **disciplines** or **fields** that are contributors to or users of theories and methods of KM. These include: information science; information technology; library science; business; management science; education; and computer science.

Core/Periphery Class Memberships:

1: RESOURCES TECHNOLOGY SYSTEMS SERVICES COMPUTERS RETRIEVAL ELECTRONIC DATA PROCESSING STORAGE PERFORMANCE POLICY
2: LIBRARIES BUSINESS THEORY NETWORKS COMMUNICATION SOFTWARE INTELLIGENCE LIBRARIANS ARCHITECTURE EXPERT LITERACY ACADEMIC DATABASES ACQUISITION

Blocked Adjacency Matrix

		1 RESOU	2 TECHN	3 SYSTE	25 PERFO	5 SERVI	6 COMPU	7 RETRI	15 PROCE	9 ELECT	10 DATA	27 POLIC	16 STORA	4 LIBRA	14 SOFTW	8 BUSIN	13 COMMU	17 INTEL	11 THEOR	19 ARCHI	20 EXPER	21 LITER
1	RESOURCES			0.151		0.192	0.136	0.089	0.105	0.192	0.096	0.236		0.272	0.236		0.471	0.089				
2	TECHNOLOGY			0.142	0.333	0.544	0.192	0.882	0.745	0.680	0.680		0.471									
3	SYSTEMS	0.151	0.142				0.615	0.161	0.191	0.174	0.174	0.213	0.151					0.403			0.826	
25	PERFORMANCE		0.333			0.408		0.378	0.447	0.408	0.408											
5	SERVICES	0.192	0.544		0.408		0.118	0.617	0.365	0.333	0.333			0.236								0.408
6	COMPUTERS	0.136	0.192	0.615		0.118		0.218	0.129	0.118	0.236						0.289	0.436			0.745	
7	RETRIEVAL	0.089	0.882	0.161	0.378	0.617	0.218		0.845	0.772	0.772	0.378	0.267									
15	PROCESSING	0.105	0.745	0.191	0.447	0.365	0.129	0.845		0.913	0.913	0.447	0.316									
9	ELECTRONIC	0.192	0.680	0.174	0.408	0.333	0.118	0.772	0.913		0.833	0.408	0.289		0.408			0.154				
10	DATA	0.096	0.680	0.174	0.408	0.333	0.236	0.772	0.913	0.833		0.408	0.289									
27	POLICY	0.236		0.213				0.378	0.447	0.408	0.408											
16	STORAGE		0.471	0.151				0.267	0.316	0.289	0.289											
4	LIBRARIES	0.272				0.236																
14	SOFTWARE	0.236								0.408								0.378				
8	BUSINESS																					
13	COMMUNICATION	0.471					0.289															
17	INTELLIGENCE	0.089		0.403			0.436			0.154					0.378					0.267	0.488	
11	THEORY																					
19	ARCHITECTURE																	0.267				
20	EXPERT			0.826			0.745											0.488				
21	LITERACY					0.408																
22	ACADEMIC													0.577								
23	DATABASES						0.144				0.204				0.500		0.189		0.354			
24	ACQUISITION			0.533			0.289							0.289				0.189			0.645	
18	LIBRARIANS					0.408																1.000
26	PERSONNEL	0.471																				
12	NETWORKS	0.471					0.289									1.000						
28	REPRESENTATION																		1.000			
29	SCIENTISTS													0.577								
30	PERIODICALS		0.192			0.236		0.218					0.408	0.333								

