



A cluster analysis of the KM field

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Abstract

Purpose – The main purpose of this study is to review the knowledge management literature from a content-related perspective using cluster analysis.

Design/methodology/approach – A critical analysis of previous review articles in KM provided a conceptual framework with nine dimensions. A survey was then administered to 120 KM authors asking them to review which dimensions they considered in their own research.

Findings – Three clusters of KM research were identified as follows: the socialization school, the collaboration school, and the codification school.

Research limitations/implications – The study does not consider the dimension of strategic versus operational KM issues nor does it consider any non-Anglophonic research.

Practical implications – The three identified clusters accrued from the review provide both scholars and practitioners with a more holistic perspective and better understanding of the main thrusts of their KM initiatives.

Originality/value – The research is the first systematic and comprehensive review of KM that provides a cluster analysis approach.

Keywords Knowledge management, Literature, Cluster analysis

Paper type Literature review

Introduction

The burst of attention paid to knowledge management (KM) in academia over the past several years, and the increasing importance of knowledge assets in today's competitive markets are two major drivers behind the emergence of KM as a critically important domain for both academic researchers and practitioners. The steep increase in the number of publications in the KM domain (Despres and Chauvel, 1998; Serenko and Bontis, 2004) and the large number of practical initiatives in the field of KM (Rigby and Bilodeau, 2007) have created a resurgence of interest. Clearly, in today's knowledge era, intellectual capital and intangible assets play a major role in sustaining competitive advantage (Mayo and Lank, 1994; Baumard, 1996; Davenport and Prusak, 1998; Drucker, 1999; Bontis, 2001a).

Although there is debate with regards to the way the field has developed (Jasimuddin, 2006), it is beyond dispute that KM is still at its infancy (Kakabadse *et al.*, 2003; Dayan and Evans, 2006; Lloria, 2008; Bergeron, 2003; Jennex, 2005) and subject to dramatic evolution based on the contribution of a large variety of fields like economics, management, human resources, information technology, philosophy, psychology and sociology (Kakabadse *et al.*, 2003; Lloria, 2008; Quintas *et al.*, 1997). Some argue that this domain of literature suffers from vague and widespread conceptions and ill-defined notions (Bergeron, 2003; Kakabadse *et al.*, 2003). Others add that there is no



clear stand about what is the essential constitution of this field (Jasimuddin, 2006) that makes it different from other related areas such as technology management, and the management of R&D (Hedlund, 1994), learning organizations (Jennex, 2005), or intellectual capital (Bontis, 1998; Bontis and Fitz-enz, 2002). As a result, we now face a highly widespread (Despres and Chauvel, 1998) and heterogeneous field that seems to be an eclectic mélange of different and inconsistent definitions, notions, models, approaches and frameworks (Curado and Bontis, 2006). In addition, a tentative assertion of different scholars in the KM domain testifies that there are lots of gaps in this literature that have not been explored so far (Jasimuddin, 2006; Bontis, 1999). So, a systematic, conceptually rich and comprehensive review of the field seems to be an imperative to further development as an established management discipline.

Hence, there is a dire need in the domain of KM for review activities in order to not only come up with classifications of works completed, but to also show which parts of the literature are not well developed, thus paving the way for further academic research and practical tools (Bontis *et al.*, 1999; Jasimuddin, 2006) as well as novel teaching approaches. One of the results of such a review could be the identification of the mainstay of KM literature and how it is really different from other close strands of thought. Although there are several attempts in this domain devoted to such review activities, most of them are not systematic, comprehensive and conceptually rich. Based on a review of previous literature reviews (which are highlighted in the second part of this paper), a comprehensive analytical framework is proposed.

Literature review

Knowledge can be both tacit and explicit (Polanyi, 1962; Nonaka and Takeuchi, 1995). These two types differ based on whether the knowledge has yet to be codified. Knowledge can also be carried by knowledge workers, embedded in products or documents, and can be found at different levels of analysis (from individual to inter-organizational). The processes embedded in knowledge management allow organizations to better achieve their goals (for reviews see Wiig, 1997; McAdam and McCreedy, 1999; Kakabadse *et al.*, 2003; Jasimuddin, 2006; Andreou and Bontis, 2007). The following is a list of the primary KM activities that emanate from the extant literature:

