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Editorial

It has been an informative and enjoyable experience to edit the ten articles in the present issue of EJKM. The editorial presents a brief overview of the ten contributions.

AlAmmary and Fung's contribution focuses on the need for present-day organizations to actively incorporate knowledge strategy (KS) into their Business Strategy (BS) because knowledge is recognized as a strategic element in the performance of organizations. They test the hypothesis that the alignment between BS (BS) and KS has a positive effect on organizational performance. The overall finding of AlAmmary and Fung's research is that there is a strong association between KS and BS and that the alignment between KS and BS clearly influences the organizational performance.

Cruywagen, Swart and Gevers present a typology that takes into account differences among knowledge-centric organizations. They observe that the knowledge management literature is characterised by frameworks for knowledge management implementation, which tend to prescribe best-practice methods to companies. The authors point out that a key weakness of these frameworks is their inability to account for contextual differences. Consequently many organisations attempt to apply a knowledge management framework that simply doesn't fit the organisational context, resulting in little or no benefit from their efforts. A shift in focus from best practice to best fit is necessary to account for the difference in organisational contexts.

They propose that a social constructionist approach to the research affords the opportunity to identify areas of significant variation in knowledge management context and practices within knowledge-centric organisations.

Cranfield and Taylor report the results of a survey that they conducted regarding how Higher Education Institutions in the UK utilize KM. They state that although KM is widely regarded in the business world as an essential tool the application of KM is relatively under-developed in UK higher education, and that on top of that the recent history of UK higher education is sprinkled with examples of failure in the effective management of knowledge. Cranfield and Taylor note that the study of KM in universities in the UK is complicated by the facts that such institutions generally historically, locationally and financially tend to be very different. Their paper sets out to answer the following questions: To what extent are HEIs moving towards adopting KM principles given the changing environment of HEIs? Are HEIs starting to realize the benefits of adopting KM principles to enhance efficiency and competitiveness? What are the current and intended practices within the UK? What are the factors that hinder or promote the implementation of KM within Higher Education?

Girard and Allison focus on factual, fabulous and fallacious aspects of claims about information anxiety. The authors state that the concept of anxiety created by information has been studied for hundreds of years, Their paper focuses on the complex relationship of five subcomponents of information anxiety as described by Wurman's book *Information Anxiety*, namely not understanding information, feeling overwhelmed by the amount of information to be understood, not knowing if certain information exists, not knowing where to find information and knowing exactly where to find the information, but not having the key to access it.

Griffiths and Remenyi use a case study approach to provide a better understanding of the knowledge management requirements for professional organizations that offer a range of information technology consulting services. The authors set out by analyzing four different sets of secondary data contained in previously published accounts of knowledge management in four different professional services organizations. They then used the information to create a general framework for the effective use of knowledge management in an information technology consulting service. The framework was subsequently presented to 12 partners in a small consulting firm as the departure point for a Socratic Dialogue about the topic. Socratic Dialogue analysis led the authors to establish nine key issues for the more effective management of knowledge in professional services organizations.

Lucardie, Hendriks and Van Ham present the results of their research on the relationship between knowledge management and business improvement within the context of the continuously growing complexity of market processes that is strengthening the logical role of knowledge as the organization's core capability to maximize business performance. The authors state that conceptions of knowledge and knowledge representation, however, prove to be highly unproductive because explicit knowledge management initiatives reinforce the production of information instead of reducing and managing knowledge. They state that a basic problem is the disentangling of knowledge from knowledge representation formalisms. The authors claim that adopting a functional view of the nature of knowledge reveals and restores the strong relation between knowledge and corporate effectiveness. The functional view does not only enable content improvement through rational classifications, but also enhances process descriptions and process implementations. It also aligns information technology to the new demands set by the knowledge economy by enabling goal-oriented, transparent and

easy-to-use-and-modify knowledge structures. The paper describes a real world case taken from the financial services industry to exemplify how a functional analysis of realizes significant increases in business performance.

Lumba and Smith's paper is based on the results of a study that explored the knowledge management practices and challenges in an international NGO network. The investigation constituted comparative case studies of two centres (Zambia and the Netherlands) belonging to a single international network. An empirically grounded framework of knowledge management practices based on the taxonomy, proposed by Holsapple and Joshi, was utilised as the reference framework for the study. Recommendations are proposed to improve knowledge management practices at local and international level. They include enhanced technical and advisory services at international level, capacity building, creating greater awareness of knowledge management, decentralization of knowledge management processes; implementation of a knowledge management strategy at network level and improving relationships between centres.

Papoutsakis focuses on differences in research methods when empirically measuring organizational characteristics that focus on inter-group, knowledge-based collaboration and when measuring the characteristics of individuals. The author states that organizational researchers have recently used the empirical technique to obtain quantifiable information on organizational structure, internal power distribution, within the group, and external relationships among groups that base their collaboration on the knowledge they share.

Smith adopts the premise that technological innovation, a critical factor in the long-term economic growth of any country, can only function successfully within a social environment that provides relevant knowledge and information inputs into the innovative process. This is dependent on the efficient transfer and communication of knowledge and information, which in turn relates to the amount and quality of interaction among scientists and technologists. These factors prompted a research project that used social network analysis techniques to investigate knowledge exchange and to map the knowledge network structure and communication practices of a group of scientists engaged with crystallographic research. This paper is based on this research project. The author's findings provide evidence of a strong social network structure among crystallographers in South Africa. A core nucleus of prominent, well connected and interrelated crystallographers constituted the central network of scientists that provided the main impetus to keep the network active. According to Smith, the core group of crystallographers were not only approached far more frequently for information and advice than any of their colleagues, but they also frequently initiated interpersonal and formal information communication acts. It was clear that this core group had achieved a standard of excellence in their work, were highly productive; very visible in their professional community and generally played a pivotal role in the social network.

According to Timonen and Paloheimo there has been a proliferation of research on knowledge work over the past decades. The authors make the point that knowledge work has mostly been used as antonym to manual work, to refer to specific occupations characterized by an emphasis on specialized skills and the use of theoretical knowledge. The efforts to encompass all the various contexts where knowledge plays a relevant role in work tasks, has resulted in various and ambiguous definitions of what knowledge work actually is. In order to shed light on the elusive concept of knowledge work, Timonen and Paloheimo studied how it has appeared in the scientific discussion, and diffused from one scientific community to another. They examined the emergence and diffusion of the concept of knowledge work through a citation analysis on articles from the Social Sciences Citation Index. The authors distinguish three periods of diffusion of the concept of knowledge work. The results show that Drucker's *In the age of discontinuity* (1969) and Bell's *The coming of post-industrial society* (1968) were the main influencers when the concept of knowledge work emerged in the scientific discussion from 1974 to 1992. After this period, the authors discern a slow diffusion period from 1993 to 2003, when the concept started to gain attention, and a fast diffusion period from 1999 to 2003, when the research has proliferated.

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Knowledge Management Strategic Alignment in the Gulf Cooperation Council Countries

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Abstract: Organizations today should actively incorporate knowledge strategy (KS) into their Business Strategy (BS) as knowledge has been recognized as a strategic element in the performance of the organization. Hence, the current research hypothesis that the alignment between BS and KS has a positive effect on the organizational performance.

In an attempt to explore the alignment between KS and BS, an operational model is proposed based on the prior studies in the strategic alignment. BS types were viewed in terms of Miles and Snow's (1978) typology of Defenders, Analyzers and Prospectors. Two KS strategies include: Aggressive Knowledge Strategy (AKS) and Conservative Knowledge Strategy (CKS) were selected to examine the KM strategic alignment with business strategies. This model was empirically validated through a survey of 106 banks selected from the six Gulf countries (Bahrain, Saudi Arabia, Kuwait, Qatar, UAE, and Oman). With respect to the perspective of alignment, the moderation approach was chosen. The overall finding of the research demonstrated that there is a strong association between KS and BS and that the alignment between KS and BS clearly influenced the organizational performance.

Keywords: knowledge strategy, strategic alignment, business strategy, banking sectors

1. Introduction

In order for an organization to be successful in the exploitation of knowledge assets to drive competitive advantages, a holistic approach that spans Knowledge Management (KM), BS, and organizational and human factors should be used (Cedar, 2003). Thus, KM should be aligned with business process, organizations, and IT to continuously capture, maintain, and reuse the key information, and arbitrates the strategic knowledge assets that improve business performance (Cedar, 2003). When such alignment is established, the KM system will be directed towards the goal and objectives of the organization which will build and enhance its long term competitive advantages. For instance, if the BS is based upon differentiation through customer service, then KM efforts should probably target customer care functions such as call centers, help desks, and other customer support activities (Sunassee and Sewry, 2002). The espoused positive relationships between KM and BS and their impact on performance outcomes has been a core belief of IT and management research, however there has been little empirical evidence to confirm or refute this belief. Considerable researches have been devoted to investigate the importance of the alignment between KM and BS (Jones, 2000; Smith and McKeen, 2003; Zack, 1999; 2002; Aidemark and Sterner, 2002; Davenport, 1999; Sabherwal and Sabherwal, 2003; Sunassee and Sewry, 2002). However, the majority of these researches have provided complex and confused models that are difficult to be measured and analyzed (Franken and Braganza, 2006). Hence there is an ultimate need to find an answer to questions such as: what is the real impact of the alignment between KS and BS on the organizational performance? What is the role played by KS in the contribution of BS on the organizational performance? The aim of the current study is to find the answers to these questions in order to provide a context for better understanding of KM strategic alignment. This proposed study will investigate the strategic alignment between KS and BS or KMBS-SA in the banking sector in the Gulf Cooperation Council (GCC) countries. Moreover, using the recommended conceptual model it will explore the impact of KMBS-SA on the organization performance.

This paper is articulated into five sections including the introduction. The research and hypotheses were discussed in the next section. Section 3 discusses the research methodology and design. Section 4 presents the results of the research. The paper then concludes with Section 5.

2. Research model and hypotheses

The KMBS-SA model proposed by the current study focuses on the relationship between alignment and organizational performance, based on the argument that strategic alignment has performance implications (Al Ammary and Fung, 2005). The research model hypothesizes that there is an alignment between KS and BS pursued by the GCC Banking and that this alignment has a positive contribution on the organizational performance.

The model is comprehensive and complex as the relationships between the constructs KS and BS are examined in this research in more complete context. KS in particular has received little recognition in the literature, thus its inclusion in this research model represents a contribution for this study. The complexity of the research model necessitates the illustration of two different conceptualizations for the model to hypothesize the different relationships between KS and BS. The first conceptualization illustrates the KMBS-SA as shown in Figure (1) and investigates the contribution of KMBS-SA on the organizational performance. The second conceptualization exhibits the different alignments between various profiles of KS and various types of BS as shown in Figure (2). Thus, this conceptualization of the research model aims at investigating the impact of different KMBS-SA on the organizational performance. Moreover, using both conceptualizations, the role of KS as a moderator in the contribution of the BS on the organizational performance was examined.

The illustrated research model in Figure (1) or Figure (2) generally consists of BS, KS, and organizational performance. Organizational performance was conceptualized in the same way in both conceptualizations of the research model. However, in each conceptualization, BS and KS were illustrated in different ways based on the investigated objectives of the study.

2.1 Knowledge strategy

KS, in the first conceptualization, was illustrated as a set of knowledge strategic actions or choices to identify the strategic knowledge assets, resources and capabilities of the organization. Among the identified strategic choices, six are selected for the purpose of the current study. These strategic choices include: Internal source of knowledge, external source of knowledge, system-focus (codification), human focus (personalization), knowledge exploitation, and knowledge exploration. These strategic choices have been extensively investigated in the literature (Bierly and Daly, 2001; Bierly and Chakrabarti, 1996).