Fig 1: Core/periphery model of terms describing KM literature, 1981-1990

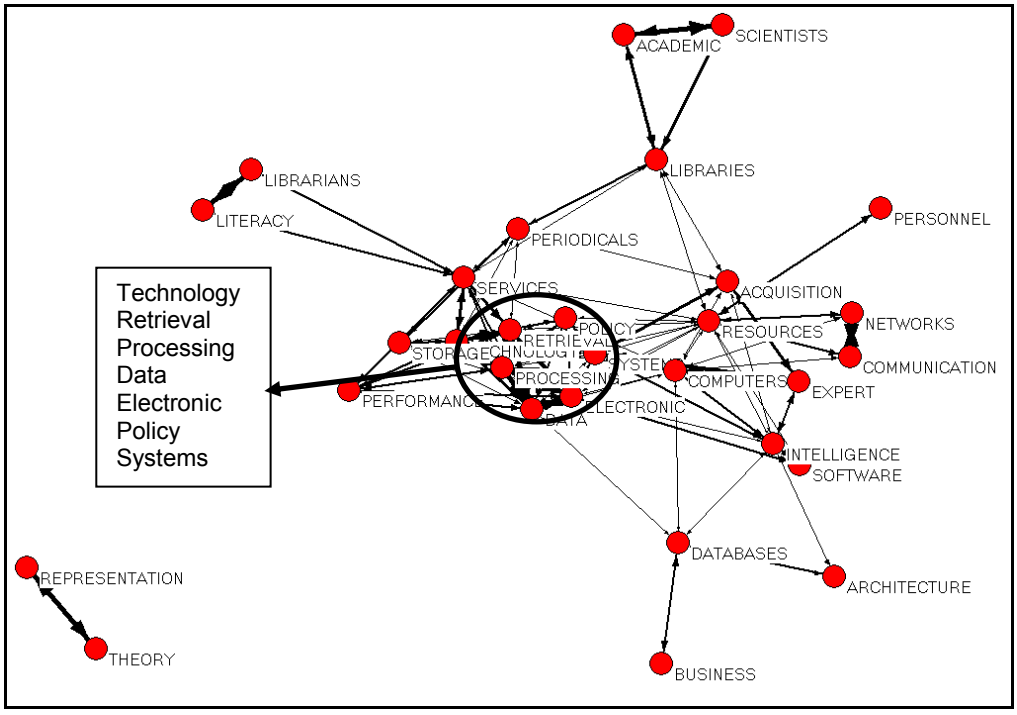


Fig 2: Visual map of core/periphery terms describing KM literature, 1981-1990

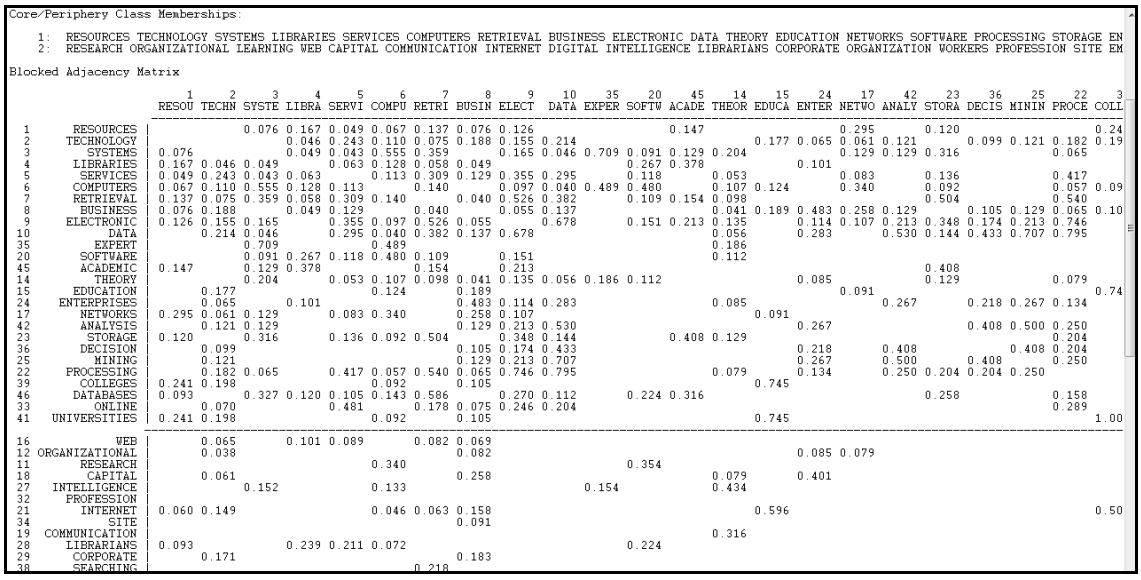
Core terms with which KM is described by LIS scholars

Two techniques were used to identify the core terms with which KM can be described or defined, namely: the core/periphery model and social networks as illustrated in Figures 1 to 6,

respectively. This section discusses the findings under three sub-headings so as to illustrate the emerging terms that are increasingly becoming associated with KM.

Core terms in 1981-1990

During this period, twelve keywords emerged as the core terms describing KM literature. These were: resources, technology, systems, performance, services, computers, retrieval, processing, electronic, data, policy, and storage. A combination of one or two of these words defined what KM was perceived to be in the said period. The highest strength of association was between the terms *retrieval* and *technology*, which recorded a normalized count of 0.882. Evidently, the areas of research focus between 1981 and 1990 were the use of technology in information retrieval and resources (including data and information) management. Essentially, therefore, KM was largely associated with the use of information technology in the retrieval of information and organization of data. Of the 90 unique terms that were selected to conduct the core/periphery analysis, 60 did not have any links to any other words in the period 1981-1990, implying that they were not used to describe KM literature. This further implies that they were not associated with the concept KM in 1981-1990. Only 30 terms were interlinked with one or more other terms. The disassociatedness of majority of the selected terms with KM (either directly or by proxy) is probably because they were introduced into KM literature later than 1990, or they were simply not related to the term KM before then. It was noted that one cluster of seven terms that had close association among themselves and therefore important in describing KM emerged in 1981-1990. Most of these terms comprised the core keywords illustrated in Fig 1 above. They are: *technology*, *retrieval*, *processing*, *data*, *electronic*, *policy* and *systems*.



