Knowledge and Process Management Volume 11 Number 3 pp 185–198 (2004)
Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/kpm.203

Research Article

Meta-Review of Knowledge Management and Intellectual Capital Literature: Citation Impact and Research Productivity Rankings

Alexander Serenko and Nick Bontis*

DeGroote School of Business, McMaster University, Canada

The objective of this study is to conduct a meta-review analysis of the knowledge management and intellectual capital literatures by investigating research productivity and conducting a citation analysis of individuals, institutions, and countries. The meta-analysis focuses on the three leading peer-reviewed, refereed journals in this area: *Journal of Intellectual Capital*, *Journal of Knowledge Management*, and *Knowledge and Process Management*. Results indicate that research productivity is exploding and that there are several leading authors and foundation publications that are referenced regularly. Copyright © 2004 John Wiley & Sons, Ltd.

INTRODUCTION

The business world's accelerated entry into the knowledge era has spawned several new terms that did not exist a few decades ago. The concept of 'knowledge management' and the closely related concept of 'intellectual capital' have recently garnered strong representation in the management lexicon of academia, business and government. A Google search conducted on these terms yields thousands of websites (knowledge management = 3 400 000, intellectual capital = 368 000), which attests to the large on-line appeal of these concepts.

According to the ABI Inform Index, the first instances of the term knowledge management appeared in 1975 (Goerl, 1975; Henry, 1975; McCaffery, 1975). Also in 1975, Feiwal (1975) wrote a book called *The Intellectual Capital of Michael Kalecki*. This, however, was not the first time the term appeared, as Feiwal himself mentions that it was John Kenneth Galbraith who first introduced the term *intellectual capital* as early as 1969 (Bontis, 1998). In a letter to economist Michael Kalecki, John Kenneth Galbraith wrote, 'I wonder if you realize how much those of us in the world around have owed to the intellectual capital you have provided over these past decades'.

It was Tom Stewart who significantly popularized the concept in his June 1991 *Fortune* article 'Brain Power: How Intellectual Capital Is Becoming America's Most Valuable Asset'. This high-profile publication set the concept of intangible assets firmly on to the management agenda for many years to come. Over the past decade, the number of articles on knowledge management and intellectual capital (KM/IC) has been increasing at the average annual rate of 50% per annum. Given this trend, the total number is predicted to exceed 100 000 publications by the year 2010. Accompanying this growth is an equally impressive growth in the number of PhD dissertations which have been recently completed. Of the world's top 10 selling PhD theses, the topic of KM/IC is represented

*Correspondence to: Nick Bontis, Associate Professor of Strategy, DeGroote School of Business, McMaster University, 1280 Main Street West, MGD #207, Hamilton, Ontario, L8S 4M4, Canada. E-mail: nick@bontis.com

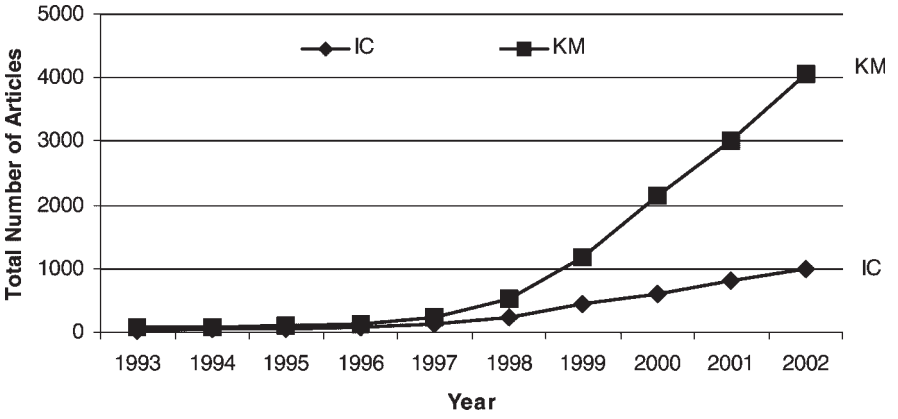

Figure 1 Published KM/IC articles as per ABI inform index

well. Figure 1 provides an illustration of the growth of this body of literature from 1993 to 2002 as determined by the ABI Inform Index.

The popularity of KM/IC has increased dramatically over the last decade for both academics and practitioners. There are many high-quality books, journals, and conferences devoted to KM/IC in addition to education programs and corporate initiatives. Historically, both researchers and practitioners expressed their individual judgments on the foundations and future directions of the discipline. However, these viewpoints have often been based on personal impressions. In order to complement the favorable (subjective) judgments about the state of the field, we decided to conduct a meta-review analysis which would present the first comprehensive investigation of this body of literature. We specifically chose to examine research productivity and citation analysis by performing a meta-review of all of the publications in the three leading peer-reviewed, refereed journals in the KM/IC area. These three journals are: (1) *Journal of Intellectual Capital* (JIC), (2) *Journal of Knowledge Management* (JKM), and (3) *Knowledge and Process Management* (KPM).

LITERATURE REVIEW

The study of research productivity and citation impact has a long-standing tradition in academia. As indicated by a substantial volume of prior research, previous investigations have taken a variety of forms, each of which has served different purposes. The earliest productivity rankings include the use and quantification of subjective reputation ratings gathered from respectful and appropriate scholars within a research field (Cartter, 1966). Contemporary studies utilize more objective measures such as counting the number of school's publications in a selected set of journals (Cox and Catt, 1977), estimating textbook citations (Gordon and Vicari, 1992; Howard and Day, 1995), or assessing the number of students' conference papers (Payne *et al*., 2001).

Most meta-review and citation impact studies are targeted to a very specific area of interest. For example, Gibby *et al*. (2002) and Surrette and College (2002) investigate the ranking of industrial-organizational psychology doctoral programs in North America. Cheng *et al*. (1999) perform a citation analysis to establish a hierarchical ranking of the technology innovation management journals. Bapna and Marsden (2002) and Erkut (2002) examine research productivity and impact of business schools faculty members. Similar projects have been conducted in various areas such as operations research (Vokurka, 1996), management information systems (Grover *et al*., 1992; Im *et al*., 1998), computer science (Goodrum *et al*., 2001), artificial intelligence (Cheng *et al*., 1996), and jurisprudence (Wright and Cohn, 1996). There also exist two journals—*Cybermetrics: International Journal of Scientometrics, Informetrics and Bibliometrics*, and *Science Watch*—devoted to the study of the quantitative analysis of scholarly and scientific communications, citation impacts, and productivities of individual researchers. Virtually every well-established research field can now boast the growing body of productivity and citation-impact research. Because it is very important to address all of these issues in the early stage of discipline development, we embarked on this project to investigate research productivity and impact of KM/IC scholars. As such, this study empirically investigates the two following issues: (1) research productivity and (2) research impact. The main questions are as follows.