However, in the second conceptualization of the research model; two profiles for KS were identified to conceptualize KS. These profiles have been identified based on the selected knowledge strategic choices. The first profile is called Aggressive KS (AKS). This profile of KS emphasizes the innovation and creation of new knowledge (Rollo, 2002). It views knowledge as an ongoing process of creative destruction (Zack, 2002b) and innovation as a set of interacting knowledge process (Skyrme, 1999). It is moreover, exploring the external knowledge and enhancing the communication and the interpersonal exchanging of tacit knowledge. The second profile to KS is called the Conservative KS (CKS). This profile of KS views knowledge primary as an objectified proprietary asset to be protected and financially exploited (Zack, 2002b). It focuses on maintaining knowledge in its original and constructive state and keeping knowledge from unauthorized transfer to other organization (Bloodgood and Salisbury, 2001). Thus, the AKS profile of KS mapped by three knowledge strategic dimensions: external source of knowledge, knowledge exploration and human focus. Three knowledge strategic choices are selected to map the CKS profile of KS. These knowledge strategic choices include: internal source of knowledge, knowledge exploitation, and system focus.

2.2 Business strategy

BS is defined as the outcome of decision made to guide an organization with respect to the environment, structure and processes that influence its organizational performance (Croteau, et al. 1999). Then, the strategic choices or decisions can be assessed by multiple traits of dimensions common to all organization. Therefore, in the first conceptualization of the research model, BS was conceptualized using Venkatraman's (1989) dimensions of strategic orientation or Strategic Orientation of Business Enterprise (STROBE) which consist of defensiveness, risk aversion, aggressiveness, proactiveness, analysis, and futurity. These dimensions represent a broad and holistic perspective of strategy built on research by Miles and Snow (1978).

Conversely, BS was conceptualized in the second conceptualization of the research using three types of Miles and Snow (1978) typologies of Prospector, Analyzer, and Defender. As such conceptualization, typology reflects the actual strategy pursued by an organization with respect to its competitors and involves a host of organizational strategic activities (Lefebvre, Mason and Lefebvre, 1997).

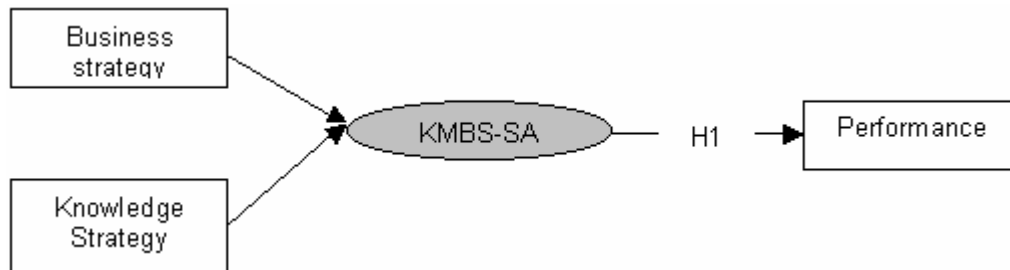


Figure 1: The first conceptualization of the research model

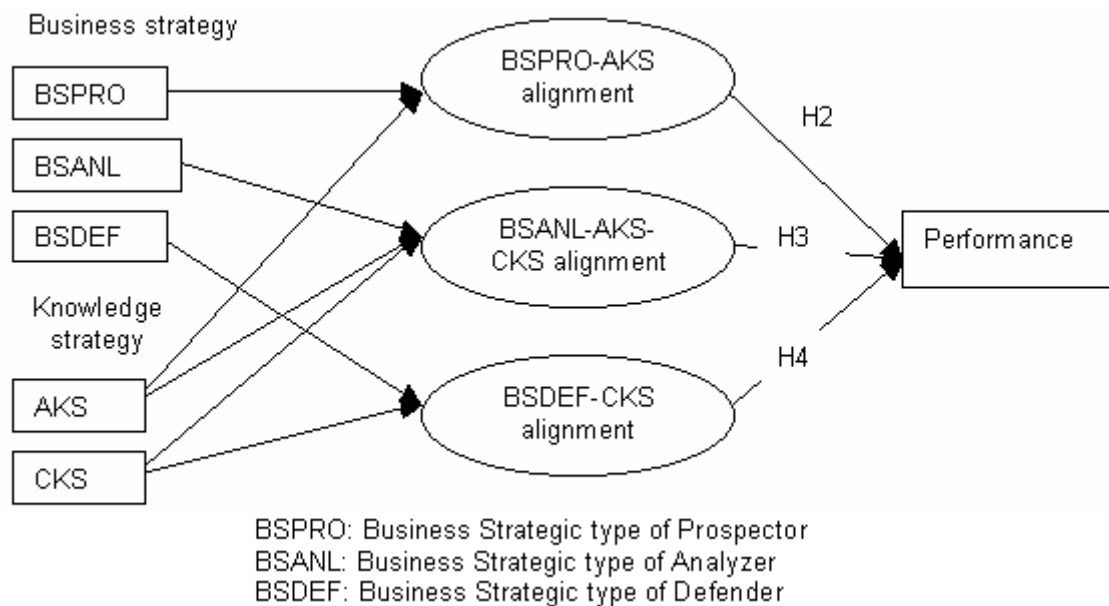


Figure 2: The second conceptualization of the research model

2.3 Research hypotheses

2.3.1 KMBS-SA and its impact on the organizational performance

The impact of KMBS-SA on the organizational performance and competitive advantage have been revealed by many researchers (Zack, 2002; Snyman and Kruger, 2004; Tiwana, 2002; Maier and Remus, 2002; Seeley, 2002). Bloodgood and Salisbury (2001) contended that the proper alignment between a specific type of BS and the knowledge resources needed by the organization to successfully implement this strategy can enhance the organizational performance. Greater alignment between BS and KM indicates that the organization is pursuing the BS most suited for its KM capabilities (Sabherwal and Chan, 2001). Snyman and Kruger (2004) and Tiwana, (2002) argued that organizations may lost many opportunities by the misalignment between the BS and KS. Thus, organizations may fall into the trap of attempting to explicate knowledge that is not explicable and failing to explicate knowledge that should have been converted from tacit (Tiwana, 2002).

Moreover, Asoh (2004), and, Shih and Chiang (2005) have provided empirical studies on the important of KMBS-SA on the performance. They examined the impact of the strategic KM alignment using different dependent variables, organizational performance and KM effectiveness, respectively. The finding of their studies has presented evidence suggesting that alignment in KM is profitable, and it helps to secure better organization performance. Moreover, a survey conducted by Maier and Remus (2002) on 200 organizations revealed that the highest benefits concerning the relationship of KM initiatives and business goals predictable to be in areas like 'improve customer satisfaction', 'improve speed of innovation' and 'improve productivity'. This expected relationship between KMBS-SA and organizational performance leads to the following hypothesis (see Figure (1)):

Hypothesis 1: The alignment between BS and KS in the Banking sector at the GCC countries is associated with a better organizational performance

2.3.2 The alignment between business strategic type of prospector and AKS profile of KS

Organization that pursued prospector type of business strategy must develop and maintain the capacity to find and exploit new product and market opportunities within a board and a continuous state of development domain. As such they need to seek and scan the external environment for new knowledge. AKS profile of KS emphasizes constructing new knowledge and exploring the external environment for new opportunities that can be used to develop new products and services. Therefore, AKS is the appropriate proposed profile of KS to be adopted by prospector type of organization. An AKS should support business strategic type of prospector in building a broader knowledge-based domain to propel the organization into new market positions while maintaining and enhancing the practicability of their existing one (Zack, 1999). Besides, an AKS profile of KS encourages the creativity, experimentation and the creation of a sharing understanding within the individual and the organizational group which can help prospector type of organization in scan the environment for potential opportunities.

Having a focus on innovation and the creation of new knowledge, AKS moreover, should help prospector type of organization to maintain their innovator position in the marketplace and enables them to remain at the forefront of new products and marketplaces (Blackler, 1995; Bierly, 1999; Bloodgood and Salisbury, 2001). Accordingly, the following research hypothesis was constructed:

Hypothesis 2: The alignment between business strategic type of prospector and AKS profile of KS in the Banking sector in the GCC countries is associated with a better organizational performance

2.3.3 The alignment between business strategic type of defender and CKS profile of KS

The success of an organization within a defender strategy in the industry depends on their ability to maintain its distinction aggressively within the chosen market segment (Miles and Snow, 1978). Organizations with a defender type of business strategy limit their search for new opportunities and instead, they focus attention internally on ways to enhance organizational effectiveness (Miles and Snow, 1978). In such organizations, where efficiency and cost reduction are crucial and advances are less common, utilizing and enhancing existing knowledge is essential and thus CKS should be a successful profile of KS to be adopted.

A CKS profile of KS views knowledge primarily as an objectified proprietary asset to be protected and effectively exploited (Zack, 2002b). The effective utilization and protection of existing knowledge, assets and resources allows defender type of organization to achieve efficiency and an excellent reputation in certain markets (Das et al., 1991). Moreover, the focusing on internal knowledge should allow such organizations to develop their own core competencies and capabilities and appropriate more profit. Moreover, CKS profile of KS focuses on maintaining knowledge in its original and constructive state and keeping knowledge from unauthorized transfer to other organizations (Bloodgood and Salisbury, 2001). This permits defender type of organization to lead products and services that are difficult to imitate and refine, become very efficient at their current practices, and maximize the organization short-term profits (Bierly, 1999). Accordingly, the following research hypothesis was constructed:

Hypothesis 3: The alignment between business strategic type of defenders and CKS profile of KS in the Banking sector at the GCC countries is associated with a better organizational performance

2.3.4 The alignment between business strategic type of analyzer and CKS and AKS profiles of KS

Analyzer type organizations operate in relatively stable as well as changing product-market domains (Miles and Snow, 1978). Consequently, these organizations must identify and pursue new product-market opportunities while simultaneously maintaining a presence in existing domains. To pursuit the effectiveness in both areas, such organizations should adopt a moderate combination of AKS and CKS profiles of KS. Adopting just one profile of KS may not be satisfying the strategic requirement of an organization that pursuing business strategic type of analyzer. The hybrid nature of analyzer type of organizations, moreover, necessitates them to view AKS and CKS profile of KS as complementary strategies.

The combination of CKS and AKS profiles of KS should help analyzer type organizations in differentiating their structure and processes to accommodate both stable and dynamic areas of operation. AKS encourages value innovation that can help such organizations in minimizing risk while maximizing opportunities for growth. CKS however, maintains a stable domain of core products for these organizations by the utilization and protection of the existing assets and resources. CKS moreover, helps analyzer type of organizations in defending a niche in the market and also in exploiting new product and market opportunities. Accordingly, the following research hypothesis was constructed:

Hypothesis 4: The alignment between business strategic type of analyzer and CKS and AKS profiles of KS in the Banking sector at the GCC countries is associated with a better organizational performance

3. Methodology

3.1 Sample and data collection

Banking sector in the Gulf Cooperation Council (GCC) or Arabian Gulf countries was deemed to be appropriate for this research due to their high information intensity. The GCC countries comprise of six Arab states. These include the Kingdom of Saudi Arabia, Kingdom of Bahrain, Kuwait, Qatar, United Arab Emirates and Oman. Since this study aimed to investigate the situation in GCC banks, the selection of banks was made on one main premise according to which they must be embedded Arabian culture that affected its operation, strategies and management. Therefore, the researcher decided to select only the local banks that are operating in the Gulf environment. Accordingly, 106 banks were selected which present most of the local banks in the GCC. These banks comprise four types: the commercial, investment, specialist and Islamic banks. Foreign banks have been excluded from the list due to the different style of operation and management in these banks.

In gathering information pertaining to the current study, a questionnaire was used as the main instrument for data collection. Questionnaires were developed to collect data about the research model's constructs: BS, KS, and organizational performance. However, some questions were developed to retrieve descriptive information. Descriptive information concerning the perception of the CEO, CKO and CIO on the KMBS-SA and their implication on the performance may support the statistical and analytical results. As such, the questionnaire was arranged into four sections as shown in Table (1).

Table 1: The structure of the questionnaire

Section number	Parts	No. Items
One (Descriptive information regarding KMBS-SA)	The business manager perception of the responsibilities for developing and managing KM in the bank	1-3
	The role of the business manager in relation to KM.	1-5
	The bank objectives of KMBS-SA	1-4
	The relationship between business manager and KM manager	1-6
	The relationship between business strategy and knowledge strategy	1-7
Two	Business strategy (Venkatraman, 1989b) measurement	1-21
Three	Organizational performance measurement	1-8
Four	Knowledge Strategy	1-17

3.2 Measurements

The construct of BS was assessed using STROBE instrument proposed by Venkatraman (1989). STROBE instrument was conceptually based and have been empirically validated in previous strategic alignment studies (Venkatraman 1989; Bergeron, Raymond and Rivard, 2004; Sabherwal and Chan, 2001).