- *Knowledge assessment.* Includes needs assessment, developing knowledge strategy and KM strategy, and identifying sources and mechanisms of other successive activities (Kreng and Tsai, 2003).
- *Knowledge acquisition/absorption/assimilation.* Are the efforts in line with attaining existing but outside knowledge that are important to the firm (Meyer and Zack, 1996; Zack, 1999).
- *Knowledge creation/processing/development/transformation.* The generation of new knowledge that either is not available outside the firm, or is not efficiently attainable (Nonaka and Takeuchi, 1995).
- *Knowledge storage/retrieval.* Codifying knowledge in different forms with various technological tools and software techniques making it more durable and more efficiently reusable.
- *Knowledge sharing/distribution/circulation/transfer.* Making knowledge accessible for different units, groups or individual within the firm (e.g.

diffusion of best practices among different business units (Davenport and Prusak, 1998).

- *Knowledge utilization/application*. Creating value (in its broadest meaning) based on existing knowledge within the firm.
- *Active forgetting of knowledge*. Trying to wipe out obsolete knowledge away from the knowledge-base of and organization in an intentional and active way (Toffler, 1993).
- *Administrative process of KM*. Activities that are not themselves any of the above processes, but include activities that have a direct bearing on them, such as KM diagnostics, KM evaluation, KM planning, and KM capability building.

It deserves mentioning that there are a myriad of versions of these KM activities and related classifications (Bergeron, 2003; Hedlund, 1994; Despres and Chauvel, 1998; Alavi and Leidner, 2001; Johnson and Bumentritt, 1998; Meyer and Zack, 1996; Zack, 1999; Lloria, 2008). The above-mentioned list is an attempt to create a comprehensive classification.

The implementation of KM functions is based on three major categories of issues: human resource issues, information and communication technologies, and organizational issues. Organizational issues can be further sub-divided into formal issues like organizational structure and processes and informal issues such as organizational culture and routines (Eschenfelder *et al.*, 1998).

Approaches toward KM can be mapped on a continuum from “engineered” to “organic”. The literature of KM provides extensive review of this dichotomy (Alvesson and Kärreman, 2001; Swan and Scarbrough, 2001). The literature also distinguishes between “knowledge management” and “enabling knowledge” (Nonaka and Toyoma, 2005; Nonaka, 1994; Nonaka and Takeuchi, 1995), US and Japanese styles of KM (Hedlund, 1994), and “technological” vs “organic” KM (Bergeron, 2003).

The *locus* of KM can be “inward” when it focuses on the management of knowledge available within the organization, or “outward” that mainly considers the way in which external knowledge can be absorbed and managed to become part of internal organizational capabilities. The focus of attention can be on three performance indicators which include “timing” (what is the proper schedule for commencing or implementing KM initiatives), “quality” (how to improve the effectiveness of KM projects), and “cost” (the amount of money needed to budget for various activities and their predicted returns). Potentially, there might be cases in which the focus is on one or more of these aspects.

The context in which KM activities take place has direct bearing on the outcomes of KM. Two major issues should be considered in this vein. First, the type of organization can be “private” (for-profit organizations), or “governmental/public” (not-for profit organizations). This distinction is important because the different nature of ownership, organizational goals and cultures influences KM activities and outcomes. Second, the size of an organization also plays an influential role. Clearly, KM in small and medium sized enterprises can have different analytical and practical considerations compared with KM in large organizations (Bergeron, 2003; Jetter *et al.*, 2005; Serenko *et al.*, 2007).

In order to analyze KM research studies, nine dimensions are proposed. Two of them are related to the content of knowledge that is going to be managed (tacit vs explicit; and level), one of them is related to the implementation dimensions (HR, ICT,

organizational issues), another one related to KM activities or processes (from assessment to active forgetting and administrative issues related to KM), three of them are related to the approach toward KM (engineered vs organic; inward vs. outward; focus on timing, quality, cost and scope), and two of them associated with the context of KM (the type and size of organization).

The purpose of this study is to review KM research within this proposed framework. Any research paper in this domain can be regarded as a point in nine-dimensional space. A cluster analysis is conducted by positioning sample journal papers within this realm. These nine dimensions and sub-categories are presented in Table I.