Research productivity

(a) What is the individual productivity ranking of KM/IC authors?
(b) What is the institutional productivity ranking?
(c) What is the country productivity ranking?

Research impact

(a) What are the most frequently cited KM/IC publications?
(b) Who are the most frequently cited KM/IC authors?

METHODOLOGY

In order to obtain empirical evidence to answer these research questions, we analyzed all articles published in the three leading peer-reviewed, refereed KM/IC journals: *Journal of Intellectual Capital*, *Journal of Knowledge Management*, and *Knowledge and Process Management*. Although there exist KM/IC articles published in other journals, our efforts focused on these targeted publications for the following reasons. First, all these journals have at least 4 years of publication history, and they are widely recognized and read by the KM/IC community. Secondly, only KM/IC-related articles are published in these journals. Therefore, the results obtained by analyzing those publications will pertain to KM/IC exclusively. There are also several other journals, for example, *Journal of Management Studies*, *Management Learning*, and *The Learning Organization*, that sometimes present very good, interesting KM/IC papers. However, we found it impossible to include those journals in this study. When we attempted to analyze non-KM/IC exclusive journals like those mentioned earlier as well as others (e.g., *Academy of Management Journal*, *Strategic Management Journal*, *Administrative Sciences Quarterly*), we found it impossible to classify articles as KM/IC-related or not because any discrimination by the coders introduced bias in the results. It is for these reasons we chose to include JIC, JKM, and KPM only. Although we understand that the selection of only three journals limits the generalizability of results, it seems unlikely that a paper evaluating all, or at least most, KM/IC articles will emerge in the foreseeable future considering the amount of manual research effort involved (i.e., relatively newer journals are not covered by automatic citation indices such as Social Sciences Citations Index and Web of Science). Processing citation data is extremely time consuming and labour intensive.

Variables utilized

Among the various challenges in meta-review analysis, the most salient is the computation of per-author publication or citation credit in case of a multi-author paper (Lindsey, 1980). A review of previous research productivity studies reveals four basic approaches to assigning scores to a multi-author article or book: (1) straight count, (2) author position, (3) equal credit, and (4) normalized page size.

The first approach, referred to as straight count, advocates that each of the co-authors should receive a score of one regardless of the number of authors. However, the use of an absolute comparison mechanism is error-prone since it favors a publication ranking of a person who often co-authors papers, and it understates the rating of an individual who mostly works alone (Bapna and Marsden, 2002). For example, a researcher who was the third author in three independent publications would receive three credits, whereas someone who produced two sole-authored papers would only obtain two scores.

The second method argues that multi-author individual productivity ratings should be based on the original position of authorship. A formula developed by Howard *et al.* (1987) is used to distribute a credit in a multi-author paper. The formula favors dramatically the ratings of the first author and diminishes the rankings of the other ones. For example, the authors of a two-author article would receive the scores of 0.6 and 0.4 respectively. The authors of a four-author manuscript would receive the scores of 0.415, 0.277, 0.185, and 0.123 respectively. Despite the acceptance of this technique in psychology research (Howard and Day, 1995), we believe that it impacts negatively on multi-author publications for which names are arranged in alphabetical order. The application of this formula in the assessment of KM/IC research may substantially diminish cooperation in the community. Therefore, other techniques should be explored.

The third approach postulates that a per-author citation credit should be calculated by taking the inverse of the number of authors (Erkut, 2002). In this case, each co-author receives an equal credit. For example, the author of a solo publication would obtain a score of one, the authors of a two-author paper would receive the scores of 0.5 each, and the authors of a four-author manuscript would receive the scores of 0.25 per person. It is this approach that we have accepted for the purposes of this study.

The fourth method addresses the contribution of each individual contributor more precisely by accounting for possible discrepancies in page

numbers among different publications. Scott and Mitias (1996) normalize page size by allocating $1/n$ pages to each of n co-authors. However, we believe that page allocation is unnecessary given the importance of quality over quantity in contemporary research and the fact that different journals have different word limits that would dictate length.

Thus, the variables used in this study include author's name, institution or company affiliation, country of residence, article title, number of authors, year of publication, volume, and issue. The last two variables were collected for the sake of completeness and to avoid duplicate entries.

Another critical issue in conducting a meta-review research impact study is the calculation of an individual publication's citation impact index. Traditional meta-review studies report the total number of citations each publication has received. This number may be obtained by utilizing existing citation databases, for example, the Thomson Corporation's ISI Web of Science Social Sciences Citation Index. Although this score provides the total citation impact of each individual article, it does not account for the relative longevity of the paper. Consider, for instance, two different articles that have been published in 1995 and 2000. Both have been cited the same number of times, and, therefore, have obtained equal ranking. However, it seems logical to assume that the latter paper has been cited more frequently in any given year, and, therefore, its contribution is more significant since it has been available for less time. In order to account for the relative longevity of publications in the calculation of citation rankings, Holsapple *et al.* (1994) suggest the use of a normalized citation analysis in their ranking of business computing research journals. Their study argues that this approach does not penalize publications of more recent vintage, and it provides more accurate and reliable results.

Calculation of indices

Given that the present investigation is the first attempt to assess the citation impacts of KM/IC scholars, we opt to report all indices that may help serve the purpose of this paper. The following three indices were calculated as follows:

(1) Individual paper citations
The cumulative number of citations obtained by each individual paper. To obtain this score, we created a database of all citations used in the three target journals and counted how many times each paper was referenced. Since contemporary automatic citation indexes (e.g., Web of Science) do not cover these relatively new journals, the database of citations was constructed manually. Only those papers that were explicitly cited in the body of a referencing article were counted. For that reason, we did not count 'suggested reading' sections. The maximum number of citation credits per referenced paper did not exceed one (i.e., even though a referencing paper *A* cited a work *B* three times, a score of one was still assigned to *B*).

(2) Individual author citations
To calculate the cumulative number of citations obtained by each individual, we counted the number of papers that referenced a particular author. The total list of citations exceeded 11 000 entries.