Having different conceptualizations for KS, creating an instrument to assess such construct was not a simple task. Therefore similar studies such as Beeson and Al Mahamid (2003), Helmi (2002), Cho (2000) and Gold et al. (2001) were used to develop a measurement for the purpose of this study.

The adopted instrument to measure the organizational performance in this research was based on the performance instruments used by Morgan (2003), Cao and Schniederjans (2004), Sin et al. (2006) and Sabherwal and Chan (2001). This instrument is a synthesized measure which was made using combination of traditional accounting-based items, market growth, profitability, company reputation, and product-service innovation.

4. Results and discussion

4.1 Descriptive statistics

The questionnaire was sent to 106 banks. The respondents were CEO, CIO or CKO. Total of 70 were returned in a form eligible for the analysis. The overall response rate for this study was 66%. This response rate considers being relatively high, as the respondents were managers who supposed to be too busy to answer questionnaires.

The descriptive data of this research has been published in Al-Ammary and Fung (2006). The result revealed that there is a strong relationship (alignment) between BS and KS pursued by the GCC banks and that the KMBS-SA has a vital importance for the survival of these banks. The result revealed that most of the business managers in the GCC banks believe that by aligning business and knowledge at a strategic level; the strategic knowledge resources, skills and capabilities would be predicted to support the bank's strategy and goals. Also most respondents demonstrated that both BS and KS have an equal priority and importance in their bank. However, the result indicated that they are preparing BS first followed by KS to reflect the objectives of BS. Planning BS with this sequential fashion is inappropriate as a more iterative approach helps BS to be informed by the strategic possibilities available (Smith, McKeen, 2003).

Moreover, the results raised an important issue regarding the position of CKO as it demonstrated that the role of CKO is unknown in the Gulf banks. The responsibilities of CKO or KM manager are assigned to the CIO, IT Director or the Head of IT department. Although, CKO or KM manager role requires advanced knowledge, skills, and experiences than the typical CIO has (Liebowitz, 2002), the result indicated that GCC banks belief that CIO or even IT Director can handle the duties of a CKO.

4.2 Testing the research hypotheses

Research hypotheses were evaluated using the moderation approach of fit (alignment). The aim of selecting the moderation approach is to assess if KS is presumed to affect the causal relationship between BS and the organizational performance. The moderation effect of KS was investigated from two perspectives: the strength and form (Venkatraman, 1989).

According to the strength perspective of moderation, the impact of a predictor variable on the dependent variable is dependent on the level of the moderator (Venkatraman, 1989). Thus, in the case of this study, moderation can be assessed by evaluating if the strength of the relation between BS and performance vary across different levels of KS. Venkatraman (1989) has proposed a subgroup analysis for testing this perspective of moderation approach. This method has been adopted by Bergeron and et al (1999). In this method the sample first splits into groups based on the moderator variable. The strength of moderation is supported when statistically significant differences exist in the value of correlation coefficient between BS and performance across the sub groups of the moderator (KS).

The form perspective of moderation however, implies that a dependent variable is jointly determined by the interaction of the independent variable (predictor) and the moderator (Venkatraman, 1989). Thus, according to the interaction perspective, the product of BS and KS could have an effect on the performance if KS and BS were aligned. The form perspective of moderation can be assessed using the moderator method (Bergeron et al, 1999; Venkatraman, 1989). In this method, the performance outcome is jointly (multiplicative) determined by the interaction of BS and KS.

The first results of note concern the inter-relationships between KS and BS. As shown in Table (2) the congruence of BS and KS in the GCC banking sector was confirmed. The result in Table (3) shows that BS is highly inter-correlated with organizational performance in the High-KS banks - banks in which BS and organizational performance, are associated with a high median for KS ($r = 0.550$). This relationship becomes insignificant in the Low-KS banks- banks in which BS and organizational performance, are associated with a low median for KS (0.242). These results indicate that the organizational performance would decrease if the bank does not possess the strategic knowledge resource required to support the increase of the bank strategic problems.

Table 2: Inter-correlation of the independent variable

Correlation with	Performance	High Performance	Low Performance	BS	KS
	<i>n</i> = 70	<i>n</i> =34	<i>n</i> =36	<i>n</i> =70	<i>n</i> =70
BS	0.650**	0.725**	0.237	-	0.559**
KS	0.652**	0.698**	0.024	0.559**	-

** P < 0.001

Table 3: Correlation between performance and BS across different levels of KS

Correlation with Performance	Controlling for	
	High-KS	Low-KS
	<i>n</i> = 34	<i>n</i> = 36
BS	.550**	.242 (0.301)

** P < 0.001

The result of the form perspective of the moderation effect of KS, which hypothesizes that the performance outcome is jointly determined by the interaction of the BS and KS was presented in Table (4). The results show that the interaction of BS and KS has an impact on the organizational performance. Thus, while BS by itself would have an effect on organizational performance ($r=0.650$) as shown in Table (2), bank would achieve more competitive position ($r=0.761$) in term of growth, profitability and reputation in conjunction with KS. Hence, the bank that joint it's KS with their BS will produce a synergy. This synergy would allow the bank to attain more competitive position through the joint effect of KS and BS.

Table 4: Correlation of KS alignment (fit) variable with performance

Correlation of KS fit variable with performance	Zero order	Partial
KS * BS	.761**	.027
LOW(KS * BS)	0.13	-.035
HIGH (KS * BS)	.801**	-.032

Controlling for linear (KS and BS) and Quadratic (KS^2 and BS^2) effects of the fit variable's original components.

** Correlation in significant at the 0.001 level

The results of the assessment of the alignment between the different profiles of KS (AKS and CKS) and different typologies of BS (defender, prospector, and analyzers) were presented in Tables (5) and (6).The results presented in Table (5) show that the alignment between business strategic type of prospector and AKS, alignment between business strategic type of analyzer and AKS, and alignment between business strategic type of analyzer and CKS have an impact on the organizational performance. However, the alignment between business strategic type of defender and CKS has no impact on the performance.

Table 5: Correlation of the different KMBS-SA and performance (strength perspective of moderation)

Correlation with performance	Controlling for			
	High AKS <i>n</i> = 36	Low AKS <i>n</i> = 34	High CKS <i>n</i> = 35	Low AKS <i>n</i> = 35
Business strategic typology				
Prospector	0.008	0.430** (.011)	-	-
Defender	-	-	0.116	0.132
Analyzer	0.432** (.008)	0.209	0.135	0.470** (.004)

The results presented in Table (6) however, show that the interaction of AKS and prospector and the interaction between AKS and analyzer have the most impact on the organizational performance. However, the interaction between defender and CKS and that between analyzer and CKS has no impact on the performance.

Table 6: Correlation of the different KMBS-SA and performance (Form perspective of moderation)

Correlation of KS fit variable with performance	Zero order	Partial
BS typology		
AKS * Prospector	0.345**(.003)	-0.352**(.004)
AKS * Analyzer	0.558**(.000)	0.275**(.026)
CKS * Analyzer	0.146	-0.077
CKS * Defender	0.083	0.039

Controlling for linear (AKS, CKS, Prospector, Analyzer, and Defender) and Quadratic (AKS², CKS², Prospector², Analyzer², and Defender²) effects of the fit variable's original components.

*** Correlation in significant at the 0.001 level

5. Conclusion

The first overall conclusion demonstrated that there is a strong association between KM and BS and that the alignment between KS and BS clearly influenced the organizational performance. Thus, KMBS-SA is important to the organizational effectiveness of the GCC banks. This interpretation is based on the significant moderation which was exhibited by KS with respect to the performance. Hence, in order to execute their banks successfully, GCC banks should take KMBS-SA challenge as seriously as possible and consider the alignment implication before moving ahead to implement a strategic plan.

Moreover, the result showed that only the alignment between prospector strategic activities and AKS profile of KS and the alignment between business strategic type of analyzer with AKS and CKS profiles of KS have a positive effect on the organizational performance. However, the alignment between defender strategic activities and CKS profile of KS has insignificant effect on the organizational performance. These results indicate that GCC bank should not totally ignore any of the six knowledge strategic choices. Thus, these banks should establish a baseline of KS support for all aspects of BS, and then move from there to add more KS support to those business strategic dimensions that are most important. Even in the case where bank records very low in one or more strategic dimensions, a minimal level of knowledge strategic choices to support these strategic dimensions is better than no support. The banks moreover, need to determine different profiles for their KS to suit their strategic needs. Then the bank should direct knowledge resources to support these profiles.

The findings of the current study have radical management implications that will need to be verified in future studies using large sample size and in different types of organizations. This study could be also resumed to investigate the effect of the human and cultural factors on the KMBS-SA.

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Knowledge Management and Higher Education: A UK Case Study

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Abstract: This paper presents the initial findings of a case study conducted at seven Higher Education Institutions within the United Kingdom. The Case Study utilizes Stankosky's Knowledge Management (KM) pillars to enterprise learning – leadership, organization, technology and learning - as a lens to investigate and understand Knowledge Management practices and perceptions within Higher Education Institutions, looking at challenges of implementation within this sector. Higher Education Institutions within the United Kingdom are very complex institutions, with diverse backgrounds, history, culture, resources and missions. The University presents itself in today's knowledge economy with a dichotomy of priorities, one which aims to provide quality teaching and research activity, and the other, to ensure effective and efficient management and administration within an increasingly competitive market. Being a service, non-profit organization ensures that the values of scholarship remain a very important aspect of its mission; yet, the external environment within which HEIs conduct their business today is rapidly changing, forcing HEIs to reflect on how they do 'business' given the external pressures they face. This case study uses the Grounded Theory methodology to begin to unpack the issues related to the implementation of Knowledge Management within this context. It focuses on two aspects of the case study – the characteristics of universities and academics that hinder or promote the implementation of KM, and the perceptions of Knowledge Management and its challenges for implementation within the HEI sector. Initial findings are presented.

Keywords: knowledge management, UK case study, grounded theory, higher education

1. Introduction

Knowledge Management (KM) has increased in popularity and credibility as a management tool, as well as a research discipline, over the past decade. There have been concerns about whether KM is simply a fad, and researchers and academics have debated its faddish like characteristics. The researchers, and this paper adopts the view that KM certainly is not a fad for different reasons, and agree with Stankosky's view that one of these reasons is that the knowledge-economy is here to stay (Stankosky, 2005). This paper does not present this debate however does present the view that the researchers have taken.

Pontzi et al (2002), supports this view in their article "Knowledge management: Another management fad?", and used the article-counting technique and applied it to the concept of Knowledge Management in order to illuminate its current state of development. They also contend that KM has faddish characteristics; however, introduces empirical evidence that proposes that a typical management movement generally reveals itself as a fad in approximately five years, and that KM has survived the 5-year period. His findings suggest that KM is in the process of establishing itself as a new aspect of management (Ponzi, 2002). Knowledge Management is therefore said to be slowly but surely capturing the attention of many organisations in a quest for competitive advantage (Boahene, 2003).

KM is a term that has not only gained credibility over the years by virtue of the increased research projects on the subject but also through the increased application of it as a management tool within business organisations. In 2000, Rowley (2000) asked the question, "Is Higher Education ready for Knowledge Management?". This paper investigates the perceptions of Knowledge Management within Higher Education in 2008 as a management tool, and presents the nature of academics and universities, and the related challenges for KM implementation within this context. The research uses the Grounded Theory methodological approach combined with a case study of 7 Higher Education Institutions. The paper begins with a brief introduction to the UK Higher Education context given in relation to its history and the Knowledge Economy, then presents the research framework and some of the initial findings that emerged from the analysis, finally, the paper ends with some concluding remarks.