A review of meta-reviews was conducted by examining six major articles in the KM domain chronologically (see Table II). By and large, previous literature review articles

Dimension	Sub-categories
<i>Content-related dimensions</i>	
1. Form	a. tacit b. explicit c. both
2. Aggregation level	a. individual b. group-level c. departmental d. organizational e. inter-organizational
3. Constitutional dimension	a. human resources b. technological (ICT) c. organizational
4. Process dimension	a. assessment b. creation c. absorption d. storage and retrieval e. sharing and dissemination f. utilization g. active forgetting h. KM administration
<i>Dimensions related to management approach</i>	
5. Management style	a. engineered (mechanistic) b. enabling (organic)
6. Focus of attention	a. inward view (resource-based) b. outward view (opportunistic)
7. Performance of KM activities	a. cost b. timing c. quality d. scope
<i>Dimensions related to the context of KM</i>	
8. Type of organization	a. private b. public (non-profit)
9. Size of organization	a. small and medium b. large

Table I.
Nine dimensions and
sub-categories of KM
research

Table II.
A review of major review
articles on KM

Authors	Dimensions adopted	Method	Clusters identified	Strengths	Shortcomings
Despres and Chauvel (1998)	<ol style="list-style-type: none"> 1. Time (KM processes) 2. Type (tacit vs explicit) 3. Level (aggregation) 	Keyword search and using SW for content analysis based on the content on the web	<ol style="list-style-type: none"> 1. Soft consultants and business schools 2. Business productivity, K assets 3. Behavioral science, leadership, team 4. Companies, industries, markets 5. Strategic services for business 6. Conferences, actors, CKOs 	<p>Early review article</p> <p>Systematic approach</p>	<p>Less-specified scope of inquiry with regard to KM</p> <p>Poor analysis of findings</p> <p>Weak analytical framework</p> <p>Sensitive to keyword and time</p>
McAdam and McCreedy (1999)	<ol style="list-style-type: none"> 1. Type (tacit vs explicit) 2. Aggregation level 3. Approach toward KM (mechanistic vs socially constructed) 	Analytical and intuitive analysis of different models	<ol style="list-style-type: none"> 1. Knowledge category 2. Intellectual capital 3. Socially constructed 	<p>Attention to the content of works done in KM domain</p>	<p>No systematic and reliable method of data collection and analysis</p> <p>Selective scope of inquiry</p> <p>No mutually exclusive clusters</p>
Chauvel and Despres (2002)	<ol style="list-style-type: none"> 1. Phenomena (enablers vs barriers) 2. Action (practice vs strategies) 3. Level (individual to culture) 4. Knowledge (identification vs valorization) 5. Technology (hard systems vs soft systems) 6. Outcomes (costs vs benefits) 	Selection of 23 KM surveys based on keyword search ("knowledge management") in English, French, and Spanish and then using manual thematic analysis	(No clusters identified)	<p>Clear scope of inquiry</p> <p>Multi-language search</p>	<p>Narrow scope of inquiry</p> <p>Low number of samples</p> <p>Inconclusive analysis</p> <p>Subjectivity of data analysis method</p>

(continued)

Authors	Dimensions adopted	Method	Clusters identified	Strengths	Shortcomings
Kakabadse <i>et al.</i> (2003)	<ol style="list-style-type: none"> 1. Treatment of knowledge 2. Dominant metaphor 3. Focus 4. Primary aim 5. Critical lever 6. Primary outcomes 7. Role of IT-based tools 	Analytical review of the content of literature in an intuitive way	<ol style="list-style-type: none"> 1. Philosophy-based 2. Cognitive 3. Network 4. Community 5. Quantum 	<p>Vast literature review</p> <p>Deep content analysis</p>	<p>Intuitive and subject analysis</p> <p>Not well developed concepts and constructs</p> <p>Approach too broad</p>
Serenko and Bontis (2004)	<ol style="list-style-type: none"> 7. Role of IT-based tools <p>Different bibliometric indicators related to citation statistics – productivity and impact (e.g. article, author, institution)</p>	Bibliometric analysis based on citations	Instead of clusters, ranked productivity and impact	Sophisticated, systematic and replicable method	No content-related analysis
Lloria (2008)	Description vs prescription	Analytical review of major approaches toward KM	<ol style="list-style-type: none"> 1. Measuring 2. Managing 3. Creating 	Good critical review	<p>Narrow scope of inquiry</p> <p>Subjective and unsystematic analysis</p> <p>Proposed dimension is questionable</p>

Table II.

emphasized two primary approaches: analytical (classifications designed through a systematic process) or inductive (identified clusters through the process of induction). This study provides both perspectives by building an overall framework while also identifying clusters.