(3) Normalized Citation Impact Index
The Normalized Citation Impact Index (NCII) considers the impact of a publication's longevity (Holsapple *et al.*, 1994). The NCII was calculated as follows:

$$\text{NCII} = \frac{\text{Total citations per referenced publication}}{\text{Publication Longevity(inyears)}}$$

Publication longevity refers to the number of years the referenced publication has been in print. With respect to this study, the year 2003 is considered the end point of the period. For example, the NCII of an article which was published in 1998 and was cited a total of 28 times, would be calculated as follows:

$$\text{NCII} = \frac{28}{5} = 5.6$$

If there were more than one edition of the same book, the year of the first edition was utilized in the calculation of publication longevity.

DATA COLLECTION AND ANALYSIS

The data collection and analysis were independently performed by both authors of this study and then reconfirmed by a research associate. The following is a summary of the analytical steps that were completed in this study to determine research productivity.

Research productivity

(1) Listing
A list was created of all authors who published in at least one target journal from the first to the last available issue in 2003. The first year, last volume and last issue number for each journal were as

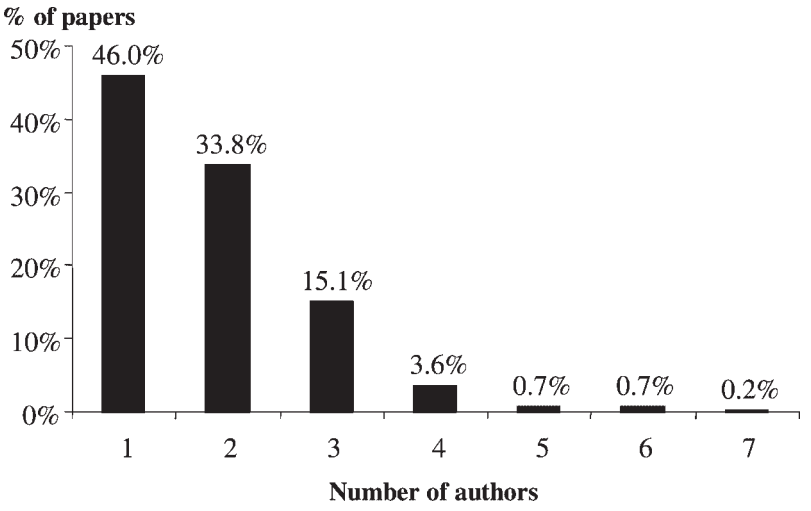

Figure 2 Co-authorship distribution of KM/IC publications

Table 1 Top KM/IC researchers ranked by individual productivity

	Name	Score	Affiliation	Country
1	Ganesh D. Bhatt	5.33	Morgan State U.	USA
2	Nick Bontis	3.67	McMaster U.	Canada
3	Syed Z. Shariq	3.58	Stanford U.	USA
4	Luiz Antonio Joia	3.00	Brazilian School of Public Admin.	Brazil
4	Patricia Ordónez de Pablos	3.00	U. of Oviedo	Spain
4	Jennifer Rowley	3.00	Edge Hill College of Higher Education	UK
4	Karl M. Wiig	3.00	Knowledge Research Institute	USA
8	Rodney McAdam	2.83	U. of Ulster	UK
9	Jay Liebowitz	2.81	U. of Maryland–Baltimore County	USA
10	Marcus Blosch	2.50	Model Resource Group	UK
10	Andrew Korac-Kakabadse	2.50	Cranfield U.	UK
10	Nada Korac-Kakabadse	2.50	Cranfield U.	UK
10	Victor Newman	2.50	Cranfield U.	UK
10	Walter Skok	2.50	Kingston U.	UK
15	Ian Caddy	2.33	U. of Western Sydney	Australia
15	Javier Carrillo	2.33	ITESM	Mexico
15	James Guthrie	2.33	Macquarie University	Australia
18	Verna Allee	2.00	Integral Performance Group	USA
18	Roelof P. uit Beijerse	2.00	EIM	The Netherlands
18	John Van Beveren	2.00	U. of Ballarat	Australia
18	Alberto Carneiro	2.00	Lusofona U. of Human and Technologies	Portugal
18	Rory L. Chase	2.00	Teleos	UK
18	Petter Gottschalk	2.00	Norwegian School of Management	Norway
18	Josephine Chinying Lang	2.00	Nanyang Technological U.	Singapore
18	Peter Matthews	2.00	Anglian Water	UK
18	Marjatta Maula	2.00	Helsinki School of Economics and B. A.	Finland
18	Mark W. McElroy	2.00	Macroinnovation Associates	USA
18	Iñaki Peña	2.00	ESTE	Spain
18	Kenneth Preiss	2.00	U. of Technology	Australia
18	Patrick H. Sullivan Sr	2.00	The ICM Group	USA
18	Mark N. Wexler	2.00	Simon Fraser U.	Canada
32	Ashley Braganza	1.92	Cranfield U.	UK
33	Leif Edvinsson	1.83	UNIC	Sweden
33	Sven Voelpel	1.83	U. of St Gallen	Switzerland
35	Gregoris Mentzas	1.75	National Technical U. of Athens	Greece
35	Harry Scarbrough	1.75	U. of Warwick	UK
37	Majed Al-Mashari	1.50	King Saud U.	Saudi Arabia
37	Debra Amidon	1.50	Entovation International	USA
37	Wendi R. Bukowitz	1.50	PricewaterhouseCoopers	USA

(Continues)