2. UK higher education context

Universities in the United Kingdom vary in size, shape, mission, ethos, history, values and location. UK HEIs have, over the last 30 years, undergone major change, especially in the period following the election of the new Conservative Government in 1979. These changes influenced the quantity and method of public funding of the system; emphasised research selectivity; introduced market elements into the funding and management of the system; and brought about an end to the binary system of higher education which had existed since 1965 (Thillaisundaram, 1998). In 1980, full cost fees for overseas students were introduced,

forcing students to pay the full economic cost of their education. This was followed, in the year 1981, by major cuts in the public funding of the university system, and universities across the UK each were affected differently by these cuts, some quite substantially. Increased focus on efficiencies within universities, both economic and administrative, followed. Significant changes took place in institutional management, recognising Vice-Chancellors as “Chief-Executive”, encouraging more devolved management and the use of targets and performance indicators. For this to succeed, effective information management and KM began to emerge as a priority. During the years 1980 – 1995, a policy of massification of higher education was endorsed by government and student numbers increased drastically. Another significant change took place in 1986 when “...the Universities Grant Committee (UGC) decided, under pressure from the Treasury, to review research quality across the university system and to allocate recurrent grants for research differentially, and separately, from the recurrent grant for teaching” (Shattock, 2003:2). The Further and Higher Education Act of 1992 formally ended the divide between polytechnics, universities and colleges. It allowed all polytechnics and some higher education colleges, which met certain criteria, to claim the title of university, thereby placing a different kind of pressure on these institutions to be successful. Within this new environment, with an emphasis on competition, marketisation, quality and operational efficiency, institutions began to recognise the importance of information management and significant progress was made within this area; however, the importance of KM was slow to emerge (Cranfield and Taylor, 2007).

In May 1996, the National Committee of Inquiry into Higher Education was appointed to make recommendations on how the purposes, shape, structure, size and funding of higher education, should develop to meet the needs of the UK in the future. This Committee produced the Dearing Report which made recommendations on a wide range of issues affecting most issues of higher education. The Dearing report highlighted the need for the UK to compete in increasingly competitive international markets where the proliferation of knowledge, technological advances and the information revolution would place demands on it (National Committee of Inquiry, 1997). It is interesting, therefore, that the Dearing Report, with its far reaching proposals, remains noticeably silent on the importance of effective KM. Since the Dearing report, global competition has intensified and high-level skills and knowledge have become ever more central to the UK's economic success (Higher Education Funding Council for England, 2006).

Shattock (2003) contends that one of the most significant changes in the way we think about universities today is how we identify its success. Given all of these changes to the Higher Education system in the UK, he further contends that universities do not all start from the same position and that historically, locationally, and financially, their positions could be very different (Cranfield and Taylor, 2007). But how do these factors affect an institutions' ability to respond to change effectively to ensure competitive advantage? In this context, how do institutions perceive the importance of KM?

3. Higher Education and the knowledge economy

Higher Education institutions face many challenges in a rapidly changing global economy (Birgeneau, 2005). As we enter the 21st century, Birgeneau (2005) contends that Higher Education institutions face a world that is more interconnected, one in which knowledge, creativity, and innovation are the essential elements of thriving societies. Bloch (in Duderstadt, 2005:81) supports this by stating that “we are entering a new age, an age of knowledge in which the key strategic resource necessary for prosperity has become knowledge itself – educated people and their ideas”. Higher Education institutions today and in the near future, will experience different and intensified external pressure influenced by globalisation, and the past few decades have witnessed the pressure on HEIs to respond to this global integration (Bloom, 2005). Globalisation refers to the process whereby countries become more and more integrated, mainly via movements of goods, capital, labour and ideas (Scott, 2005:22). Scott (2005) highlights two main attributes of what he terms the 21st century globalisation: 1) Acceleration of trends associated with a ‘knowledge society’. Some of these trends include the rise of information and communication technologies, which has been accompanied by a cultural revolution. 2) The process of acceleration and innovation has brought about ‘uncertainty’ about individual identity, about social affinities, about gender roles and about jobs and careers.

If it is easy for goods, capital, labour and ideas to move around, what do HEIs need to do to stay competitive to ensure the quality of their products and to ensure that a good academic experience is achieved by their students? Globalisation and marketization have therefore forced Higher Education Institutions to think about the way in which they teach, conduct research and manage the institution and its various stakeholders. This paper looks at whether HEIs within the UK are able to respond to these changes in a timely manner, or whether they are going about their business in 2008 as they have done before. Are they beginning to appreciate the need to embrace the philosophy of efficiency and effectiveness, and ways in which to

incorporate management methods and models from the business world to ensure an ability to respond to change effectively and efficiently? When the adoption of business management models is discussed in relation to HEIs, it is inevitable that the mission and purpose of Higher Education Institutions are raised and the distinction made between non-profit and for-profit missions to discourage its use. This paper looks at one business management tool – knowledge management, and how it is perceived and implemented within seven HEIs within the UK.

4. Knowledge management

Knowledge Management has sparked a plethora of definitions, and a variety of explanations, and encompasses diverse disciplines, which hence gives rise to the different perspectives. An extensive literature review yielded many different models, thoughts, perspectives, frameworks and definitions for KM. This particular research aimed to investigate the application of KM within the HEI context; however this is an under-researched area and a relatively new area for this context. For the purposes of this research, a particular view of KM was taken as a lens through which to view KM in HEIs. Stankosky's Knowledge Management pillars to enterprise learning – leadership, organization, technology and learning, were used as a systemic and holistic framework to investigate the perceptions and practices of KM within seven HEIs. Universities already engage in Davenport and Prusak's (2000) view on knowledge, and KM, who presents knowledge as deriving from information as information derives from data. Davenport further contends that for information to be transformed into Knowledge it requires human intervention hence humans apply their skills, ability, experience, know-how, values and culture via some transformation (comparison, communication, connections, and consequences) to change the information into knowledge. The case study will primarily look at organisational knowledge but acknowledges the psychological debates around what knowledge is. However, for the purposes of this study, it recognises that each individual has abilities, skills, experience, values and a particular work ethos and culture which each uses to transform information into knowledge which can be acted upon and which can become part of the broader organisational knowledge. "Knowledge Management therefore draws from existing resources that an organisation may already have in place - good information systems management, organisational change management, and human resources management practices" (Davenport and Prusak, 2000:163).

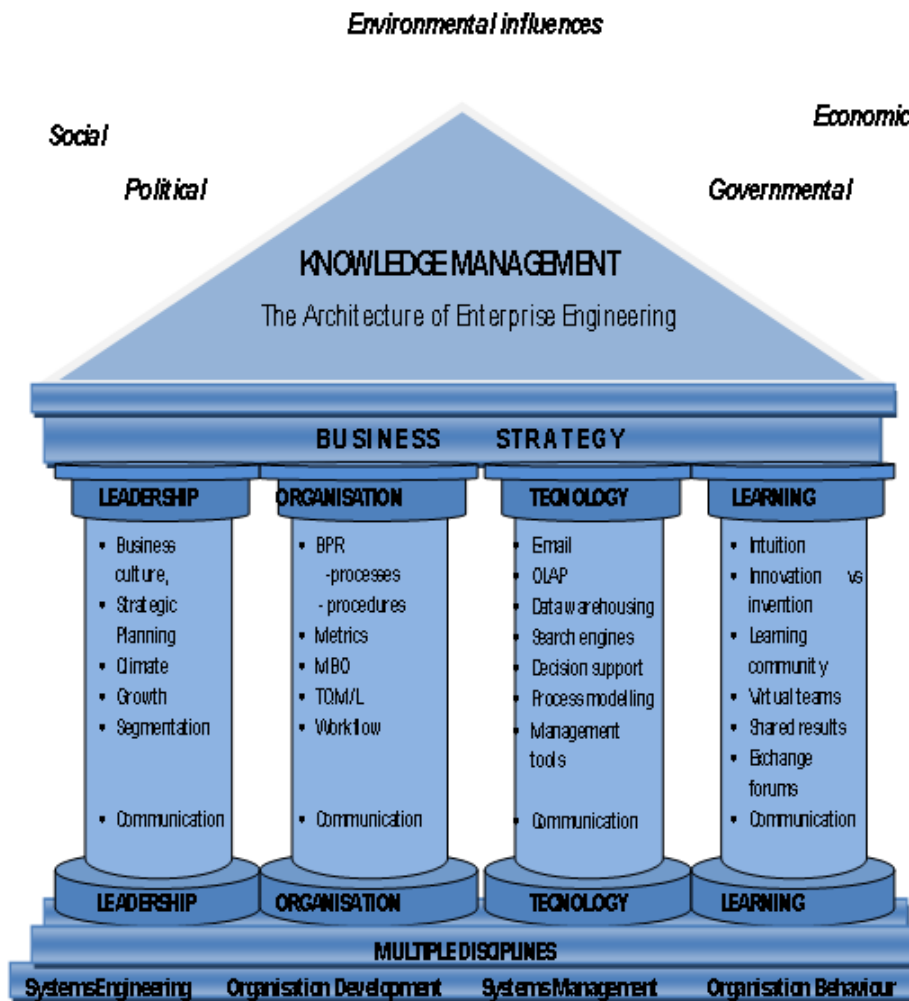


Figure 1: Pillars of enterprise learning, adapted from Stankosky (2005)

Birgeneau (2005) contends that universities have, and always will be, keepers and creators of knowledge. HEIs aim to “prepare new generations with the skills, cultural and scientific literacy, flexibility, and capacity for critical inquiry and moral choice necessary to make their own contribution to society” (Birgeneau, 2005:ix). Higher Education institutions are said to be in the “knowledge business” since they are involved in knowledge creation, dissemination and learning (Rowley, 2000:332). Given the mission and purpose of HEIs, is knowledge overtly managed in a way to enhance its competitive advantage? Do HEIs effectively manage what they know about their organisation in a systemic and institutional way?

5. The case

5.1 The research framework

Epistemology is defined as the study or a theory of the nature and grounds of knowledge especially with reference to its limits and validity (Webster, 2007). It provides a philosophical grounding for ascertaining the kinds of knowledge possible and how to ensure that it is adequate and justifiable (Crotty, 1998).

This research was influenced by the *constructionism* epistemology. *Constructionism* permits the researcher to explore the views of the different participants within the subject context recognizing that each might have a different view or understanding of the same situation, and that truth or reality exists only through interaction with the realities of the world (Levy, 2003). The nature of this research requires a conceptual and contextual understanding of the current state of KM practices within HEIs, as well as perceptions of KM practices and their use or non-use within this context. The culture and environment of HEIs encourage individual thought and opinion; each is therefore able to construct meaning and each possibly perceive world phenomena at times very differently from one another.

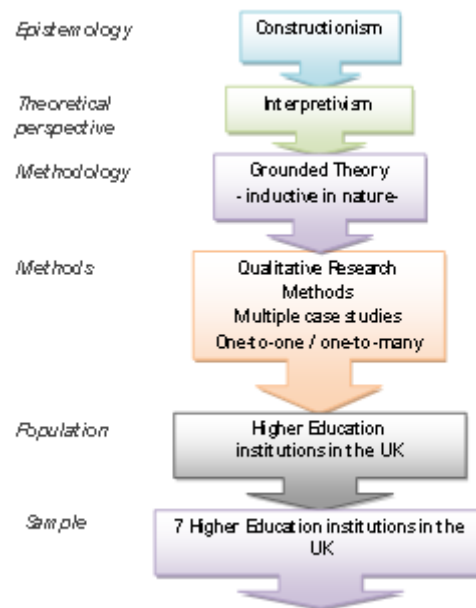


Figure 2: Research Framework adapted from Crotty's (1998) model.

The *theoretical perspective* used for the research was that of interpretivism. Interpretive research assumes that people create and associate their own subjective and inter-subjective meanings as they interact with the world around them and interpretive researchers thus attempt to understand phenomena through accessing the meanings participants assign to them (Myers, 1997).

Methodology is defined as “the strategy, plan of action, process or design lying behind the choice of particular methods and linking the choice and use of methods to the desired outcomes” (Crotty, 1998). This research attempts to allow the theory to be built up from the data and hence Grounded Theory (GT) was used for this purpose.

5.2 Methodology: Grounded theory

GT research methods can be traced back to Glaser & Strauss (1967) in the book ‘*The Discovery of Grounded Theory: Strategies for Qualitative Research*’. It is described by Glaser and Strauss as the discovery of theory from data which is systematically obtained and analysed (Glaser and Straus, 1967).

The GT data analysis approach involves searching for concepts by looking for the codes (Allan, 2003). Codes, concepts and categories are generated by analysis of the data, and a process of constant comparative analysis is used, which compares these codes, categories and concepts iteratively and constantly to each other until a core category is discovered and theoretical saturation is reached, leading to theory generation. By linking the categories and investigating the connections between concepts, the theory emerges.