Core/Periphery Class Memberships:

1: RESOURCES TECHNOLOGY SYSTEMS LIBRARIES SERVICES COMPUTERS RETRIEVAL BUSINESS ELECTRONIC DATA THEORY EDUCATION NETWORKS SOFTWARE PROCESSING STORAGE EN
2: RESEARCH ORGANIZATIONAL LEARNING WEB CAPITAL COMMUNICATION INTERNET DIGITAL INTELLIGENCE LIBRARIANS CORPORATE ORGANIZATION WORKERS PROFESSION SITE EM

Blocked Adjacency Matrix

		1 RESOU	2 TECHN	3 SYSTE	4 LIBRA	5 SERVI	6 COMPU	7 RETRI	8 BUSIN	9 ELECT	10 DATA	35 EXPER	20 SOFTW	45 ACADE	14 THEOR	15 EDUCA	24 ENTER	17 NETWO	42 ANALY	23 STORA	36 DECIS	25 MININ	22 PROCE	3 COLL
1	RESOURCES			0.076	0.167	0.049	0.067	0.137	0.076	0.126				0.147			0.295		0.120					0.24
2	TECHNOLOGY				0.046	0.243	0.110	0.075	0.188	0.155	0.214					0.177	0.065	0.061	0.121		0.099	0.121	0.182	0.19
3	SYSTEMS	0.076			0.049	0.043	0.555	0.359		0.165	0.046	0.709	0.091	0.129	0.204			0.129	0.129	0.316			0.065	
4	LIBRARIES	0.167	0.046	0.049		0.063	0.128	0.058	0.049				0.267	0.378			0.101							
5	SERVICES	0.049	0.243	0.043	0.063		0.113	0.309	0.129	0.355	0.295		0.118		0.053			0.083		0.136			0.417	
6	COMPUTERS	0.067	0.110	0.555	0.128	0.113		0.140		0.097	0.040	0.489	0.480		0.107	0.124		0.340		0.092			0.057	0.09
7	RETRIEVAL	0.137	0.075	0.359	0.058	0.309	0.140		0.040	0.526	0.382		0.109	0.154	0.098					0.504			0.540	
8	BUSINESS	0.076	0.188		0.049	0.129		0.040		0.055	0.137				0.041	0.189	0.483	0.258	0.129		0.105	0.129	0.065	0.10
9	ELECTRONIC	0.126	0.155	0.165		0.355	0.097	0.526	0.055		0.678		0.151	0.213	0.135		0.114	0.107	0.213	0.348	0.174	0.213	0.746	
10	DATA		0.214	0.046		0.295	0.040	0.382	0.137	0.678					0.056		0.283		0.530	0.144	0.433	0.707	0.795	
35	EXPERT			0.709			0.489								0.186									
20	SOFTWARE			0.091	0.267	0.118	0.480	0.109		0.151					0.112									
45	ACADEMIC	0.147		0.129	0.378			0.154		0.213										0.408				
14	THEORY			0.204		0.053	0.107	0.098	0.041	0.135	0.056	0.186	0.112				0.085			0.129			0.079	
15	EDUCATION		0.177				0.124		0.189									0.091						0.74
24	ENTERPRISES		0.065		0.101				0.483	0.114	0.283				0.085				0.267		0.218	0.267	0.134	
17	NETWORKS	0.295	0.061	0.129		0.083	0.340		0.258	0.107						0.091								
42	ANALYSIS		0.121	0.129					0.129	0.213	0.530						0.267				0.408	0.500	0.250	
23	STORAGE	0.120		0.316		0.136	0.092	0.504		0.348	0.144			0.408	0.129								0.204	
36	DECISION		0.099						0.105	0.174	0.433						0.218		0.408			0.408	0.204	
25	MINING		0.121						0.129	0.213	0.707						0.267		0.500		0.408		0.250	
22	PROCESSING		0.182	0.065		0.417	0.057	0.540	0.065	0.746	0.795				0.079		0.134		0.250	0.204	0.204	0.250		
39	COLLEGES	0.241	0.198				0.092		0.105							0.745								
46	DATABASES	0.093		0.327	0.120	0.105	0.143	0.586		0.270	0.112		0.224	0.316						0.258			0.158	
33	ONLINE		0.070			0.481		0.178	0.075	0.246	0.204												0.289	
41	UNIVERSITIES	0.241	0.198				0.092		0.105							0.745								1.00
16	WEB		0.065		0.101	0.089		0.082	0.069															
12	ORGANIZATIONAL		0.038						0.082								0.085	0.079						
11	RESEARCH						0.340						0.354											
18	CAPITAL		0.061						0.258						0.079		0.401							
27	INTELLIGENCE			0.152			0.133					0.154			0.434									
32	PROFESSION																							
21	INTERNET	0.060	0.149				0.046	0.063	0.158							0.596								0.50
34	SITE								0.091															
19	COMMUNICATION														0.316									
28	LIBRARIANS	0.093			0.239	0.211	0.072						0.224											
29	CORPORATE		0.171						0.183															
38	SEARCHING							0.218																