Table 1 Continued

	Name	Score	Affiliation	Country
37	Thomas H. Davenport	1.50	Babson College	USA
37	Faren Foster	1.50	IBM	USA
37	Nigel Holden	1.50	Kassel International Management School	Germany
37	Davis Klaila	1.50	Celemi	USA
37	Ned Kock	1.50	Temple U.	USA
37	Rado Kotorov	1.50	Bowling Green State U.	USA
37	Daryl Morey	1.50	The Parthenon Group	USA
37	Joy Palmer	1.50	Interknectives	UK
37	Fawzy Soliman	1.50	U. of Technology	Australia
37	Karl-Erik Sveiby	1.50	Swedish School of Economics and B. A.	Finland
37	Amrit Tiwana	1.50	Emory U.	USA
51	Kurt A. April	1.33	U. of Cape Town	South Africa
51	Colin Armistead	1.33	Bournemouth U.	UK
51	William Keogh	1.33	Heriot-Watt U.	UK
51	David Paper	1.33	Utah State U.	USA
51	Richard Petty	1.33	U. of Hong Kong	Hong Kong
51	James A. Rodger	1.33	U. of Pittsburgh at Johnstown	USA
51	Jonas Roth	1.33	Chalmers U. of Technology	Sweden
51	Alexander Styhre	1.33	Chalmers U. of Technology	Sweden
51	P. N. SubbaNarasimha	1.33	St Cloud State U.	USA
60	Dimitris Apostolou	1.25	Planet	Greece
60	Amar Gupta	1.25	MIT	USA
62	Kuan-Tsae Huang	1.20	IBM	USA
63	Richard T. Herschel	1.17	St Joseph's U.	USA
63	Rob Lambert	1.17	Cranfield U.	UK

follows: JIC (2000, 4, 2), JKM (1997, 7, 2) and KPM (1994, 10, 2). Editorials, book reviews, and interviews were excluded from the analysis.

(2) Proofreading

The final list was validated by cross-checking references to identify double entries, misspelled authors' names, and inconsistent affiliations. Every possible attempt was made to identify inconsistent usage of authors' names. For example, Nada Korac-Kakabadse was also listed as Nada Kakabadse, Nada K. Kakabadse, and Nada K.Kakabadse. This inconsistent nomenclature made the automatic generation of scores unreliable. Thus, a manual revision of all names was done to solve this problem. If an author was affiliated with an educational institution and with an organization in a unique publication (e.g., Babson College and IBM Global Services), the educational institution was selected (i.e., Babson College). This was done so that there was a clear attempt to make the university count as valid and reliable as possible. If an author was affiliated with two organizations in a unique paper neither of which was an educational institution (e.g., ICM Group and Xerox), the first-mentioned affiliation was selected. This was done to reduce double counting. Since there were only a handful of these cases, the overall findings of the paper should not have been adversely affected.

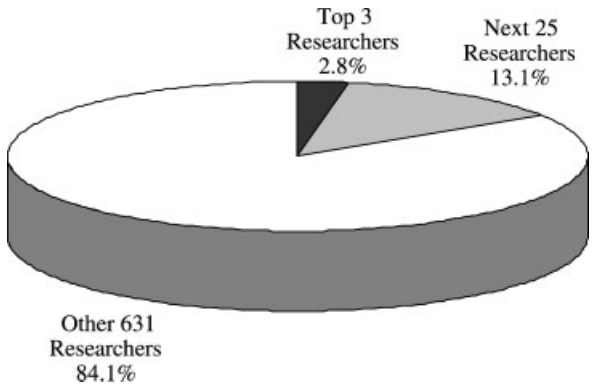

Figure 3 Percentage of total work contributed by top KM/IC scholars

(3) Computation

The individual publication score was calculated for each paper as well as the total score for all publications for each contributor. The same calculation was computed for every institution or organization as well as for every country by adding the scores of all contributors associated with that particular organization or nation.

The following is a summary of the analytical steps that were completed in this study to determine research impact.

Table 2 Top KM/IC institutions ranked by research productivity

	Name	Country	Total Score	# of individual contributors	Individual researcher contribution
1	Cranfield U.	UK	18.08	10	1.81
2	McMaster U.	Canada	7.83	8	0.98
3	U. of Warwick	UK	5.75	9	0.64
4	Morgan State U.	USA	5.00	1	5.00
4	U. of Technology Sydney	Australia	5.00	6	0.83
6	Macquarie U.	Australia	4.83	4	1.21
7	Chalmers U. of Technology	Sweden	4.50	7	0.64
7	IBM	USA	4.50	8	0.56
7	Open U.	UK	4.50	8	0.56
10	Stanford U.	USA	4.42	3	1.47
11	Copenhagen Business School	Denmark	4.33	6	0.72
12	U. of Oviedo	Spain	4.00	2	2.00
12	Xerox	USA	4.00	6	0.67
14	U. of Maryland–Baltimore County	USA	3.71	4	0.93
15	U. of Ulster	UK	3.67	4	0.92
16	SRI Consulting	USA	3.50	5	0.70
16	U. of St Gallen	Switzerland	3.50	6	0.58
16	U. of Western Sydney	Australia	3.50	3	1.17
19	ITESM	Mexico	3.33	2	1.67
20	Edge Hill College of Higher Education	UK	3.00	1	3.00
20	Helsinki U. of Technology	Finland	3.00	3	1.00
20	Knowledge Research Institute	USA	3.00	1	3.00
20	Nanyang Technological U.	Singapore	3.00	2	1.50
20	Swedish School of Economics and B. A.	Finland	3.00	3	1.00
20	The ICM Group	USA	3.00	2	1.50
26	MIT	USA	2.58	3	0.86
27	Kingston U.	UK	2.50	1	2.50
27	U. of Southampton	UK	2.50	4	0.63
27	U. of Texas at Austin	USA	2.50	4	0.63
30	National Technical U. of Athens	Greece	2.25	2	1.13
31	Kent State U.	USA	2.17	4	0.54
32	Anglian Water	UK	2.00	1	2.00
32	Arthur Andersen	UK	2.00	2	1.00
32	Aston U.	UK	2.00	3	0.67
32	Autonomous U. of Madrid	Spain	2.00	4	0.50
32	EIM	The Netherlands	2.00	1	2.00
32	ESTE	Spain	2.00	1	2.00
32	IESE—U. of Navarra	Spain	2.00	4	0.50
32	Integral Performance Group	USA	2.00	1	2.00
32	Interknectives	UK	2.00	2	1.00
32	Macroinnovation Associates	USA	2.00	1	2.00
32	Monash U.	Australia	2.00	2	1.00
32	Norwegian School of Management	Norway	2.00	1	2.00
32	Rio de Janeiro State U.	Brazil	2.00	1	2.00
32	Robert Morris U.	USA	2.00	2	1.00
32	Simon Fraser U.	Canada	2.00	1	2.00
32	Stockholm U.	Sweden	2.00	2	1.00
32	Telematics Research Centre	The Netherlands	2.00	3	0.67
32	Teleos	UK	2.00	2	1.00
32	U. of Ballarat	Australia	2.00	1	2.00
32	U. of Bradford	UK	2.00	4	0.50
32	U. of Salford	UK	2.00	5	0.40
53	U. of Cambridge	UK	1.75	4	0.44
54	Lancaster U.	UK	1.67	4	0.42
54	St Cloud State U.	USA	1.67	2	0.84
54	St Joseph's U.	USA	1.67	3	0.56
54	U. of Cape Town	South Africa	1.67	2	0.84
54	U. of Limerick	Ireland	1.67	5	0.33
54	U. of Northumbria	UK	1.67	3	0.56
54	Brunel U.	UK	1.67	5	0.33