Glaser and Strauss (Glaser and Straus, 1967) believed that there was more to research than testing previously brilliant theories and that theory could still be developed, refuting the fact that only the intelligent theorists of the past could develop theory. They also assumed the emergence of theory to be the underpinning of the GT approach. Despite working together on the discovery of GT, Strauss and Glaser developed different views on what GT was and how it should be implemented. This paper does not provide an in-depth analysis and discourse of the different perspectives and approaches to GT, but presents the approach used for the purposes of this research. The research has combined the techniques of both Glaser and Strauss, combining some of Strauss's structure and techniques of micro-analysis (word-by-word analysis of the text and subsequent code generation for it) at the beginning to allow the researcher to gain confidence in the method. Initially, the researchers favored a more structured approach to concept generation; however, having become more confident with the technique, it became possible to concentrate on generating general concepts and ideas, using the constant comparative method rather than coding word for word. The process depicted in Fig 3 is a framework used for the theory generation.

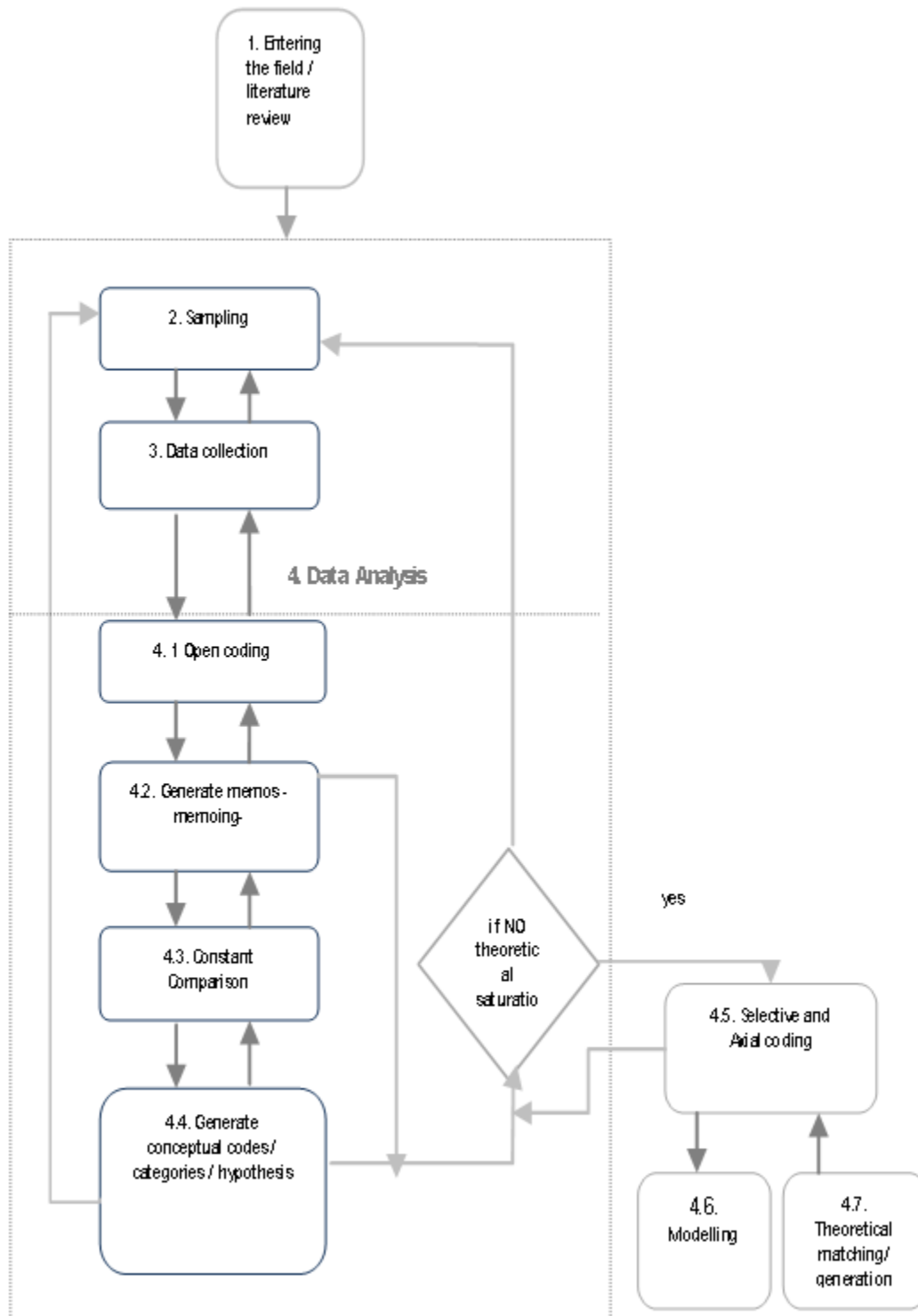


Figure 3: Grounded Theory building process adapted and expanded from (Rodon and Pastor, 2007)

The combination of case study research with GT is supported by Eisenhardt (Eisenhardt, 1989) who suggests three strengths for theory building from cases:

- "One strength of theory building from cases is its likelihood of generating novel theory" (Eisenhardt, 1989:546);
- "A second strength is that the emergent theory is likely to be testable with constructs that can be readily measured and hypotheses tested" (Eisenhardt, 1989:547);
- "A third strength is that the resultant theory is likely to be empirically valid" (Eisenhardt, 1989:547).

Eisenhardt (1989) further contends that building theory from cases is particularly well suited to new research areas or research areas for which existing theory seems inadequate, given its strengths as listed above. KM

as a research area is certainly not a new one; however, divergent theory exists and its application, particularly within the Higher Education (HE) sector, is relatively new, which makes KM and this research well suited to this combination of research methods: case study and GT.

5.3 Qualitative research methods used

A case study is an empirical inquiry that “Investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (Yin, 1994:3).

Case study research should be considered as a research strategy which includes specific approaches to data collection and data analysis, which Yin (1994) continues to add can be based on single- or multiple-case studies, and by nature it can be explanatory, exploratory, or descriptive. This research used a multi-case and it is presented in an explanatory nature. Semi-structured, one-to-one, and one-to-two interviews were conducted at the case locations.

The qualitative analysis tool, NVIVO 7 was used to analyse the data. The interviews were transcribed from digital audio recordings and the process of open coding ensued. Further data collection and coding and then selective coding took place as coding saturation became apparent.

5.4 Population and sample

Given that universities can be historically, locationally and financially very different, the sample was carefully selected to be representative of the different types of HEIs within the UK. A representative sample of 7 Higher Education Institutions was carefully selected in terms of type and size of institution, as can be seen in Table 1 and Table 2 respectively.

Unfortunately, we were unable to include the only Private Higher Education institution in the UK within the case study; however the sample is very representative of the HEIs within the UK.

Two of these institutions could be classified as primarily teaching universities, while the other 5 are research intensive universities.

Table 1: Type of institution participating within the case study (2008).

Type of Institution	Number
Post -1992 Former polytechnics ¹	2
Post-1992 : other ²	1
Pre-1992: Russell group ³	3
Pre 1992: other ⁴	1
Total	7

Table 2: Size of institution participating within the case study (2008)

Size of Institution	Number
Less than 10,000 students	1
10,000> and <15,000 students	3
>15,000 and < 20,000 students	2
>20,000 and < 30,000 students	1
Total	7

Initial participants were selected by the Vice-Chancellor (or Principal as used within some institutions) as a first point of contact, and were considered to be the most knowledgeable and/or involved with KM-type

1 In 1992 Higher Education in the UK underwent major change, abolishing the Polytechnic institutions as a type of Higher Education institution and condoning University status to some. Institutions within the UK having the polytechnic status pre-1992 and received university status in 1992

2 Post-1992: other – Higher Education institutions with university status after 1992 but not classified as polytechnics before 1992.

3 Russell Group - A group of HEIs within the UK that enjoy an excellent reputation internationally and that receives two-thirds of universities' research grant and contract funding in the United Kingdom.

4 Pre 1992: other – Institutions with the university status before 1992 not in the Russell Group.

activities at the institution. These initial participants were very senior members of staff, who then selected additional members of staff to take part in the case study. The participant roles are reflected in Table 3.

Table 3: Participant roles

Role	Number
Academic Dean	3
Director/ Manager of IT / Information	3
VP / Executive Director : Knowledge Management	2
Registrar	2
VP / senior officer: Knowledge Transfer Partnership	2
VP	1
Assistant to principal	1
Pro Vice-Chancellor	1
Librarian	1
Knowledge Manager	1
Project staff	1
Total	18

5.5 Structure of Interviews

The interviews were conducted in a semi-structured way. A select number of participants requested to be part of a two-person interview rather than being interviewed one-on-one. Although the researchers found the one-on-one interviews to be more constructive as it allowed individuals to provide their own perspectives without having a colleague influence it, the one-to-two interviews provided very valuable perspectives as well which were used in the case study.

Having scanned the literature for KM models, perspectives and frameworks, the researchers came across two sets of models and perspectives on KM which provided the lens through which to investigate KM at HEIs in the UK; 1) Stankovsky's (2005) model on Enterprise learning depicted in Fig.1, was used to frame the interview questions to better understand perceptions and practices within the four pillars in HEIs i.e. Technology, Learning, the Organisation, and Leadership. 2) Davenport and Prusak (2000) have a very pragmatic approach to Knowledge Management and hence their perspective on what KM is was used.

As KM has such a diverse range of definitions, and can be very differently understood depending on the discipline it is being viewed from, it was necessary to have a frame to structure the interview in some way so as to optimise its value. It was decided to do this even though there is contradictory advice given in the GT literature about entering the field with a clear mind and not allowing the literature to influence the emergent themes. This approach is consistent with researchers who have studied and used GT and have found that entering the research field without any preconceived ideas or frameworks or an understanding of the area is very difficult to do and there is debate about the aimlessness that could happen if there is no idea of the theory of the field of research.

6. Initial findings

This case study has yielded a rich set of data that has provided valuable insights into the perceptions and practices of KM within seven HEIs within the UK. For the purposes of this paper, two aspects from the interviews will be discussed:

1. Characteristics of academic staff
2. The context and characteristics of universities, focusing on
3. Culture
4. Difficulties experienced and
5. Management structure and style.

These aspects will be considered in relation to the implications for KM implementation.

6.1 Characteristics of Academics

One of the questions asked within the “Perceptions of KM” theme was, “Why was KM not accepted more broadly in Higher Education”. This question sparked a vigorous discussion about what the nature of “an academic” was perceived to be, and what the characteristics and culture of Higher Education were, and the associated difficulties in relation to implementing change within this context. Addressing the first point, the nature of academics, the ideas emanating from the interviews was that academics are, by nature of their jobs, experts in their field and the view was that academics viewed their role as that of expert and hence should be the most qualified to judge the methods and pedagogy implemented in relation to their perception of quality. The issue of academic arrogance was raised against this issue of academic freedom. Another theme emerging from the data was that academic staff do not want to be managed in the hard-core business sense. Their natural unit of working is one – themselves, and in the main they are self-sufficient units. A very senior academic and administrator had this to say

“We need to develop more of a team concept within the staff. They do naturally tend to be a unit of one. But if they have the chance to talk, if they have time to deal with their peer group and they make good use of it, you know, even the most stubborn will see over time that there are real merits and benefits in the sharing processes.”

Although it was thought that academics are quite open to the idea of sharing, there is the further issue of creating opportunities for such interaction, as well as a real issue of innovation and publishing whose goals go against the idea of sharing at the beginning stages; hence, timing is an issue for sharing research innovation.