Fig 3: Core/periphery model of terms describing KM literature, 1991-2000

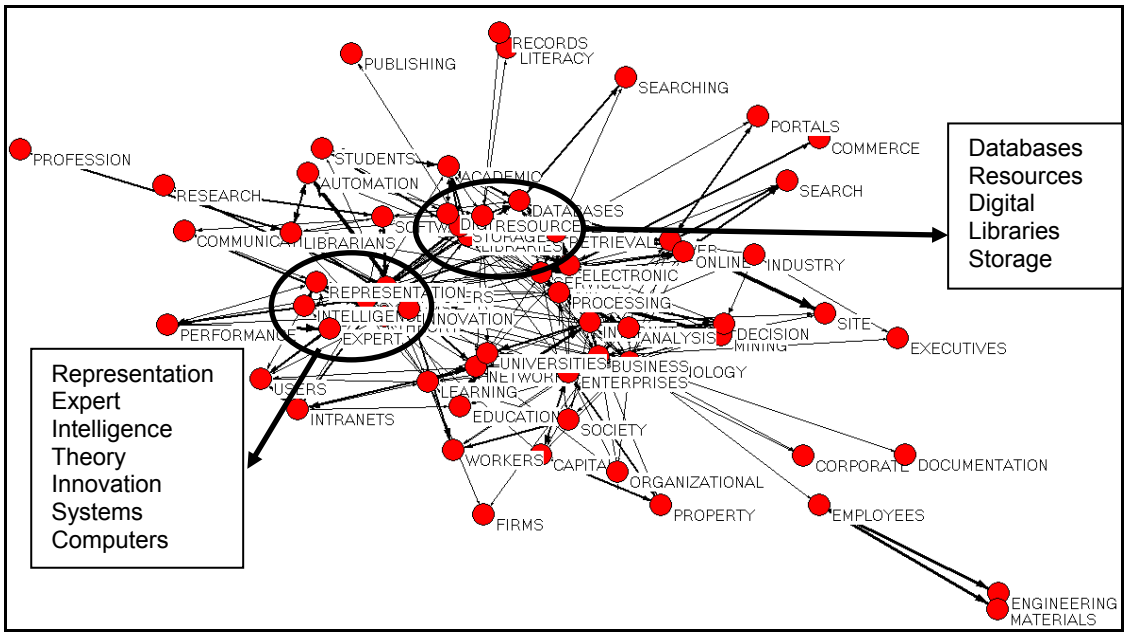


Fig 4: Visual map of core/periphery terms describing KM literature, 1991-2000

Core terms in 1991-2000

This period is widely seen as a time when there was a lot of emerging interest in KM (Ponzi, 2002). The number of the core terms with which KM was described in 1991-2000 rose to 26 from the previous year's total of 11 terms, thereby indicating an increased interest from various scholars belonging to a variety of disciplines or same discipline but with different perspectives on KM. An analysis of the associatedness of terms reveals that the highest strengths of association (represented by the normalized frequency count) were between *data* and *processing*, *electronic* and *processing*, *education* and *universities, education* and *colleges*, *expert* and *systems, data* and *mining, electronic* and *data, computer* and *systems*, *databases* and *retrieval, data* and *analysis, storage* and *retrieval, storage* and *processing,* and *analysis* and *mining*. The linkage of two or more of these words defines the perceptions of LIS scholars about KM during 1991-2000 period. Seemingly, electronic data processing (including storage and retrieval) in academic libraries dominated the KM literature, thereby being the main activity or process defining KM in the said period of study.

It was observed that the strengths of association between these and other terms in the cluster consisting of the core terms in the previous year-period recorded lower values during this year period. This is contrary to our expectation of higher values, which would have meant stronger associatedness between the terms. This scenario may imply a shift in research focus areas to include more aspects whose terms comprised the terms in the periphery. It may also mean that scholars were trying to gain a deeper understanding of KM and had not found common terms with which to define the 'new' concept. These assumptions could not, however, be substantiated in this study. At the periphery were terms such as the Web, organizational, research, capital, intellectual, profession, Internet, site, communication, librarians, corporate, searching and records, among others. Fig 4 illustrates this pattern more clearly than Fig 3. Although some terms appeared frequently in the KM subject headings, they were not associated with any of the other terms. There were only 65 out of 90 terms that were inter-linked with at least one other term unlike in 1981-1990 year period where only 40 terms were associated with at least one other term. There was therefore an increase in the number of terms (i.e. in the core or the periphery) that were associated with KM on the one hand and

with each other, on the other hand. This trend may have been brought about by interdisciplinary research.

Another emerging aspect is the formation of several small clusters of terms as demonstrated in Fig 4. Two of these clusters which produced a relatively higher number of terms each are circled. Whereas the cluster to the left of the sociogram describes KM in relation to the use of computer systems in data representation, expert intelligence, theory and innovation the other cluster focuses on the storage of digital resources (including the application of e-databases) by libraries.

Core/Periphery Class Memberships:

1: RESOURCES TECHNOLOGY SYSTEMS LIBRARIES SERVICES COMPUTERS RETRIEVAL BUSINESS ELECTRONIC DATA RESEARCH THEORY EDUCATION WEB NETWORKS SOFTWARE INTERNET
2: ORGANIZATIONAL LEARNING CAPITAL COMMUNICATION ENTERPRISES INTELLIGENCE LIBRARIANS CULTURE ORGANIZATION WORKERS PLANNING PROFESSION SITE ARCHITECTURE