Furthermore, previously completed KM reviews have either emphasized quantitative methods that can be replicated (e.g. the citation analysis conducted by Serenko and Bontis, 2004), or have utilized more intuitive approaches preventing them from being systematically repeatable (e.g. Kakabadse *et al.*, 2003; Lloria, 2008).

Data collection

A search in the ProQuest database yielded over 1,800 papers which had “knowledge management” as an exact phrase in the title. The number of papers with other terms such as “management of knowledge” (19) and “managing knowledge” (148) were relatively small. Figure 1 illustrates the number of papers published from 1997 to 2007. The average number of authors per paper was 1.7.

A target sample of 1,200 authors whose email addresses were accessible was gleaned from the overall 1,800 papers that were published. A customized e-mail was sent to each author (by name) requesting the main dimensions articulated in their publication (by article title). The data collection phase lasted two months and 150 completed questionnaires (i.e. 12.5 percent response rate). Of those, 120 research records were used for analysis. For a 95 percent confidence level and 5 percent margin of error, the 120 sample out of a large population is acceptable. Authors with two or more publications were asked to select their overall body of research for the purposes of this study. The Cronbach’s alpha of the collected data is 0.78 (the standard Cronbach’s alpha is 0.81) which shows an acceptable level of reliability.

For data collection, we transformed our general framework into a questionnaire that was composed of nine questions. Based on the opinion of several experts, the questionnaire was evaluated for content validation.

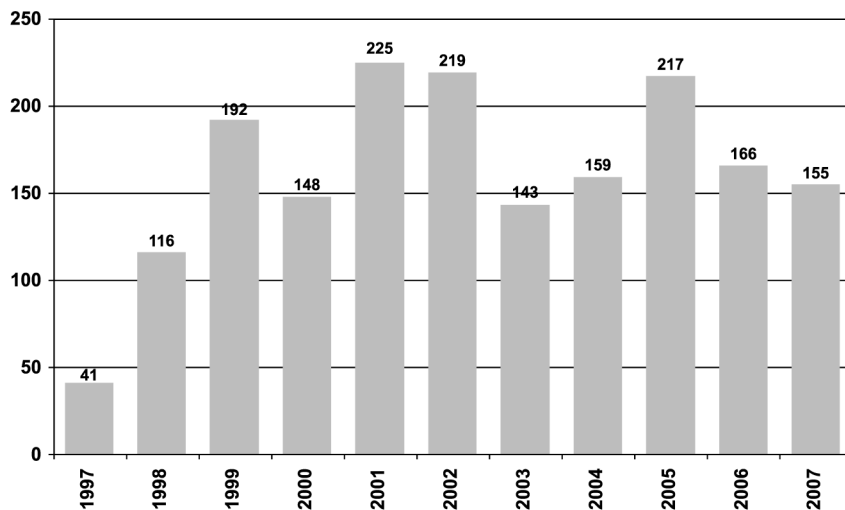


Figure 1.
Number of KM papers in
ProQuest database

Analysis and results

The first step in the analysis was to determine whether the nine dimensions were in fact considered by KM authors in their publications. Then, a cluster analysis was conducted.

Tacit vs explicit

Results show that almost 50 percent of authors distinguished between tacit and explicit knowledge in their research.

Aggregation level

Around 75 percent of respondents considered the organizational level of aggregation as the major focus of their research, while 58 and 57 percent of papers respectively also included the group and individual levels. Only 37 percent concentrated on KM at the departmental and inter-organizational levels.

KM activities

The majority of publications in the field of KM emphasize knowledge sharing (82 percent), creation (61 percent), and utilization (61 percent). The least emphasis is on active forgetting (11 percent) (Figure 2).

Performance indicators of KM

Most of the research completed seems to be in the quest for understanding the quality of KM initiatives (70 percent) rather than the time (29 percent), cost (21 percent) or scope (20 percent).