(Continues)

Table 2 Continued

	Name	Country	Total Score	# of individual contributors	Individual researcher contribution
62	PricewaterhouseCoopers	USA	1.58	4	0.40
63	Andersen Consulting	USA	1.50	4	0.38
63	Celemi	USA	1.50	1	1.50
63	Charles Sturt U.	Australia	1.50	2	0.75
63	Concordia U.	Canada	1.50	2	0.75
63	Dalhousie U.	Canada	1.50	2	0.75
63	Edith Cowan U.	Australia	1.50	3	0.50
63	Eindhoven U. of Technology	The Netherlands	1.50	3	0.50
63	Emory U.	USA	1.50	1	1.50
63	Erasmus U.	The Netherlands	1.50	4	0.38
63	Ernst & Young	USA	1.50	2	0.75
63	Helsinki School of Economics and B. A.	Finland	1.50	2	0.75
63	Intellectual Capital Services Ltd	UK	1.50	3	0.50
63	Maastricht U.	The Netherlands	1.50	2	0.75
63	Temple U.	USA	1.50	1	1.50
63	U. of New Mexico	USA	1.50	2	0.75
63	U. of Queensland	Australia	1.50	3	0.50
79	Athens U. of Economics and Business	Greece	1.33	3	0.44
79	Bournemouth U.	UK	1.33	1	1.33
79	Multimedia U.	Malaysia	1.33	4	0.33
79	Robert Gordon U.	UK	1.33	2	0.67
79	U. of Hong Kong	Hong Kong	1.33	1	1.33
79	U. of Illinois at Chicago	USA	1.33	2	0.67
79	U. of Pittsburgh at Johnstown	USA	1.33	1	1.33
79	UNIC	Sweden	1.33	1	1.33
79	Utah State U.	USA	1.33	1	1.33
88	Knowledge Associates	UK	1.25	2	0.63
88	Planet S.A.	Greece	1.25	3	0.42
88	U. of Batt	UK	1.25	2	0.63

Research impact

(1) Listing

A list of all the articles and their associated citations was created from the first to the last available issue in 2003 for each of the target journals. Editorials, book reviews, and interviews were once again excluded from the analysis. In total, 11 842 citations were identified.

(2) Proofreading

The final list was validated to identify incorrect references. Overall, 100 incorrect or incomplete citations were discovered. For example, an author's

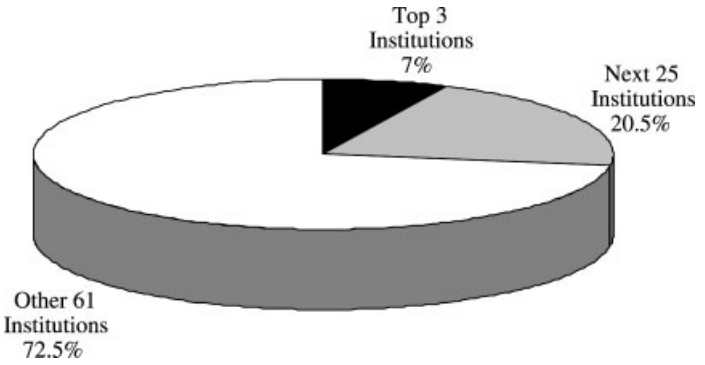

Figure 4 Percentage of total work contributed by top KM/IC institutions

Table 3 Top KM/IC countries ranked by research productivity

	Country	Absolute score	% score
1	USA	144.9	32.28
2	UK	104.3	23.22
3	Australia	32.3	7.20
4	Canada	19.8	4.42
5	Spain	18.2	4.05
6	Sweden	14.7	3.27
7	The Netherlands	14.3	3.17
8	Finland	10.0	2.23
9	Germany	9.5	2.12
10	Denmark	7.1	1.58
11	Greece	6.8	1.52
12	Switzerland	6.0	1.34
13	Brazil	5.8	1.30
14	Singapore	5.3	1.17
15	France	5.0	1.11
15	Mexico	5.0	1.11
17	Belgium	4.3	0.96
18	India	4.0	0.89
18	Ireland	4.0	0.89
20	Hong Kong	3.8	0.85
21	Japan	3.5	0.78
22	Norway	3.0	0.67
23	Malaysia	2.7	0.59
24	Portugal	2.3	0.50
25	China	2.0	0.45
25	Israel	2.0	0.45
25	South Africa	2.0	0.45
28	Korea	1.8	0.39
29	New Zealand	1.5	0.33
30	Saudi Arabia	1.0	0.22
30	Thailand	1.0	0.22
32	Italy	0.5	0.11
33	Luxembourg	0.3	0.07
34	Namibia	0.3	0.07

name was misspelled, or a publication year or a title was incorrect. This represents less than 1% of all entries.

(3) Computation

The list was sorted to identify the most frequently cited books, book chapters, journal articles, and conference papers. The Normalized Citation Impact Index was calculated and a list of the top KM/IC contributors was compiled by counting the number of times each author was cited. The straight count method was used.

RESULTS

The following sections report the results of this study on both research productivity and research impact. The authors apologize for any possible errors or omissions associated with the compilation and publication of these results.

Productivity ranking

The results reveal that 659 individual authors published 450 distinct papers in the three journals that we have reviewed from their inception to mid-2003. Further investigation demonstrates that almost half of the papers were written by a single researcher, 33.8% by two co-authors, and 15.1% by three individuals. Figure 2 illustrates the co-authorship distribution of KM/IC publications.

These findings contradict the results obtained by Bapna and Marsden (2002). In their study of Canadian business school research, they concluded that almost half of the journal articles published had two co-authors and only around 25% of the papers were single-authored.