Blocked Adjacency Matrix

		1 RESOU	2 TECHN	3 SYSTE	4 LIBRA	5 SERVI	6 COMPU	7 RETRI	8 BUSIN	9 ELECT	10 DATA	11 RESEA	23 STORA	35 ONLIN	14 THEOR	15 EDUCA	16 WEB	17 NETWO	62 MATER	41 SEARC	20 SOFTW	21 INTER	22 PROCE	5 DATA
1	RESOURCES		0.374	0.340	0.244	0.262	0.255	0.278	0.184	0.386	0.179	0.167	0.182	0.148	0.096	0.108	0.200	0.202	0.080	0.161	0.144	0.152	0.093	0.16
2	TECHNOLOGY	0.374		0.300	0.125	0.232	0.238	0.209	0.146	0.168	0.144	0.161	0.145	0.094	0.074	0.115	0.091	0.129	0.030	0.059	0.112	0.119	0.107	0.07
3	SYSTEMS	0.340	0.300		0.170	0.143	0.313	0.389	0.128	0.209	0.149	0.094	0.464	0.063	0.194	0.092	0.120	0.087	0.057	0.061	0.141	0.081	0.079	0.14
4	LIBRARIES	0.244	0.125	0.170		0.297	0.076	0.192	0.052	0.170	0.055	0.093	0.164	0.119	0.038	0.227	0.057	0.051	0.224	0.066	0.047	0.067	0.052	0.06
5	SERVICES	0.262	0.232	0.143	0.297		0.142	0.242	0.116	0.179	0.112	0.110	0.083	0.332	0.044	0.108	0.077	0.062	0.040	0.063	0.106	0.101	0.114	0.09
6	COMPUTERS	0.255	0.238	0.313	0.076	0.142		0.106	0.112	0.154	0.135	0.067	0.072	0.078	0.104	0.047	0.247	0.550	0.021	0.066	0.462	0.155	0.122	0.08
7	RETRIEVAL	0.278	0.209	0.389	0.192	0.242	0.106		0.039	0.254	0.200	0.064	0.664	0.096	0.060	0.045	0.096	0.036	0.070	0.203	0.077	0.107	0.222	0.13
8	BUSINESS	0.184	0.146	0.128	0.052	0.116	0.112	0.039		0.054	0.064	0.071	0.050	0.020	0.050	0.033	0.031	0.145		0.021	0.071	0.058	0.011	0.02
9	ELECTRONIC	0.386	0.168	0.209	0.170	0.179	0.154	0.254	0.054		0.282	0.061	0.155	0.167	0.022	0.041	0.119	0.046	0.072	0.217	0.062	0.123	0.413	0.16
10	DATA	0.179	0.144	0.149	0.055	0.112	0.135	0.200	0.064	0.282		0.067	0.101	0.150	0.049	0.051	0.022	0.025	0.022	0.247	0.093	0.050	0.592	0.28
11	RESEARCH	0.167	0.161	0.094	0.093	0.110	0.067	0.064	0.071	0.061	0.067		0.024	0.052	0.148	0.111	0.040	0.021	0.094	0.018	0.013	0.052	0.029	0.03
23	STORAGE	0.182	0.145	0.464	0.164	0.083	0.072	0.664	0.050	0.155	0.101	0.024		0.013	0.029	0.032	0.043		0.124	0.097	0.078	0.078	0.110	0.11
35	ONLINE	0.148	0.094	0.063	0.119	0.332	0.078	0.096	0.020	0.167	0.150	0.052	0.013		0.021	0.026	0.083	0.043		0.179	0.042	0.108	0.118	0.19
14	THEORY	0.096	0.074	0.194	0.038	0.044	0.104	0.060	0.050	0.022	0.049	0.148	0.029	0.021		0.006	0.088	0.051		0.044	0.039	0.018	0.026	0.02
15	EDUCATION	0.108	0.115	0.092	0.227	0.108	0.047	0.045	0.033	0.041	0.051	0.111	0.032	0.026	0.006		0.067	0.005	0.035		0.026	0.110	0.036	0.02
16	WEB	0.200	0.091	0.120	0.057	0.077	0.247	0.096	0.031	0.119	0.022	0.040	0.043	0.083	0.088	0.067		0.265	0.012	0.088	0.062	0.251		0.04
17	NETWORKS	0.202	0.129	0.087	0.051	0.062	0.550	0.036	0.145	0.046	0.025	0.021		0.043	0.051	0.005	0.265			0.018	0.045	0.118	0.022	0.04
62	MATERIALS	0.080	0.030	0.057	0.224	0.040	0.021	0.070		0.072	0.022	0.094	0.124			0.035	0.012						0.048	0.01
41	SEARCHING	0.161	0.059	0.061	0.066	0.063	0.066	0.203	0.021	0.217	0.247	0.018	0.097	0.179	0.044		0.088	0.018			0.067	0.256	0.088	0.45