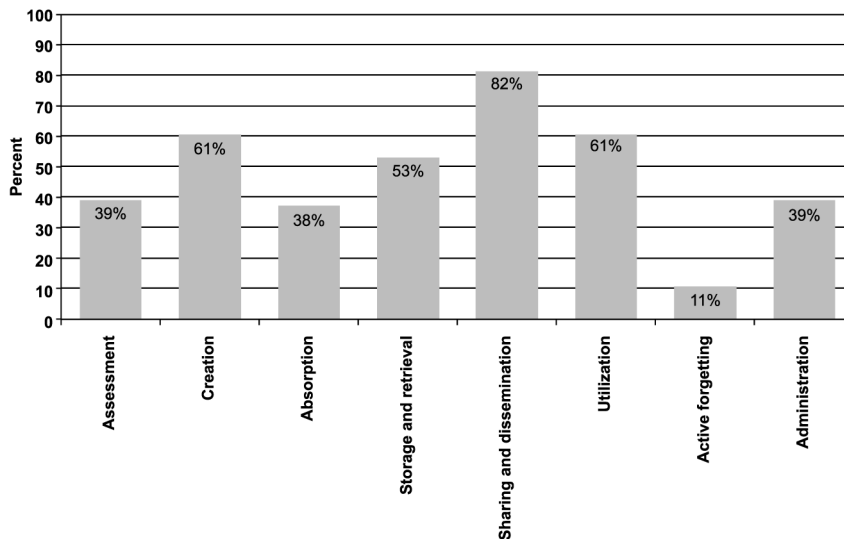


Figure 2.
Share of papers focused on
each KM activity

Focal dimension of KM implementation

Organizational issues (i.e. structure and processes) have been the most attractive dimension to KM scholars as 71 percent of authors expressed their direct attention to this dimension in their research. HR (61 percent) and ICT (53 percent) were also highly represented.

Engineered vs enabling approach

Only 17 percent of respondents admitted that their focus had been to use an engineered approach while 50 percent claimed they had adopted an organic approach. Interestingly, the results show the majority of authors (82 percent) with an engineered approach also focused on ICT as one of the implementation dimensions.

Inward or outward view

Over 50 percent of the research took an inward view toward KM, while just 11 percent focused on the external environmental (outward) factors that influence KM.

Type of organization

Results support the claim that KM for not-for-profits is not well developed because only 8 percent of the research focused on KM in such organizations. On the other hand, 30 percent of the research was classified as applicable to private firms, and a greater portion (60 percent) had no special orientation toward to the type of organization studied.

Size of organization

Over 56 percent of the authors surveyed confessed that they had paid no attention to the size of organization in their work. However, the research conducted in large firms (26 percent) exceeded the works associated with small and medium size organizations (16 percent).

Cluster analysis

A taxonomy of papers was generated using cluster analysis by grouping similar papers across the nine dimensions in the framework. A process recommended by Everitt *et al.* (2001) was utilized. A total of three clusters were revealed covering more than 92 percent of the sample (see Table III).

The first cluster which covers 45 percent of the sample can be described as research that focuses on sharing and utilization at both the individual and organizational levels of analysis with a focus on quality and an inward approach. This first cluster is labeled as the socialization school. Regarding the ICT-Human dichotomy, this cluster is mainly shaped around the human and organizational aspects of KM.

The second cluster represents 25 percent of the sample and can be briefly described as research that focused on storage at the group level in private and large companies. This second cluster is labeled as the codification school. Also, this cluster is mainly concerned about non-ICT aspects of KM.

The final cluster represents 21 percent of the research and is mainly associated with sharing explicit knowledge at the departmental level with an inward view, and mainly with focus on the role of ICT. This final group is labeled as the collaboration school.

Cluster	Description	Attributions based on framework dimensions
The Socialization School 45%	Sharing and utilization at the individual and organizational levels of analysis with a focus on quality and an inward approach	<ol style="list-style-type: none"> 1. Very little concern about the knowledge type 2. 80% focus on individual and organizational level 3. 86% sharing, 72% utilization, 22% active forgetting 4. 84% quality, 26% cost, 27% time 5. 78% HR, 80% organizational 6. 4% engineered 7. 2% outward view 8. 94% no concern about organization type 9. 94% no concern about organization size
The Codification School 25%	Storage at the group level in private, large companies	<ol style="list-style-type: none"> 1. 77% no concern about knowledge type 2. 80% group level, 73% organizational level 3. 93% storage, 100% not active forgetting 4. 27% cost, 83% quality 5. 73% HR, 80% organizational 6. 13% engineered 7. 83% inward view 8. 83% private 9. 67% large
The Collaboration School 21%	Sharing explicit knowledge at the departmental level with an inward view	<ol style="list-style-type: none"> 1. 96% explicit 2. 80% group, 75% organizational 3. 17% assessment, 17% absorption, 71% sharing, 4% active forgetting 4. 17% cost, 17% time 5. 67% ICT 6. 12% no special concern about approach 7. 67% inward 8. 75% no concern about type of firm 9. 25% SME, 25% large

Table III.
Description of research clusters based on framework dimensions

Conclusion

The purpose of this study was to review previous KM literature reviews and develop a framework that would encompass many of the field's dimensions. This framework was then utilized through a process of cluster analysis to identify the three main groupings of research in the field of KM. The following schools of thought were presented: socialization, codification and collaboration.