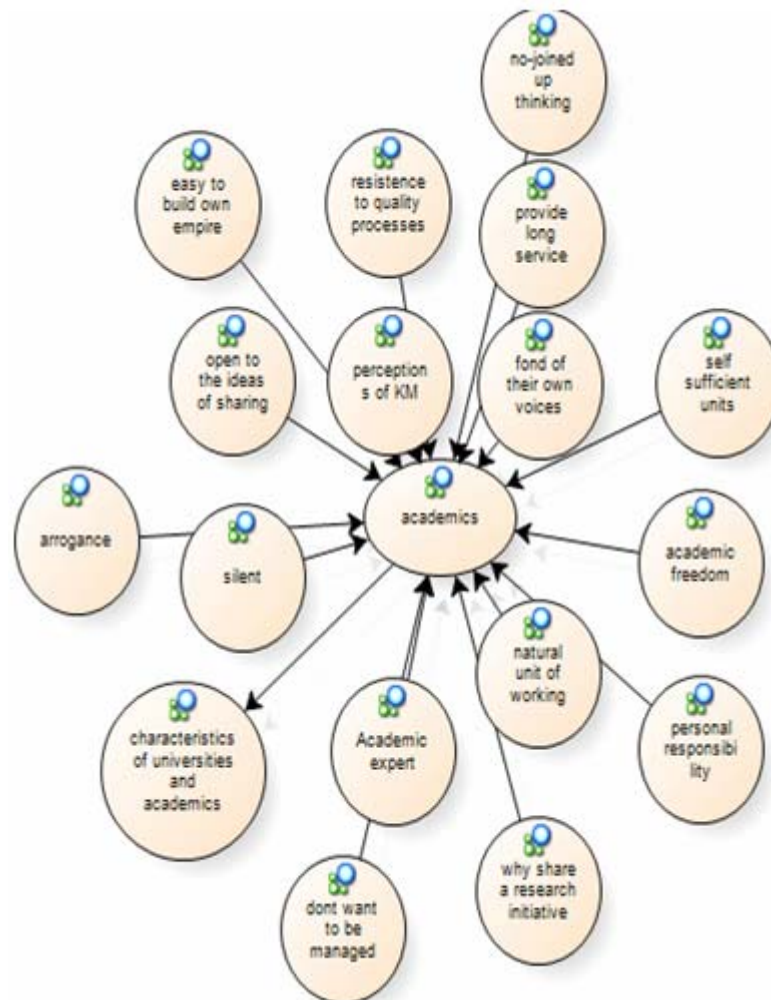


Figure 4: Characteristics of academics

The perception of Knowledge Management among academic staff is that their work involves managing knowledge; they are the managers of their own knowledge, and hence are already involved at some level in KM. Academics also generally tend to provide very long service to a university and hence, once they decide to leave, this could have a detrimental impact on the School, Faculty and ultimately the institution, especially

if the academic is a renowned expert within a particular field attracting students and funding for the School, Faculty and the institution as a whole. This raises major issues of the importance of intellectual capital, especially for this context and the application of effective knowledge management principles to address this challenge.

Another concept that emerged was that academics generally affiliate themselves with their research unit or discipline as a first, and then with their School, and that this is where their allegiance and priority is concentrated. This finding is in line with the research of Becher (2001), first published in 1989. The university as a whole is impacted in various ways by this, and institutions ability to encourage support for institutional-wide initiatives and change, for example KM, is difficult unless there are perceived and demonstrable benefits at the academic and individual level.

6.2 Characteristics of Universities and implications for KM implementation

With regards to the characteristics of universities, interesting themes and concepts emerged as well, as can be seen in Fig 5. For the purposes of this paper, the issues of culture, difficulties experienced, management style and structure, in relation to the implications for the implementation of KM, will be considered.

6.2.1 Culture

Morgan (1986), defines *culture* as the shared meaning, shared understanding, and shared sense making that contributes to the personality of an individual or an organisation. It also has to be understood that, within any organisation or culture, there will be subcultures operating at lower levels of influence (Cole, 2004). With regards to the case study, very senior members of staff were interviewed, as well as some middle managers who would be at the cold front of operation and less influential and privy to the 'more influential inner circle' and possibly the heightened awareness that goes with being in it. It was interesting to note the difference and sometimes contradictory views and perceptions from these different groups which is a significant find yet goes beyond the scope of this paper.

Within HEIs there is the perception of an academic and administrative divide. A perception from an administrator suggests:

"..the academic community have a much more sharing culture. On the administrative side it is a case of getting the information only that you ask for, and if you do not ask the correct questions you possibly will not get the information you looking for".

This was felt to be the case with certain units, although practice within other units explicitly embrace and incorporate the sharing of knowledge and best practices to a degree. The universities within the cases were found to be traditionally collegiate, consensus type organisations, and two cases in particular highlighted this as a very strong culture within their university, considered to be very different from other universities with highly politicised environments.

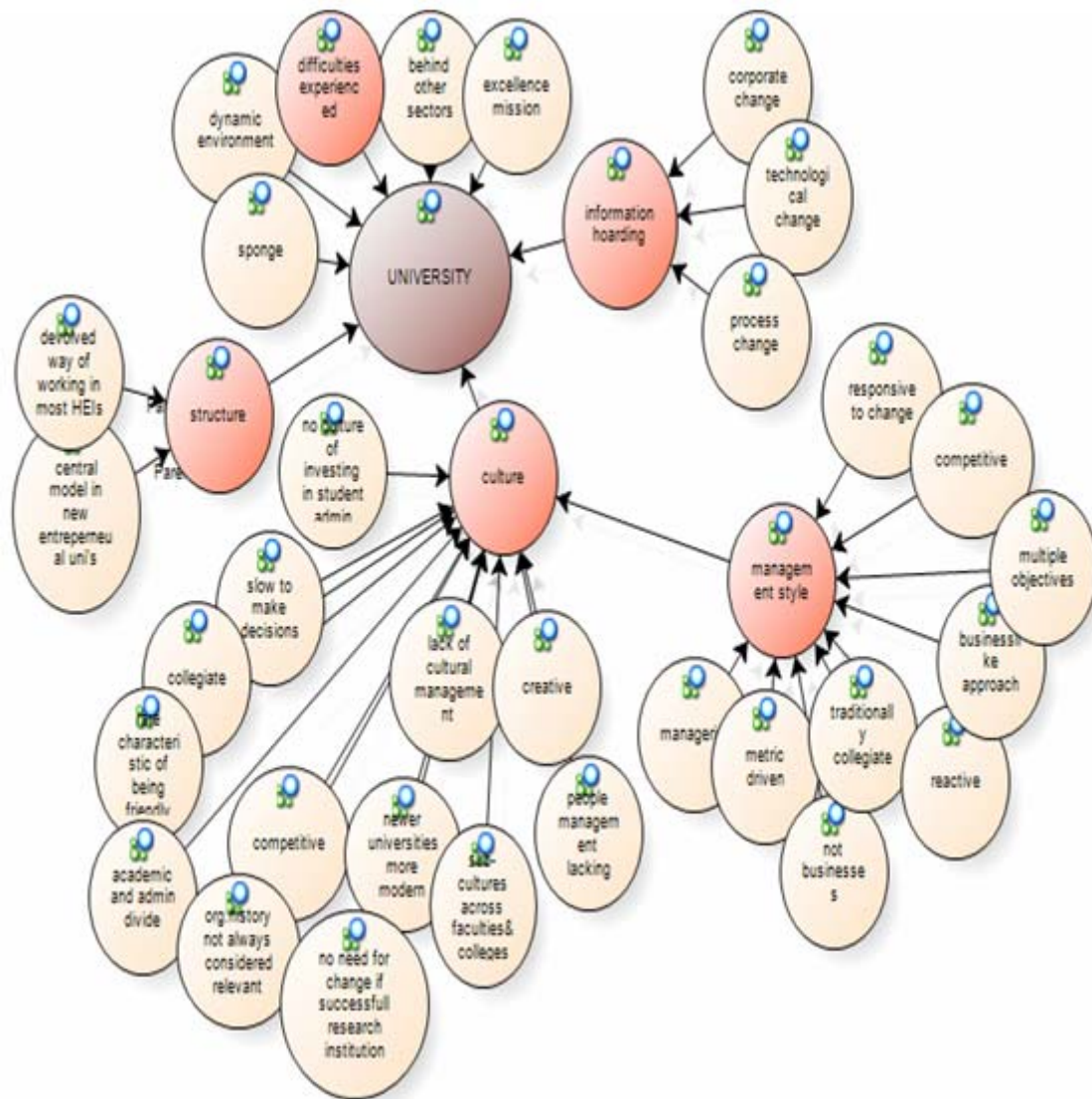


Figure 5: Characteristics of Universities

It was noted that sub-cultures existed within the universities, and posing these questions to a different person might yield slightly different answers (if from a different discipline for example); however, it was mentioned that all the senior staff would be very aware of the culture created by the Vice-Chancellor and their ultimate objectives and direction for the institution.

Universities are complex organisations and hence organisational change and the decision making process is a very long one; hence the rate of change within this context is slow.

6.2.2 Management structure and style

The management structure and style of the case universities, varied. One of the Russell group universities within the research has a very clear, explicit mission of excellence, and although it is a traditional, well-established, 'old', UK university, it embraces the 21st century management practices of KM evident in the redefining of an executive position with a clear mandate and responsibility for KM, both in the job title and duties. This position has been in place for a few years; however, a new appointment had recently been made, and some redefining of the position has occurred. At the time of the case study, a second university had, two months prior to the case study, redefined the position of Director to that of senior executive, also with a very clear mandate and responsibility for KM in the job title as well as in the job description. Both of these universities mentioned have a devolved structure, empowering Heads (Deans) of Faculties or Colleges with devolved budgets and power, and one indicated that the structure potentially weakens the 'centre' or the senior executive's position and ability to drive change across the institution, armed with the financial resources required for it. This has a direct impact on the way in which systemic implementation of KM and

institutional change is brought about. Although the leadership of the university values KM, and is one of the leading institutions within this case to embrace KM, it does have to deal with implementation difficulties imposed by the structure of the institution. The university has also embarked on an institutional wide project to begin to improve student processes in a significant way.

A third university, considered as a newer, pre-1992 university, also known for its national and international excellence in research and teaching, has marked its strategy with a wish to be enterprising and outward-looking and seeks to covertly match academic excellence with relevance, a policy which was not always popular in the late 1960s and early 1970s. Although, entrepreneurial in style and mission, it does not covertly practice KM, but considers KM-like activity to be part of what senior individuals within the institution already do. Its structure, however favours a more central model and hence the senior members of staff do not have the same difficulties as the decentralised universities do, that of decentralised budgets which in effect weakens the centre's ability to introduce systemic, institutional-wide change.

6.2.3 Difficulties experienced

The HEIs within the sample are very representative of the different types of universities in the UK, and certainly, as Shattock (2003) contends, they all may be universities but historically, locationally, and financially, their positions are very different. They certainly did not all start from the same position. Given the differences in history, culture and mission, the interviews identified that commonalities in the difficulties experienced over the years existed; however there were major differences as well. One of the commonalities is change; however the difference presents in the extent of that change. UK Universities in general underwent change over the past decade, however this change was considered to be especially strong in the universities classified as pre-1992: Former Polytechnics compared to the other well established, traditional universities who enjoyed research prestige, and were not pressured to change their processes and systems at the time. However, these well established universities, having missed the extreme pressure of change in 1992 and beyond, have now begun to rethink the way they do 'business', given the impact of globalisation and marketisation and their ambition to continue to maintain their prestige. These Universities within the case, have now recognised the importance of changing the way in which they do 'business', and are undergoing substantial change in terms of either their structure, processes or management tools adopted. One in particular has recently undergone a major restructuring exercise and at the senior level has embraced very modern 21st century management tools, for example ensuring very senior representivity and responsibility for KM, and utilising the Balance Score Card, and process improvement. The second Russell Group University has not overtly prioritised KM, but recognises what it does on a daily basis to achieve some of the KM objectives, and, in terms of the organisation and its processes, it has embarked on a 21st century management tool which will identify and eliminate waste to deliver improved value and service based on what their stakeholder requirements are, hence improving existing processes and creating new ones where required. This university is a much smaller university, and hence raises the question of size and geographical location of the university – whether spread across a wide area or localised in one area - would necessitate the implementation of KM or not, and how the process would work in practice. This institution, therefore, is actively and aggressively, seeking to ensure that they continue not only to deliver quality research, but also ensure quality of management, processes and services through prioritising 21st century management tools to maintain rank and prestige.