20	SOFTWARE	0.144	0.112	0.141	0.047	0.106	0.462	0.077	0.071	0.062	0.093	0.013	0.078	0.042	0.039	0.026	0.062	0.045		0.067		0.072	0.018	0.08
21	INTERNET	0.152	0.119	0.081	0.067	0.101	0.155	0.107	0.058	0.123	0.050	0.052	0.078	0.108	0.018	0.110	0.251	0.118		0.256	0.072		0.040	0.08
22	PROCESSING	0.093	0.107	0.079	0.052	0.114	0.122	0.222	0.011	0.413	0.592	0.029	0.110	0.118	0.026	0.036		0.022	0.048	0.088	0.018	0.040		0.13
50	DATABASES	0.164	0.076	0.143	0.062	0.096	0.088	0.138	0.029	0.161	0.283	0.030	0.112	0.192	0.027	0.029	0.047	0.044	0.016	0.458	0.081	0.082	0.131	
29	CORPORATE	0.130	0.119	0.107	0.020	0.069	0.020	0.029	0.105	0.022	0.065	0.042	0.026		0.030		0.009	0.017		0.015	0.020			
25	MINING	0.159	0.106	0.130	0.045	0.040	0.074	0.063	0.051	0.051	0.713	0.017	0.050	0.067	0.030	0.041	0.035			0.257	0.131	0.034	0.135	0.29
26	DIGITAL	0.158	0.100	0.199	0.393	0.101	0.084	0.167	0.019	0.165	0.039	0.008	0.199	0.120	0.020	0.049	0.052	0.016	0.216	0.043	0.070	0.023	0.101	0.03
38	EXPERT	0.047	0.040	0.321		0.051	0.155	0.010	0.029	0.022	0.047	0.037			0.178			0.037	0.027		0.075			0.01
42	COLLEGES	0.142	0.055	0.069	0.154	0.078	0.017	0.081	0.059	0.058		0.057	0.043	0.108	0.011	0.179	0.020		0.063	0.033	0.023	0.053		0.05
12	ORGANIZATIONAL	0.012	0.012	0.007	0.003	0.006	0.001	0.007	0.007	0.003	0.004	0.018	0.010	0.002	0.017	0.007	0.002	0.001	0.002		0.002	0.001	0.003	
30	CULTURE	0.136	0.110	0.094	0.021	0.059	0.021	0.029	0.100	0.015	0.074	0.035	0.026		0.021	0.026		0.017		0.015	0.021			0.01
24	ENTERPRISES	0.140	0.148	0.081	0.013	0.071	0.116	0.019	0.678	0.007	0.043	0.075	0.034		0.036		0.024	0.141		0.013	0.054	0.010		0.01
32	WORKERS	0.113	0.142	0.118	0.021	0.097	0.080	0.060	0.096	0.054	0.042		0.054		0.032	0.035	0.028	0.018		0.031	0.075	0.025	0.024	0.02
33	PLANNING	0.144	0.086	0.154	0.031	0.020	0.036	0.025	0.262	0.052	0.036	0.023	0.023		0.018	0.044		0.022		0.052		0.010	0.020	0.03
34	PROFESSION	0.157	0.090	0.014	0.089	0.128	0.028	0.027	0.024	0.048	0.008	0.016		0.064		0.132	0.025	0.047	0.017	0.027		0.044	0.011	0.02
13	LEARNING	0.129	0.141	0.076	0.064	0.030	0.030	0.037	0.088	0.049	0.036	0.114	0.029	0.010	0.075	0.161	0.020	0.019	0.041	0.022	0.015	0.009	0.017	0.00
36	SITE	0.166	0.070	0.087	0.040	0.046	0.242	0.064	0.013	0.066	0.016	0.008	0.038	0.041	0.041	0.033	0.786	0.277	0.018	0.058	0.041	0.176		0.03
37	ARCHITECTURE	0.140	0.118	0.100	0.046	0.060	0.139	0.066	0.015	0.059	0.093	0.029	0.015	0.047	0.058	0.010	0.113	0.135			0.047	0.108	0.079	0.05
27	INTELLIGENCE	0.083	0.081	0.100		0.087	0.053	0.033	0.357	0.043	0.065		0.044	0.032	0.070	0.010	0.010			0.017	0.059	0.027	0.013	0.04
39	DECISION	0.060	0.066	0.141	0.011	0.051	0.039	0.024	0.116	0.016	0.108	0.019		0.076	0.067	0.028	0.010	0.019		0.065	0.011	0.026	0.025	0.10
18	CAPITAL	0.093	0.145	0.068	0.030	0.034	0.025	0.024	0.176	0.006	0.068	0.043	0.021	0.011	0.034	0.021	0.015	0.007			0.034			