The main conclusions from this study include:

- there is little attention to active forgetting (or unlearning) as an important KM activity;
- a significant void exists between technologically-focused and human-focused KM research;
- a strong emphasis of KM research relates to the quality of initiatives rather than the timing, cost, or scope of their impact;
- the literature surrounding an outward view toward KM is not well developed;

- non-for-profit organizations are significantly underrepresented in case studies and target groups for KM research; and
- the KM literature does not differentiate explicitly by organizational size.

A major academic contribution of this study has been the replication and extension of Kakabadse's claim that there exist only two KM domains IT-based and non-IT based (2003, p. 76). The results of this study also contravene the claim that the KM literature is solely technology focused (Swan *et al.*, 1999). Future researchers may wish to replicate or even extend the nine dimensions currently proposed. Furthermore, future studies may also test the discriminant validity of the three clusters identified.

A significant implication for practitioners focuses on the importance of taking a more holistic approach when discussing KM concepts within organizations. KM professionals should also be warned that academic studies are not necessarily generalizable across various dimensions (e.g. levels of analysis, activity, organization type). In other words, when reading KM research, CKOs must be careful not to hastily apply concepts in their own particular context (Bontis, 2001b).

Opportunities for future research include the extension of dimensions to include strategic vs. operational approaches, as well as Anglophonic vs. non-Anglophonic publications. Given that all of the research reviewed in this study was published in English, no global claim or generalizable message can truly be made.

The next step in this study would be to provide a longitudinal perspective with regards to how the dimensions and clusters are changing over time. This would require a sufficient sample over many years. A similar process may also be conducted for related fields such as organizational learning (Bontis *et al.*, 2000a, b, 2002), intellectual capital (O'Regan *et al.*, 2001; O'Donnell *et al.*, 2004, 2006, Seleim *et al.*, 2004; Cleary *et al.*, 2007), leadership (Bart *et al.*, 2001; Boehnke *et al.*, 2003), and technology management (McKnight and Bontis, 2002; Chauhan and Bontis, 2004; Serenko *et al.*, 2007; Turel *et al.*, 2007).

References

- Alavi, M. and Leidner, D.E. (2001), "Knowledge management and knowledge management systems: conceptual foundations and research issues", *MIS Quarterly*, Vol. 25 No. 1, pp. 107-36.
- Alvesson, M. and Kärreman, D. (2001), "Odd couple: making sense of the curious concept of knowledge management", *Journal of Management Studies*, Vol. 38 No. 7, pp. 995-1018.
- Andreou, A.N. and Bontis, N. (2007), "A model for resource allocation using operational knowledge assets", *The Learning Organization*, Vol. 14 No. 4, pp. 345-74.
- Bart, C.K., Bontis, N. and Taggar, S. (2001), "A model of the impact of mission statements on firm performance", *Management Decision*, Vol. 39 No. 1, pp. 19-35.
- Baumard, P. (1996), "Organization in the fog: an investigation into the dynamics of knowledge", in Moingeon, B. and Admonston, A. (Eds), *Organizational Learning and Competitive Advantage*, Sage, London, pp. 74-91.
- Bergeron, B. (2003), *Essentials of Knowledge Management*, John Wiley & Sons, Inc., Hoboken, NJ.
- Boehnke, K., Bontis, N., DiStefano, J.J. and DiStefano, A.C. (2003), "Transformational leadership: an examination of cross-national differences and similarities", *Leadership & Organization Development Journal*, Vol. 24 No. 1, pp. 5-15.