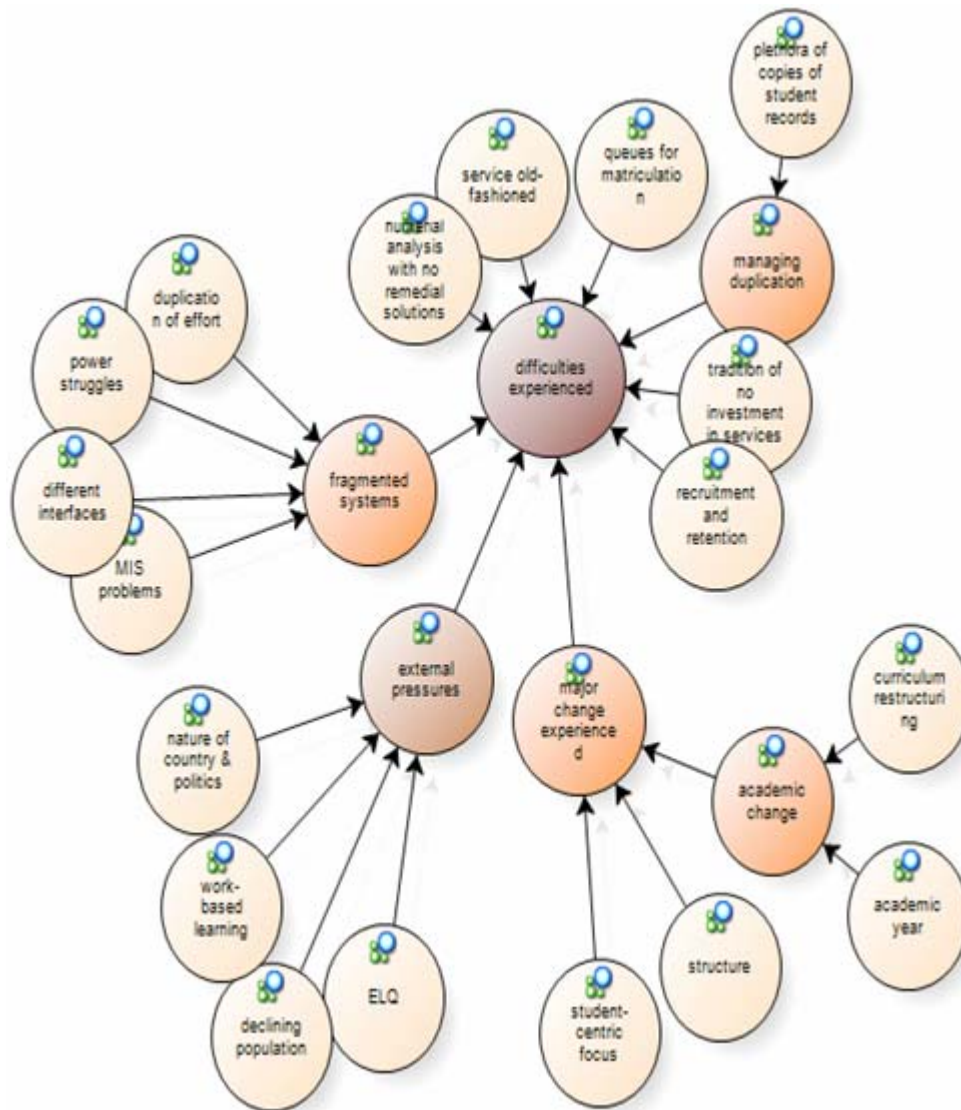


Figure 6: Difficulties experienced by universities

It was noted that the difficulties experienced by major change in the universities classified in the paper as “Post-1992: Former Polytechnics”, have impacted on their ability to embrace additional major change not imposed by government or the funding councils. These institutions contended that a period of stability was required, where change and improvement was minimal. Their stance was one that 21st century management tools either need to be imposed by Government or the funding councils or have to be tested and tried by the elite well-established research intensive universities within the UK. The perception was that they do not have the luxury of resources to invest in any activities not considered core or critical to the university’s mission.

7. Conclusion

Universities in general, and UK HEIs in particular, do have a significant level of KM activities, which Rowley(2000) contends is important to recognize and use as foundations for further development. It is evident from the cases that two out of the seven HEIs were engaging in KM in a systemic and institutional-wide way, and a further two had champions engaging in KM overtly within their faculty. These four institutions were therefore actively engaged in prioritizing 21st century management tools.

Higher Education Institutions within the United Kingdom have undergone major change over the past decade which has impacted on their ability to respond to external forces not imposed by the government or funding councils. Some of these are linked to the influences of globalization and market forces and impact directly on institutions’ ability to maintain their prestige and rank. Well-established, prestigious universities within the UK appear to be more capable of responding to these forces and have recently begun to prioritize 21st century management tools like Knowledge Management, Lean Management, Balance Score Card, and Process

Improvement, to name a few. The case study has enabled research to be conducted on a spread of universities within the UK, and has presented very interesting and current findings as to the context of HEI's and its position on KM as a management tool. Some of the initial themes emanating from the cases are highlighted below:

1. **HEI leadership slowly prioritizing KM and 21st century management tools:** Two of the seven case studies have senior executives with titles Vice Principal Knowledge Management, and 1 has a very senior member of the executive board championing KM activity within the university. Another has been charged to investigate the possibility and potential for KM activity at the university. Hence 4 of the 7 case institutions have varying degrees of KM consideration.
2. The nature of academic staff and perceptions of the academic job have a direct impact on the culture of the institution and impose their own factors that contribute to the ability to adopt KM as a management tool: To implement KM within any organization, the correct culture needs to be cultivated. HEI's have two distinct cultures, an academic culture and an administrative culture, and even within these there would be sub-cultures for example per discipline or function. A theme that came out of the research was that not enough cultural management is exercised within this context. Academics are considered experts in their field and hence do not take too easily to being managed or having "what they know" managed. They are not averse to the idea of sharing of best practice, but, rightfully so, want to exercise their academic freedom so as to cultivate innovation and creativity.
3. Evidence of the benefits of explicitly adopting KM principles within this context needs to be clearly understood by individual researchers and academics, as well as the administrators: Universities by virtue of their missions, share knowledge with their students, and use committees to make decisions and share information and knowledge. The additional benefits of adopting KM within this context needs to be understood, as universities consider themselves to already be sharing, creating and disseminating knowledge. What are the areas that can explicitly improve with KM, what are the gaps in application, and how best can the explicit adoption of KM harness competitive advantage?
4. **The taxonomy for the application of KM within the HEI context should be considered:** The word "manage" immediately receives a negative response as it reflects a business-like attitude which does not sit well with a few more traditional academics, except with a few Business Academics. Even within the universities that have embraced KM, there have been lengthy debates to not use the word "manage" in the terminology. In some, there has also not been a clear definition for KM specified and hence the role of Vice Principal: Knowledge Manager is that of facilitator and enabler of various activities that would be considered KM. The HEI context would benefit greatly by a taxonomy that specifically accommodates its context.
5. **The management structure of a university affects its ability to respond quickly to external influences and pressures:** Universities have become more and more decentralized, shifting budgets and hence power down to the Heads of schools or colleges. The impact of this is that colleges/faculties, and hence the Heads or Deans, become all-powerful which tends to weaken the 'centre' from implementing systemic or institutional-wide change without the express approval and supporting finances from the Deans/Heads. The positive side to this structure is that if there is an environment and culture of collaboration and trust, then the centre has to receive the buy-in of all the Heads of Deans before it can engage in any systemic changes, which will improve the success of the initiative. Centralized models do not have this problem, and it was found that the newer, modern universities tend to be more entrepreneurial in nature and adopt the more central model.
6. There is a correlation between the history of the institution and its ability to respond to the challenges of the 21st century Knowledge Economy: The universities who underwent major change, those who changed their status from Polytechnics to University in 1992, expressed the need for evidence based benefits of KM or for a clear instruction from government or the funding councils to adopt KM. In their opinion, this would tip the scales in favor of KM as the major change that they needed to undergo over the past few years necessitates a period of stability before any further substantial change would be implemented. By contrast, pre-1992 universities, are now beginning to make substantial changes to their structure, processes, systems and able to adopt 21st management tools to ensure that they maintain their cutting edge.

In conclusion, this research has enabled some rich themes and findings to emerge with regards to the current perceptions of KM within the HEI context and the factors that hinder or promote its implementation. Two of the areas from the research were considered in this paper namely, the characteristics of academics and universities and the impact on the implementation of KM within this context. This research is fascinating in that academic research in the area of KM is increasing in popularity and institutions offer it as an academic programme or course, yet few, have embarked on research of the application or implementation of KM within

this context. Further research is required to provide an evidence base of the benefits of KM as a management tool to enhance the competitive advantage of universities within the UK; however, this case study research has shown that, as Ponzi (2002) postulates, KM is in the process of establishing itself as a new aspect of management and slowly but surely it is capturing the attention of the HEIs.

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One Size Does Not Fit All – Towards a Typology of Knowledge-Centric Organisations

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Abstract: Organisations are increasingly turning their attention to the creation and use of knowledge as a strategic resource. Too often however, knowledge management initiatives fail to deliver the competitive advantage expected from a strategic resource. The knowledge management literature is characterised by frameworks for knowledge management implementation which tend to prescribe best-practice methods to a large range of companies. Although useful, a key weakness of these frameworks is their inability to account for contextual differences. Consequently many organisations attempt to apply a knowledge management framework that simply doesn't fit the organisational context resulting in little or no benefit from their efforts. A shift in focus from best practice to best fit is necessary to account for the difference in organisational contexts.

Systems thinking emphasises context as an important element in understanding a system, and five concepts from systems theory are used to define the criteria for establishing a best-fit approach. A social constructionist approach to the research further affords the opportunity to identify areas of significant variation in knowledge management context and practices within knowledge-centric organisations. A multi-method research strategy, comprising cluster analysis and case study research, is proposed to develop insight into the emergence of different configurations of knowledge management capabilities within different organisational contexts.

The proposed conceptual framework forms the foundation for building a typology of knowledge-centric organisations which will enable organisations to choose the most appropriate approach to knowledge management based on their specific context which varies along the dimensions of their knowledge-orientation, knowledge management intent and knowledge management enactment.

Keywords: knowledge management, knowledge-centric organisations, typology, social constructionism, configurational approach, systems thinking

1. Introduction

Managing knowledge is not a new phenomenon. Knowledge about discoveries made thousands of years ago, passed on through generations through storytelling, apprenticeships and in written form, has led to the rise of the modern industries we know today. Sharing know-how and exchanging ideas lead to the creation of new knowledge, and applying the new knowledge to common problems have resulted in countless innovations through the past few centuries.

Over the past decade it became apparent that the industrial era has entered the end of its lifecycle. During this period technological advancements started to emerge that rapidly changed the way in which production was being organised, trade occurred and value was delivered to consumers (Greenspan, 1998). Although the fundamental rules of the economy have not changed, the structure and drivers of the economy have changed and knowledge is increasingly being recognised as a strategic resource. When managers consequently started to shift their attention from physical resources to the more intangible, which includes knowledge, the term knowledge management was coined to describe the emerging discipline of the conscious effort to examine and promote the sharing, use and creation of knowledge in organisations in a formal manner.

With knowledge management being positioned as a strategic imperative, numerous studies have explored its resource-base and its management alternatives. These studies and frameworks have played an important role in establishing knowledge management as a field of inquiry within the business sciences and although useful, a number of weaknesses have limited the successful implementation of knowledge management. Most knowledge management frameworks present knowledge management best practices while failing to address contextual differences between organisations. The implication is that knowledge management initiatives fail too often, fuelling the fear that knowledge management is simply another passing fad.

To account for contextual differences between organisations, knowledge management frameworks should shift the focus from a best practice to a best fit approach. This means a framework should first provide a mechanism to investigate and understand an organisation's context, and then, based on the context, provide insight into the most suitable approach to knowledge management.

The primary objective of the research is to develop a facilitative framework for becoming a knowledge-centric organisation, which in this context, is defined as an organisation that views and manages knowledge as a strategic resource based on an understanding of its own organisational context.

This paper focuses on describing the approach that will be followed to develop the knowledge-centric framework. First the best-fit concepts that form the foundation of the knowledge-centric framework are described and the compatibility of existing knowledge management frameworks is evaluated against these criteria. Second, the choice of research philosophy and research approaches is explained. Finally, a multi-method research methodology is described, highlighting the contribution of each of the proposed methods to the development of the knowledge-centric framework.