Fig 5: Core/periphery model of terms describing KM literature, 2001-2007

Core terms in 2001-2007

This period witnessed an increase of the number of terms (both in the core and periphery clusters) that were used to describe KM from 65 in the previous year period to 90, implying that all the selected terms used for the core/periphery model analysis were associated with at least another term, on the one hand and KM, on the other. There was no term that was on its own, as shown in Fig 6. This implies that most of the terms were introduced between 2001 and 2007 or have increasingly become more closely associated with KM. Seemingly, new methods and theories of KM were formulated during the 2001-2007 period, a situation that also contributed to the introduction of several new subject terms with which KM literature was indexed in the LISTA database. Interdisciplinary research would have also contributed to the patterns exhibited in Figures 5 and 6, where all the terms were inter-linked with each other. Different technologies and tools (e.g. intranets, institutional repositories, internet, data mining tools, project collaboration software tools, expert systems, portals, etc) are increasingly being applied to KM. Various different services, resources and systems are also falling under the umbrella of KM practices. A large number of disciplines have become contributors and/or utilizers of KM theories and methods. This diversity is therefore likely to complicate the search for a unified definition of KM within the context of LIS.

A comparison of the core terms in Fig 3 and Fig 5 reveals that whereas the number of terms has increased from 26 to 28, there are seven terms in Fig 5 that did not feature in Fig 3, namely: research, Web, materials, searching, Internet, corporate, and digital. The terms that

featured in Fig 3 but did not comprise the core terms in Fig 5 include: academic, enterprises, analysis, decision, and universities. A relatively high number of terms have been consistent in their appearance in the cluster of core terms, e.g. resources, technology, systems, libraries, retrieval, services, computers, business, electronic, data and expert. The emergence and high ranking of the Web and Internet in 2001-2007 heralds new approaches of KM. This may also imply the shift in the type of resources that are increasingly managed by various knowledge managers. It is widely acknowledged that information is increasingly becoming available in the Internet and more so in the World Wide Web, thereby requiring new approaches and techniques in its management. The use of the Internet and the Web in managing knowledge (including information) is therefore becoming common in the LIS profession.

One other aspect worth mentioning is that the strengths of association for the majority of the core terms in 2001-2007 were below average (i.e. 0.5). The highest strength of association (i.e. 0.713) was recorded between *data* and *mining* followed by *storage* and *retrieval* (0.664), and *computer* and *networks*. Apparently, data mining and information storage and retrieval have increasingly become the core activities of KM within the LIS profession. The core concepts that can be used to describe KM in the information age include those highlighted in Fig 6 (as circled and outlined).

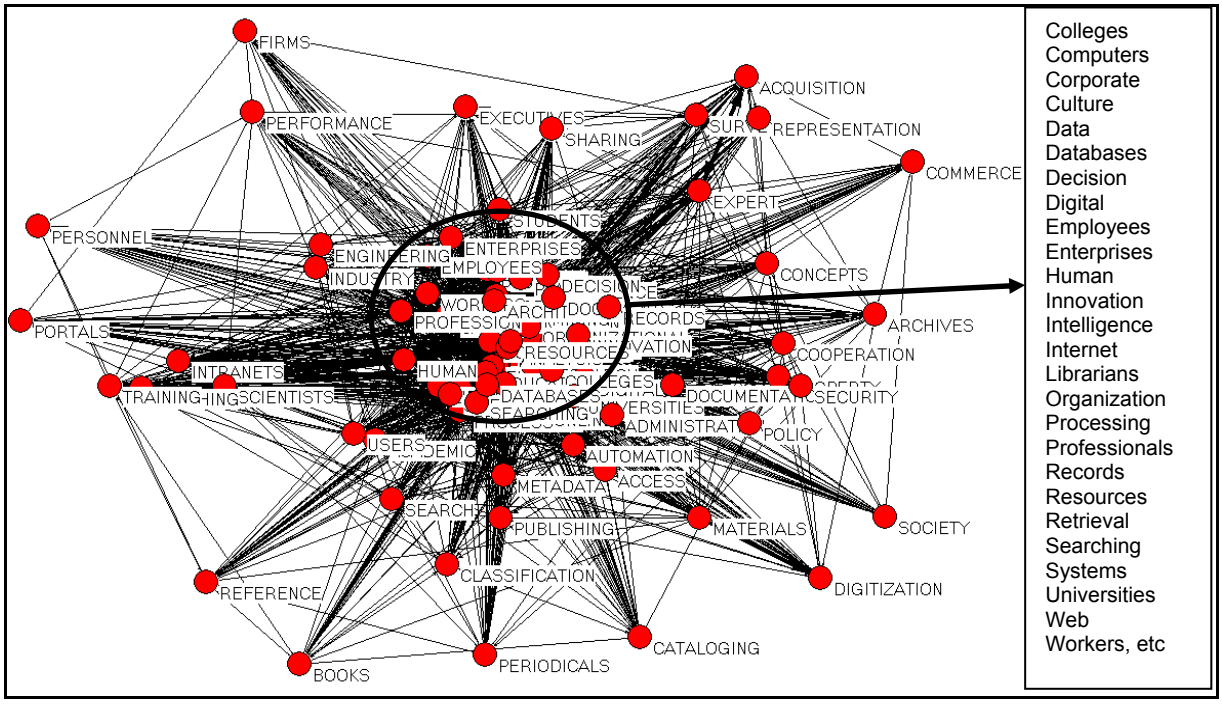


Fig 6: Visual map of core/periphery terms describing KM literature, 2001-2007

Conclusion and recommendations

The terms that frequently co-occurred with KM, in descending order of intensity, include the following: information resources management; information science; information technology; information services; information retrieval; library science; management information systems; organizational learning; and data mining, to name a few. These and several other terms are indicative of the LIS professionals' perception/understanding of KM. It was also observed that LIS professionals view KM's scope as encompassing institutions that practice KM (libraries, information services, universities and colleges, business enterprises, archives, etc); activities or processes (information retrieval, organizational learning, data mining, electronic data processing, database searching, knowledge acquisition, information organization,