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- Bontis, N. (1998), "Intellectual capital: an exploratory study that develops measures and models", *Management Decision*, Vol. 36 No. 2, pp. 63-76.
- Bontis, N. (1999), "Managing organizational knowledge by diagnosing intellectual capital: framing and advancing the state of the field", *International Journal of Technology Management*, Vol. 18 Nos 5-8, pp. 433-62.
- Bontis, N. (2001a), "Assessing knowledge assets: a review of the models used to measure intellectual capital", *International Journal of Management Reviews*, Vol. 3 No. 1, pp. 41-60.
- Bontis, N. (2001b), "CKO wanted – evangelical skills necessary: a review of the chief knowledge officer position", *Knowledge and Process Management*, Vol. 8 No. 1, pp. 29-38.
- Bontis, N. and Fitz-enz, J. (2002), "Intellectual capital ROI: a causal map of human capital antecedents and consequents", *Journal of Intellectual Capital*, Vol. 3 No. 3, pp. 223-47.
- Bontis, N., Chua, W. and Richardson, S. (2000a), "Intellectual capital and the nature of business in Malaysia", *Journal of Intellectual Capital*, Vol. 1 No. 1, pp. 85-100.
- Bontis, N., Crossan, M. and Hulland, J. (2002), "Managing an organizational learning system by aligning stocks and flows", *Journal of Management Studies*, Vol. 39 No. 4, pp. 437-69.
- Bontis, N., Keow, W.C.C. and Richardson, S. (2000b), "Intellectual capital and business performance in Malaysian industries", *Journal of Intellectual Capital*, Vol. 1 No. 1, pp. 85-100.
- Bontis, N., Dragonetti, N.C., Jacobsen, K. and Roos, G. (1999), "The knowledge toolbox: a review of the tools available to measure and manage intangible resources", *European Management Journal*, Vol. 17 No. 4, pp. 391-402.
- Chauhan, N. and Bontis, N. (2004), "Organisational learning via groupware: a path to discovery or disaster?", *International Journal of Technology Management*, Vol. 27 Nos 6/7, pp. 591-610.
- Chauvel, D. and Despres, C. (2002), "A review of survey research in knowledge management: 1997-2001", *Journal of Knowledge Management*, Vol. 6 No. 3, pp. 207-23.
- Cleary, P., O'Regan, P., O'Donnell, D., Kennedy, T. and Bontis, N. (2007), "Positioning management accounting in the intellectual capital agenda", *International Journal of Accounting, Auditing and Performance Evaluation*, Vol. 4 Nos 4/5, pp. 336-59.
- Curado, C. and Bontis, N. (2006), "The knowledge-based view of the firm and its theoretical precursor", *International Journal of Learning and Intellectual Capital*, Vol. 3 No. 4, pp. 367-81.
- Davenport, T. and Prusak, L. (1998), *Working Knowledge: How Organizations Manage What They Know*, Harvard Business School Press, Boston, MA.
- Dayan, R. and Evans, S. (2006), "KM: your way to CMMI", *Journal of Knowledge Management*, Vol. 10 No. 1, pp. 69-80.
- Despres, C. and Chauvel, D. (1998), "Knowledge management(s)", *Journal of Knowledge Management*, Vol. 3 No. 2, pp. 110-20.
- Drucker, P. (1999), "Knowledge-worker productivity: the biggest challenge", *California Management Review*, Vol. 41 No. 2, pp. 79-94.
- Eschenfelder, K., Heckman, R. and Sawyer, S. (1998), "The distribution of computing: the knowledge markets of distributed technical support specialists", *Information Technology & People*, Vol. 11 No. 2, pp. 84-103.
- Everitt, B., Landau, S. and Leese, M. (2001), *Cluster Analysis*, Arnold, London.
- Hedlund, G. (1994), "A model of knowledge management and the N-form corporation", *Strategic Management Journal*, Vol. 15, pp. 73-90.