The list of the most productive KM/IC researchers is presented in Table 1. The productivity score of each contributors exceeds (1) one. The benefit of selecting this threshold is twofold. First, it produces a relatively short list of 64 top academics and practitioners. Second, it allows new scholars to enter this list given a reasonable qualitative and quantitative input to the KM/IC community. It is suggested that future meta-review studies select a minimum score which generates a list of least 60 of the most productive individuals so that incentive for new researchers continues.

Figure 3 presents the percentage of total published work contributed by the top three and next 25 researchers. These numbers are consistent with findings by Im *et al.* (1998), who conclude that similar categories of MIS contributors account for 2%, 10%, and 88% respectively. As such, the KM/IC field is not dominated by several leading scholars. Instead, it is the contribution of various researchers and practitioners who represent the driving force of the discipline.

Table 2 provides a list of the most productive institutions. There are three measures listed: the total (normalized) score of each institution (accounting for multi-author papers), the total number of contributors, and the average individual researcher contribution score. The average individual researcher contribution score is the ratio of the total score and the number of individual contributors in a particular institution or an organization. All institutions with the total score of 1.25 and higher are presented.

Figure 4 depicts the percentage of total work contributed by the top institutions and organizations.

The results yield three major findings. First, Cranfield University is credited as being the leading KM/IC institution, whose total score is more than twice as high as that of the closest follower McMaster University. Second, almost all highly

Table 4 Top KM/IC publications ranked by straight count

	Paper	Author(s)	Year	Score
1	The Knowledge Creating Company	Nonaka, I. and Takeuchi, H.	1995	122
2	Working Knowledge	Davenport, T. H. and Prusak, L.	1998	58
3	Intellectual Capital	Stewart, T. A.	1997	55
4	The New Organizational Wealth	Sveiby, K. E.	1997	50
5	A dynamic theory of organizational knowledge...	Nonaka, I.	1994	46
6	The Knowledge Creating Company	Nonaka, I.	1991	44
7	The Fifth Discipline	Senge, P.	1990	42
8	Intellectual Capital	Edvinsson, L. and Malone, M. S.	1997	40
9	Reengineering the Corporation	Hammer, M. and Champy, J.	1993	39
10	The Tacit Dimension	Polanyi, M.	1966	32
10	Process Innovation	Davenport, T. H.	1993	32
10	Organization learning and communities of practice	Brown, J. S. and Duguid, P.	1991	32
13	The core competence of the corporation	Hamel, G. and Prahalad C. K.	1990	30
14	Personal Knowledge	Polanyi, M.	1958	28
15	Wellsprings of Knowledge	Leonard, D.	1995	27
15	Firm resources and sustained competitive advantage	Barney, J.	1991	27
15	Intellectual Capital	Roos, G., Roos, J. *et al.*	1998	27
18	An Evolutionary Theory of Economic Change	Nelson, R. R. and Winter, S. G.	1982	26
18	Knowledge of the firm, combinative capabilities...	Kogut, B. and Zander, U.	1992	26
20	Organizational Learning	Argyris, C. and Schön, D.	1978	25
21	Absorptive capacity	Cohen, W. M. and Levinthal, D. *et al.*	1990	24
22	What's your strategy for managing knowledge	Hansen, M. T., Nohria, N. *et al.*	1999	22
23	Post Capitalist Society	Drucker, P.	1993	21
24	Toward a knowledge-based theory of the firm	Grant, R.	1996	20
25	Intellectual capital: an exploratory study that...	Bontis, N.	1998	19
26	Assessing knowledge assets: a review of the...	Bontis, N.	2001	18
27	The concept of Ba: building a foundation for...	Nonaka, I. and Konno, N.	1998	17
27	Competing for the Future	Hamel, G. and Prahalad, C.K.	1994	17
29	Exploration and exploitation in organizational...	March, J.	1991	16
30	Improving knowledge work processes	Davenport, T., Jarvenpaa, S. *et al.*	1996	15
30	Managing organizational knowledge by...	Bontis, N.	1999	15
30	Knowledge and competence as strategic assets	Winter, S. G.	1987	15
30	Care in knowledge creation	Krogh, G.	1998	15
30	Dynamic capabilities and strategic management	Teece, D., Pisano, G. and Shuen, A.	1997	15

productive institutions demonstrate the highest number of individual contributors, which highlights the importance of research cooperation among colleagues as a key success factor. The average number of individual contributors per institution is three. Last, less than one-third of all articles were published by the top 28 institutions. This implies that the body of KM/IC research is highly diverse.

Table 3 lists KM/IC contribution by countries. All countries whose residents published in the reviewed journals are accounted for. According to this ranking, the USA and the UK are the most productive countries, having published over 50% of all the KM/IC articles. They are followed by Australia, Canada, and Spain. The top 10 countries produced almost 85% of all the research. The contribution of small Scandinavian countries, such as Sweden and

Finland, is also evident. These countries benefit from a strong corporate presence in the KM/IC field (e.g., Skandia and Nokia) from which several case studies have been published.

Research impact

Recall that the purpose of the research impact investigation is to identify the most frequently cited KM/IC publications as well as the most frequently cited individual authors. On average, each KM/IC paper has 26 unique citations. Tables 4 and 5 list the most frequently cited publications sorted by straight and normalized citation scores. Although there are several differences in these rankings, three publications stand out as the foundation pieces of the KM/IC field: Nonaka and Takeuchi (1995), Davenport and Prusak (1998), and Stewart (1997). These three citations have been very influential in the development of the KM/IC field. As such, 50% of all articles in the three target journals cited at least one of these works. Figure 5 outlines the percentage of all citations contributed by top publications.