documentation, knowledge representation, library automation, information sharing, classification, website development, etc); different types of management and/or management functions (e.g. information resources management, industrial management, records management, information services management, database management, personnel management, document management, resource management, and library administration); and people engaged in KM (knowledge workers, information professionals, librarians, executives, information scientists, library employees, etc) in LIS-related disciplines or subject domains (e.g. information science, information technology, library science, business, management science, education, and computer science). This essentially forms the basis upon which KM can be defined in the context of LIS. Thus, knowledge management is a discipline that involves the management and organization of knowledge/information through services, activities and processes of knowledge-based institutions fulfilled by knowledge workers in various disciplines or subject domains such as information and library science. Furthermore, the core/periphery model analysis of the terms that most frequently co-occurred with KM produced the following terms: resources, technology, libraries, systems, services, retrieval, computers, electronic, data, and storage. All these terms play a big role in KM practices and processes in the information age.

In conclusion, LIS scholars view KM as comprising largely the management of information resources, services, systems and technologies using various technologies and tools through activities such as information acquisition/creation, information retrieval and storage, data mining, classification and cataloguing, and information use in different information handling institutions or centers such as libraries, archives and museums. These activities are carried out by information professionals (e.g. librarians, archivists, knowledge workers, executives, etc). This view is not so different from that held by Skyrme in Gu (2004:171), who suggests that KM is about:

- Managing information – explicit/recorded knowledge;
- Managing processes – embedded knowledge;
- Managing people – tacit knowledge;
- Managing innovation – knowledge conversion; and
- Managing assets – intellectual capital

Anderson & Perez-Carballo in Schneider & Borlund (2004:524) opine that "knowledge organization within library and information science denotes classification, indexing, and cataloguing, applied to storage, access, and retrieval of documents in information retrieval systems". Indeed, although only 'classification' featured among the top 100 subject terms, 'cataloguing' co-appeared with KM 9 times while 'indexing' co-occurred 8 times. 'Abstracting' appeared only twice. We did, however, observe that KM processes were overwhelmingly information retrieval oriented, which may combine the areas of knowledge organization listed above. In a nutshell, KM focuses on IRM; its major functions are people and document/records management oriented; and it largely involves IR processes while the resources and systems managed are overwhelmingly IT (conduit, content, networks, etc) oriented. We believe that a survey involving LIS professionals should be conducted to ascertain whether the observations made in this conclusion about KM practices, activities and processes within library and information science/studies are valid. The findings of this study can only be validated through such a survey. Still, can informetric methods be applied to define a concept? We think it is possible.

For purposes of inter-disciplinary understanding of KM, further research employing several analytic approaches as those used in this study is recommended to examine how other

professions such as computer science, business, management science, financial management, information technology and systems, etc view KM.

References

Al-Hawamdeh, S. 2003. Knowledge management: cultivating knowledge professionals. Oxford: Chandos Publishing.

Borgatti, S.P., and Everett. M.G. (1999) Models of core/periphery structures. Social Networks, 21, 375-395

Borgatti, S.P., Everett, M.G. and Freeman, L.C. (2002). Ucinet 6 for Windows. Harvard: Analytic Technologies.

DiMattia, S. & Order, N. (1997). "Knowledge management: Hope, hype or harbinger?" Library Journal, (Sept. 15 1997), 33-35

Gu, Y. (2004). Global knowledge management research: a bibliometric analysis. Scientometrics, 61(2), 171-190

Chaudhry, A.S. & Higgins, S.E. (2001). Perspectives on education for knowledge management: paper presented to 67th IFLA Council and General Conference. Retrieved May 4th, 2005 from www.ifla.org/IV/ifla67/papers/036-115ae.pdf

Jacobs, D. (2004). Growth and development in knowledge management research: a bibliometric study. In: TJD Bothma & A Kaniki (ed). Proceedings of the 3rd biennial DISSAnet Conference, Pretoria, 28-29 October 2004. Pretoria: Infuse, pp. 211-220

Kim, S. 2000. The roles of knowledge professionals for knowledge management: a paper presented at International Federation of Library Associations (IFLA), 65th IFLA Council and General Conference, Bangkok, Thailand, August 20th-28th, 1999. INSPEL, 34(1), 1-8

Krsul, I. (2002). Co-word analysis tool Retrieved on December 3rd, 2003, from http://www.acis.u..edu/~ivan/coword/algorithmdescription.pdf.

Onyancha, O.B. & Ocholla, D.N. (2006). Trends and patterns of 'knowledge management' research in South Africa: an informetric analysis of tacit and explicit knowledge management. In: XVII Standing Conference of Eastern, Central & Southern Africa Library & Information Associations. Dar es Salaam: The Library and Information Association of Tanzania, pp. 337-361

Read-Smith, J., Ginn, ML, & Kallaus, NF, et al. (2002). Records management. Mason, OH: South-Western.

Rowley, J. 2000 From learning organisation to knowledge entrepreneur. Journal of Knowledge Management, 4(1), 7-14.

Schneider, J.W. & Borlund, P. (2004). Introduction to bibliometrics for construction and maintenance of thesauri: methodical considerations. Journal of Documentation, 60(5), 524-549

Wiig, K.M. 1999. What future knowledge management users may expect. Journal of knowledge management, 3(2), 155-65