- Jasimuddin, S.M. (2006), "Disciplinary roots of knowledge management: a theoretical review", *International Journal of Organizational Analysis*, Vol. 14 No. 2, pp. 171-7.
- Jennex, M.E. (2005), *Case Studies in Knowledge Management*, Idea Group Publishing, Hershey, PA.
- Jetter, A., Kraaijenbrink, J., Schröder, H.-H. and Wijnhoven, F. (2005), *Knowledge Integration: The Practice of Knowledge Management in Small and Medium Enterprises*, Physica-Verlag, Heidelberg.
- Johnson, R. and Bumentritt, R. (1998), "Knowledge moves to center stage", *Communication*, Vol. 20 No. 1, pp. 99-105.
- Kakabadse, N.K., Kakabadse, A. and Kouzmin, A. (2003), "Reviewing the knowledge management literature: towards a taxonomy", *Journal of Knowledge Management*, Vol. 7 No. 4, pp. 75-91.
- Kreng, V.B. and Tsai, C.M. (2003), "The construct and application of knowledge diffusion model", *Expert Systems with Applications*, Vol. 25 No. 2, pp. 177-86.
- Lloria, M.B. (2008), "A review of the main approaches to knowledge management", *Knowledge Management Research and Practice*, Vol. 6 No. 1, pp. 77-89.
- McAdam, R. and McCreedy, S. (1999), "A critical review of knowledge management models", *The Learning Organization: An International Journal*, Vol. 6 No. 3, pp. 91-101.
- McKnight, B. and Bontis, N. (2002), "E-improvisation: collaborative groupware technology expands the reach and effectiveness of organizational improvisation", *Knowledge and Process Management*, Vol. 9 No. 4, pp. 219-27.
- Mayo, A. and Lank, E. (1994), *The Power of Learning: A Guide to Gaining Competitive Advantage*, Institute of Personnel Development, London.
- Meyer, M.H. and Zack, M.H. (1996), "The design of information products", *Sloan Management Review*, Vol. 37 No. 3, pp. 43-59.
- Nonaka, I. (1994), "A dynamic theory of organizational knowledge creation", *Organization Science*, Vol. 5 No. 1, pp. 14-37.
- Nonaka, I. and Takeuchi, H. (1995), *The Knowledge Creating Company*, Oxford University Press, New York, NY.
- Nonaka, I. and Toyoma, R. (2005), "The theory of the knowledge-creating firm: subjectivity, objectivity and synthesis", *Industrial and Corporate Change*, Vol. 14 No. 3, pp. 419-36.
- O'Donnell, D., Bontis, N., O'Regan, P., Kennedy, T., Cleary, P. and Hannigan, A. (2004), "CFOs in eBusiness: eArchitects or foot-soldiers?", *Knowledge and Process Management*, Vol. 11 No. 2, pp. 105-16.
- O'Donnell, D., Tracey, M., Henriksen, L.B., Bontis, N., Cleary, P., Kennedy, T. and O'Regan, P. (2006), "On the 'essential condition' of intellectual capital-labour", *Journal of Intellectual Capital*, Vol. 7 No. 1, pp. 111-28.
- O'Regan, P., O'Donnell, D., Kennedy, T., Bontis, N. and Cleary, P. (2001), "Perceptions of intellectual capital: Irish evidence", *Journal of Human Resource Costing and Accounting*, Vol. 6 No. 2, pp. 29-38.
- Polanyi, M. (1962), "The republic of science", *Minerva*, Vol. 1 No. 1, pp. 54-72.
- Quintas, P., Lefrere, P. and Jones, G. (1997), "Knowledge management: a strategic agenda", *Long Range Planning*, Vol. 30 No. 3, pp. 385-91.
- Rigby, D. and Bilodeau, B. (2007), *Management Tools and Trends 2007*, Bain & Company, Inc., Boston, MA.

-
- Seleim, A., Ashour, A. and Bontis, N. (2004), "Intellectual capital in Egyptian software firms", *The Learning Organization*, Vol. 11 Nos 4/5, pp. 332-46.
- Serenko, A. and Bontis, N. (2004), "Meta-review of knowledge management and intellectual capital literature: citation impact and research productivity rankings", *Knowledge and Process Management*, Vol. 11 No. 3, pp. 185-98.
- Serenko, A., Bontis, N. and Hardie, T. (2007), "Organizational size and knowledge flow: a proposed theoretical link", *Journal of Intellectual Capital*, Vol. 8 No. 4, pp. 610-27.
- Swan, J. and Scarbrough, H. (2001), "Knowledge management: concepts and controversies", *Journal of Management Studies*, Vol. 38 No. 7, pp. 973-93.
- Swan, J., Scarbrough, H. and Preston, J. (1999), "Knowledge management: the next fad to forget people?", *Proceedings of the 7th European Conference on Information Systems, Copenhagen, Denmark, 23-25 June*.
- Toffler, A. (1993), *War and Anti-War*, Little, Brown, Boston, MA.
- Turel, O., Yuan, Y. and Rose, J. (2007), "Antecedents of attitude towards online mediation", *Group Decision and Negotiation*, Vol. 16 No. 6, pp. 539-52.
- Wiig, K.M. (1997), "Knowledge management: an introduction and perspective", *Journal of Knowledge Management*, Vol. 1 No. 1, pp. 6-14.
- Zack, M.H. (1999), "Developing a knowledge strategy", *California Management Review*, Vol. 41 No. 3, pp. 125-45.

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