Table 6 offers an overview of research impact of individual researchers by presenting a list of the

Table 5 Top KM/IC publications ranked by NCII

	Paper	Author	Year	NCII
1	The Knowledge Creating Company	Nonaka, I. and Takeuchi, H.	1995	15.25
2	Working Knowledge	Davenport, T. H. and Prusak, L.	1998	11.60
3	Intellectual Capital	Stewart, T. A.	1997	9.17
4	Assessing knowledge assets	Bontis, N.	2001	9.00
5	The New Organizational Wealth	Sveiby, K. E.	1997	8.33
6	Intellectual Capital	Edvinsson, L. and Malone, M. S.	1997	6.67
7	What's your strategy for managing knowledge	Hansen, M. T., Nohria, N. *et al.*	1999	5.50
8	Intellectual Capital	Roos, G., Roos, J. *et al.*	1998	5.40
9	A dynamic theory of organizational knowledge...	Nonaka, I.	1994	5.11
10	Reengineering the Corporation	Hammer, M. and Champy, J.	1993	3.90
11	Intellectual capital	Bontis, N.	1998	3.80
12	Managing organizational knowledge by...	Bontis, N.	1999	3.75
13	The Knowledge Creating Company	Nonaka, I.	1991	3.67
14	The concept of Ba: building a foundation...	Nonaka, I. and Konno, N.	1998	3.40
15	Wellsprings of Knowledge	Leonard, D.	1995	3.38
16	The Fifth Discipline	Senge, P.	1990	3.23
17	Process Innovation	Davenport, T. H.	1993	3.20
18	Care in knowledge creation	Krogh, G.	1998	3.00
19	Toward a knowledge-based theory of the firm	Grant, R.	1996	2.86
20	Organization learning and communities of practice	Brown, J. S., and Duguid, P.	1991	2.67
21	Dynamic capabilities and strategic management	Teece, D., Pisano, G. and Shuen, A.	1997	2.50
22	Knowledge of the firm, combinative capabilities...	Kogut, B. and Zander, U.	1992	2.36
23	The core competence of the corporation	Hamel, G. and Prahalad, C. K.	1990	2.31
24	Firm resources and sustained competitive advantage	Barney, J.	1991	2.25
25	Improving knowledge work processes	Davenport, T., Jarvenpaa, S. *et al.*	1996	2.14
26	Post Capitalist Society	Drucker, P.	1993	2.10
27	Competing for the Future	Hamel, G. and Prahalad, C. K.	1994	1.89
28	Absorptive capacity	Cohen, W. M. and Levinthal, D. A.	1990	1.85
29	Exploration and exploitation in organizational...	March, J.	1991	1.33
30	An Evolutionary Theory of Economic Change	Nelson, R. R. and Winter, S. G.	1982	1.24
31	Organizational Learning	Argyris, C. and Schön, D.	1978	1.00
32	Knowledge and competence as strategic assets	Winter, S. G.	1987	0.94
33	The Tacit Dimension	Polanyi, M.	1966	0.86
34	Personal Knowledge	Polanyi, M.	1958	0.62

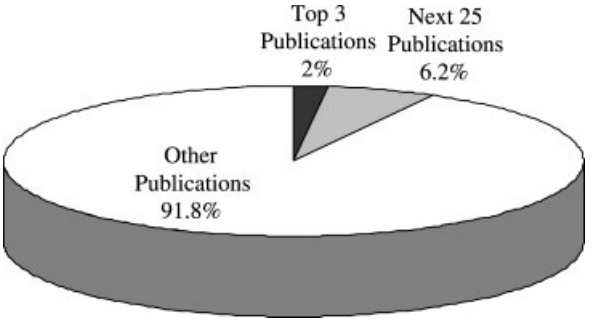

Figure 5 Percentage of all citations contributed by top publications

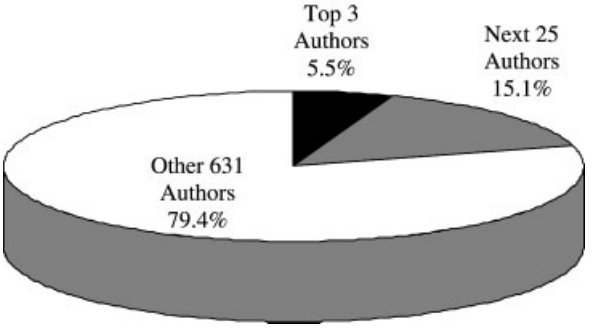

Figure 6. Percentage of all citations contributed by top authors

most frequently cited authors. The score is the number of times an author was cited. Books, journal articles, and conference proceedings are included. Edited books are accounted for only if a book rather than a book chapter was cited.

Table 6 Most frequently cited KM/IC authors ranked by straight count

	Author	Score
1	Nonaka, I.	306
2	Davenport, T. H.	218
3	Bontis, N.	128
3	Takeuchi, H.	128
5	Edvinsson, L.	98
6	Sveiby, K. E.	96
7	Prusak, L.	89
8	Roos, J.	81
8	Stewart, T. A.	81
10	Hamel, G.	80
11	Grant, R. M.	78
11	Krogh, G.	78
13	Hammer, M.	74
14	Drucker, P. F.	71
14	Prahalad, C. K.	71
16	Porter, M.	70
17	March, J.	69
18	Senge, P.	68
19	Wiig, K. M.	63
20	Teece, D. J.	61
21	Polanyi, M.	59
22	Roos, G.	56
23	Brown, J. S.	55
24	Leonard-Barton, D.	54
25	Barney, J. B.	51
25	Winter, S. G.	51
25	Guthrie, J.	51
25	Malone, M. S.	51
25	Weick, K. E.	51
30	Argyris, C.	49
31	Levinthal, D. A.	41
32	Nelson, R.	40
32	Petty, R.	40

Figure 6 approximates the percentage of citations contributed by the top three and next 25 researchers. As such, publications by I. Nonaka, T. H. Davenport, N. Bontis, and H. Takeuchi have the highest impact on the direction of the KM/IC discipline.

CONCLUSIONS

The meta-review of the KM/IC literature yielded several interesting results. First, in contrast to other research areas, almost half of all publications are sole authored. It demonstrates that KM/IC is a relatively young field in which a single person may provide a substantial contribution. At the same time, as the body of knowledge and the complexity of the discipline grow, future authors may find it more difficult to embark on challenging projects alone.

Secondly, in many universities and organizations, there is a single person who leads the KM/IC field, and he or she accounts for a substantial number of all publications produced by this institution. Usually, this person writes solo papers and co-authors articles with colleagues, research associates, and students. Ganesh Bhatt (Morgan State University, USA), Syed Z. Shariq (Stanford University, USA), Jay Liebowitz (University of Maryland–Baltimore County, USA), and Rodney McAdam (University of Ulster, UK) are among many individuals standing behind various research initiatives in their respective universities. There are also several authors who are the only KM/IC researchers in their institutions. We hope that those individuals start seeking opportunities for collaboration both in and outside of their institutions. This will dramatically increase the research outputs of their universities.

Given that this study is the first of its kind, it does have several limitations. First, since

automated citation indices do not cover the target journals, data collection and analysis was done manually by using built-in spreadsheet functions and macros. Although we have made every possible attempt to avoid mistakes and omissions, a small probability of an error cannot be completely eliminated.

The publication longevity in the NCII was measured by accepting the year 2003 as the ending point. This, however, may benefit works that appeared at the end of a year (i.e., the latter issue in any given calendar volume) and penalize those published at the beginning of a year. For example, the publication longevity of two articles that appeared in the first and the last issues of the same journal volume in one particular calendar year would be equal although the former work has been in print for 8 months longer.

Self-citations were included in the calculation of citation scores. Although it is possible that an author may be citing his or her work more diligently than those of others, we have no reason to assume that KM/IC researchers are more likely to self-cite and to ignore competing viewpoints. Moreover, it is becoming standard practice to include self-citations in meta-review analysis since there is ample evidence that this practice is common (e.g., see Erkut, 2002). Besides, automatic citation indices also include self-citation in their calculations.

Clearly the influential models developed by Nonaka and Takeuchi, as well as Davenport and Prusak, coupled with the editorial prowess of Tom Stewart (formerly at *Fortune Magazine* and currently at *Harvard Business Review*), provide much of the intellectual foundation of the KM/IC field. However, what is evident in the meta-review analysis is that the KM/IC field benefits from a wide and diverse publication base that covers both academic institutions and corporate organizations. Furthermore, the global coverage of countries represented, as well as the sheer number of authors that have influenced the field's rise, bodes well for its future health as a body of literature that is both influential and meaningful to managers in the knowledge era.

ACKNOWLEDGEMENT

The authors would like to thank the research contribution made by our research associate Amer Mohamed, who was responsible for assisting us in the coding of the articles and citations for this study.

REFERENCES

Bapna R, Marsden JR. 2002. The paper chase: comparing the research productivity of quantitative/technical departments in schools of business. *OR/MS Today* **29**(6). http://www.lionhrtpub.com/orms/orms-12-02/frpaperchase.html [5 June 2004].

Bontis N. 1998. Managing organizational knowledge by diagnosing intellectual capital: framing and advancing the state of the field. *Journal of Technology Management* **18**(5–8): 433–462.

Cartter AM. 1966. *An Assessment of Quality in Graduate Education*. American Council on Education: Washington, DC.

Cheng CH, Holsapple CW, Lee A. 1996. Citation-based journal rankings for AI research: a business perspective. *AI Magazine* **17**(2): 87–97.

Cheng CH, Kumar A, Motwani JG, Reisman A, Madan MS. 1999. A citation analysis of the technology innovation management journals. *IEEE Transactions on Engineering Management* **46**(1): 4–13.

Cox WM, Catt V. 1977. Productivity ratings of graduate programs in psychology based upon publication in the journals of the American Psychological Association. *American Psychologist* **32**: 793–813.

Davenport TH, Prusak L. 1998. *Working Knowledge: How Organizations Manage What They Know*. Harvard Business School Press: Cambridge, MA.

Erkut E. 2002. Measuring Canadian business school research output and impact. *Canadian Journal of Administrative Sciences* **19**(2): 97–123.

Feiwal G. 1975. *The Intellectual Capital of Michal Kalecki: A Study in Economic Theory and Policy*. University of Tennesee: Knoxville, TN.

Gibby RE, Reeve CL, Grauer E, Mohr D, Zickar MJ. 2002. The Top I-O psychology doctoral programs of North America. *The Industrial-Organizational Psychologist* **39**(4): 17–25.

Goerl GF. 1975. Cybernetics, professionalizations, and knowledge management: an exercise in assumptive theory. *Public Administration Review* **35**(6): 581.

Goodrum AA, McCain KW, Lawrence S, Giles CL. 2001. Scholarly publishing in the Internet Age: a citation analysis of computer science literature. *Information Processing and Management* **37**(5): 661–675.

Gordon RA, Vicari PJ. 1992. Eminence in social psychology: a comparison of textbook citation, social sciences citation index, and research productivity rankings. *Personality and Social Psychology Bulletin* **18**: 26–38.

Grover V, Segars AH, Simon SJ. 1992. An assessment of institutional research productivity in MIS. *ACM SIGMIS Database* **23**(4): 5–9.

Henry N. 1975. Bureaucracy, technology, and knowledge management. *Public Administration Review* **35**(6): 572.

Holsapple CW, Johnson LE, Manakyan H, Tanner J. 1994. Business computing research journals: a normalized citation analysis. *Journal of Management Information Systems* **11**(2): 131–141.

Howard GS, Day JD. 1995. Individual productivity and impact in developmental psychology. *Developmental Review* **15**(2): 136–149.

Howard GS, Cole DA, Maxwell SE. 1987. Research productivity in psychology based on publication in the journals of American Psychology Association. *American Psychologist* **42**(11): 975–986.

Im KS, Kim KY, Kim JS. 1998. An assessment of individual and institutional research productivity in MIS. *Decision Line* **December/January**: 8–12.

Lindsey D. 1980. Production and citation measures in the sociology of science: the problem of multiple authorship. *Social Studies of Science* **10**(2): 145–162.

McCaffery J. 1975. Knowledge management in fiscal policy formation. *Public Administration Review* **35**(6): 598.

Nonaka I, Takeuchi H. 1995. *The Knowledge-Creating Company*. Oxford University Press: New York.

Payne SC, Succa CA, Maxey TD, Bolton KR. 2001. Institutional representation in the SIOP conference program: 1986–2000. *The Industrial-Organizational Psychologist* **39**(1): 53–60.

Scott LC, Mitias PM. 1996. Trends in rankings of economics departments in the U.S.: an update. *Economic Inquiry* **34**(2): 378–400.

Stewart TA. 1991. Brainpower: how intellectual capital is becoming America's most valuable asset. *Fortune* **3**(June): 44–60.

Stewart TA. 1997. *Intellectual Capital: The New Wealth of Organizations*. Currency Doubleday: New York.

Surrette MA, College S. 2002. Ranking I-O graduate programs on the basis of student research presentations at IOOB: an update. *The Industrial-Organizational Psychologist*, http://siop.org/tip/backissues/TIPJuly02/18surrette.htm [23 May 2004].

Vokurka RJ. 1996. The relative importance of journals used in operations management research: a citation analysis. *Journal of Operations Management* **14**(4): 345–355.

Wright RA, Cohn EG. 1996. The most-cited scholars in criminal justice textbooks, 1989–1993. *Journal of Criminal Justice* **24**(5): 459–467.