2. Foundational concepts of best-fit approaches

Identifying knowledge management best practices, benchmarks or influencing factors seem to be the goal of the majority of empirical studies in knowledge management (APQC, 2005; Chase, 1997; Choi & Lee, 2003; Darroch, 2003; Davenport et al., 1998; De Long & Fahey, 2000; Gold et al., 2001; C. W. Holsapple & Joshi, 2000; Khalifa & Liu, 2003; KPMG, 2003; López et al., 2004; Lucas & Ogilvie, 2006; Martini & Pelligrini, 2005; O'Dell et al., 1999; Skyrme & Amidon, 1997; Sveiby & Simons, 2002; Viitala, 2004; Wong & Aspinwall, 2005). These studies play an important role in developing a better understanding of the components of knowledge management and in some cases, the interaction between the components. A void however still remains in developing insight into the differences in context between organisations, and the implications of these differences in terms of choice of knowledge management approaches. This highlights the need for a best-fit approach to knowledge management, and such a framework will have different characteristics than a framework promoting a best-practice approach.

The focus on contextual differences is a key differentiator of best-fit approaches, immediately reminding of systems thinking where the context of a system plays a central role in understanding the system. Five key concepts of systems theory can be used as criteria for best-fit approaches. The first concept is that a system is an integrated whole consisting of parts (Jackson, 2003). Translated to the context of knowledge management, this means that knowledge management could be viewed as a system consisting of parts, or a subset of knowledge management activities. Incorporating the concept into a knowledge management framework, would mean that the knowledge management framework should identify or prescribe the activities that make up knowledge management. This alludes to a prescriptive function embedded in a knowledge management framework, and a large number of knowledge management frameworks do exactly that. A knowledge life-cycle is a typical example of a prescriptive framework and some examples from the literature include Nonaka and Takeuchi's (1995) knowledge spiral, the American Productivity & Quality Centre's (APQC) knowledge management process (O'Dell et al., 1999), Lee and Yang's (2000) knowledge value chain, Mack, Ravin and Byrd's (2001) knowledge work tasks and Birkenshaw and Sheehan's (2002) knowledge life cycle.

A second systems concept says that the parts of an integrated system are organised around a specific purpose (Dostal, 2005). In the knowledge management context this means that knowledge management activities are organised to achieve specific organisational goals. A knowledge management framework therefore should establish a link between knowledge management activities and organisational goals or objectives. A number of knowledge management studies (Davenport et al., 1998; Khalifa & Liu, 2003; Skyrme & Amidon, 1997; Wong & Aspinwall, 2005) have identified the linkage of knowledge management activities to organisational goals as a knowledge management success factor, however few knowledge management frameworks have incorporated this.

A third systems theory concept is that the whole is larger than the sum of its parts (Capra, 1997). This means the characteristics of a system (the whole) emerges from the configuration of relationships or interdependencies of the parts. The properties of a system can therefore not be understood by looking at the parts independently - the focus needs to be on the relationships between the parts and with the whole (Jackson, 2003). It is the pattern of relationships that determines the characteristics of a system. In terms of knowledge management frameworks, this means that knowledge management cannot be described simply

by describing the various components of knowledge management as many descriptive frameworks tend to do (Gallagher & Hazlett, 2000; C.W. Holsapple & Joshi, 2002; Weerdmeester et al., 2002). The properties of knowledge management are destroyed when it is simply dissected into the underlying components. Instead, a knowledge management framework should facilitate the investigation of the configuration of relationships and interdependence among all the components in order to understand the characteristics of knowledge management.

A fourth concept borrowed from systems theory is that a system is a whole in its own right, but also part of one or more larger wholes (Dostal, 2005). This means that any system should be viewed in the context of its parts, which are systems themselves, as well as the larger system it forms part of. In terms of knowledge management this means that knowledge management should not only be viewed in terms of its underlying activities, but also in terms of the organisation in which it is or will be deployed. Contextual-sensitivity therefore needs to be embedded in a knowledge management framework, facilitating the investigation or identification of the context in which knowledge management is deployed. Although a few recent studies have started to investigate aspects such as knowledge management styles (Choi & Lee, 2003) and organisational capabilities (Gold et al., 2001), the majority of knowledge management frameworks fail to identify or address the contextual differences between organisations.

A fifth systems theory concept is that systems co-produce each other (Dostal, 2005). This means that a system is co-produced by factors present in other systems. In terms of knowledge management this means that knowledge management is not only shaped by its underlying knowledge management activities, but also by factors belonging to other systems, for example the industry within which an organisation operates, organisational structures and leadership, to name a few. A number of knowledge management studies have investigated the relationships that exist between knowledge management and factors such as culture (De Long & Fahey, 2000; López et al., 2004; Lucas & Ogilvie, 2006; Ribière, 2001), leadership (Viitala, 2004), organisational performance (Choi & Lee, 2003) or a combination of factors (Darroch, 2003; Davenport et al., 1998; Gold et al., 2001; C. W. Holsapple & Joshi, 2000; Khalifa & Liu, 2003; Martini & Pelligrini, 2005; Wong & Aspinwall, 2005). Although these factors are often described in knowledge management frameworks, these frameworks fail to provide insight into which approach to knowledge management might best suit a particular organisational configuration.

Best-practice knowledge management frameworks are prescriptive on the types of knowledge management practices and procedures organisations should follow. On the other hand, a best-fit approach involves considering an organisation in its entirety, including its internal and external environment, and examining the relationships between its various entities, before recommending the most suitable approach to knowledge management. Although knowledge management studies and existing frameworks have addressed a number of the concepts described above, a knowledge management framework that meets the criteria of a best-fit framework has yet to emerge.

3. Theoretical framework

The overarching objective of the study is to develop a facilitative framework for becoming knowledge-centric, which in this context, is defined as an organisational property or quality to view, manage and use knowledge as a strategic resource *with a grounded understanding of the organisational context*. From a theoretical perspective it is important to understand what knowledge is and how it can be used as a strategic resource. The study is therefore grounded in two main theoretical strands, namely epistemology and the resource-based perspective.

Epistemology is the subject area that investigates the origin, structure, methods and validity of knowledge by addressing what is known as the three basic questions of epistemology. First epistemology is concerned with the nature and sufficient conditions of knowledge (Steup, 2006), in other words 'what is knowledge?' A second set of questions concerns the sources of knowledge (Steup, 2006), asking 'where do we get knowledge from?', 'how do we know if it is reliable?' and 'when are we justified in saying we know something?' Finally epistemology is concerned with the scope and structure of knowledge (Steup, 2006), in other words 'what are the limits of knowledge?' and 'are there any in the first place?' The theoretical framework of the study is built on the premise that knowledge is a social construct, with communal interchange as the main source of knowledge. Social constructionism emphasises the importance of language, context, and interaction with the environment, which leads to the view that organisational knowledge is created through interaction between people both in an organisation's internal and external environment. Organisational knowledge-creation in the theoretical framework is built on a combination of the

models proposed by Cook & Brown (1999), Powell & Swart (2005), Tsoukas (1996), Tsoukas & Vladimirou (2001) and Von Krogh & Roos (1994).

The resource-based perspective shifts the focus away from analysing organisations from the product side towards analysis from the resource side (Wernerfelt, 1984). Organisations are therefore viewed as different collections of physical and intangible assets and capabilities. Resource-based theory views these assets and capabilities as potential sources of sustained competitive advantage (Barney, 1991). For an organisational resource to hold the potential of sustained competitive advantage, they must simultaneously be valuable, rare, imperfectly imitable, and non-substitutable (Barney, 1991). Some major criticism against the resource-based view is the absence of a theory of the environment and of a convincing treatment of dynamic factors and processes (Foss, 1998). Any conceptual framework which views knowledge as a strategic resource therefore will have to address these two weaknesses.

The knowledge-based view, which evolved from the resource-based perspective, views knowledge as the primary resource of sustainable competitive advantage (Grant, 1996). The knowledge-based view considers five characteristics as important for the utilisation of knowledge within an organisation to create value, namely transferability, capacity for aggregation, appropriability, specialisation in acquisition and the knowledge requirements of production (Grant, 1996). These characteristics however fail to address conditions of an evolutionary theory of the organisation (Von Krogh & Grand, 2002), whereby organisations appropriate returns from innovation and knowledge creation in order to create competitive advantage. Von Krogh & Grand (2002) propose a further five conditions for a knowledge-based view, namely a concept of knowledge origin, a concept of the knowledge creation process, a concept of corporate coherence, a concept of change and a concept of management. In the theoretical framework, the concepts of knowledge origin and the knowledge creation process are addressed in the epistemological view of knowledge as a social construct and a combination of Cook and Brown's (1999) model for organisational knowledge-creation, Tsoukas' (1996) view of the organisation as a distributed knowledge system and Powel and Swart's (2005) description of organisational knowing.

The concepts of corporate coherence, change and management are addressed in the dynamic capabilities theory. In the context of knowledge, dynamic capabilities can be viewed as the ability of an organisation to integrate, build and reconfigure internal and external knowledge to address changes in its external environment (Teece et al., 1997). It is argued that the competitive advantage of an organisation lies within its processes, specific asset positions and available paths (Teece et al., 1997). The roles of managerial and organisational processes are to coordinate and integrate the knowledge efforts of the organisation, resulting in a certain level of corporate coherence. Learning processes in turn enable tasks to be performed more efficiently and effectively and opportunities to be identified. Reconfiguration and transformation processes enable an organisation to sense the need to adapt to changes in its external environment. An organisation's asset position is influenced by various types of assets, for example technological, financial and structural assets, along with organisational boundaries (Teece et al., 1997). Path dependencies are influenced by an organisation's current position, which in turn is influenced by its previous investments and processes. Paths are however also influenced by considering the opportunities available to an organisation (Teece et al., 1997).

The specific configuration of the dynamic capabilities of an organisation thus has a large impact on the potential competitive advantage of the organisation.

4. Research philosophy and approach

Many knowledge management studies follow a positivistic research philosophy which is characterised by a reductionistic analysis of knowledge management. In attempting to statistically isolate the effects of variables, complex forms of interaction are downplayed and nonlinear relationships are ignored.

Developing a facilitative framework for becoming a knowledge-centric organisation, requires an approach that affords the opportunity to explain how being knowledge-centric emerges from the interaction of various organisational entities as a whole, and from the interaction of the organisation as a whole with its external environment. The research objective can be attained by addressing three questions. First, which dimensions can be used to describe an organisation's knowledge management abilities? Second, given these dimensions, what configuration of knowledge management abilities will emerge in different organisational contexts? Third, why do these configurations emerge, in other words, how are the dimensions related to each other within a specific context?

In order to address these questions, organisations are viewed as a function of a particular set of circumstances and individuals. Social constructionism therefore is an appropriate research philosophy to obtain rich insights into the unique and complex contexts of organisations (Saunders et al., 2003). Social constructionism affords the opportunity to develop an understanding of the subjective reality of an organisation’s knowledge management abilities by exploring its knowledge management motives, actions and intentions.

The research’s strong focus on identifying emerging patterns or configurations of knowledge management abilities highlights the necessity of a configurational research approach. Configurational research aims to identify multidimensional constellations of conceptually distinct characteristics that commonly occur together (Meyer et al., 1993). The approach is built on the premise that various “dimensions of environments, industries, technologies, strategies, structures, cultures, ideologies, groups, members, processes, practices, beliefs, and outcomes cluster into configurations” which can then be represented in conceptually-developed typologies (Meyer et al., 1993). These configurations can also be viewed as a quality or property that varies among organisations (Miller, 1996). Identifying configurations of knowledge management abilities within varying organisational contexts is therefore grounded in a configurational approach.

5. Research methodology

5.1 Multi-method

Different research methods will be employed to address the three research questions (figure 1). First a conceptual framework will be developed to identify the dimensions that can be used to describe an organisation’s knowledge management abilities. Second a survey, based on the dimensions of the conceptual framework, will be employed to obtain the data from which the configurations of knowledge management abilities will be derived. Third, case studies will be developed to explore the emergence of configurations within specific organisational contexts.

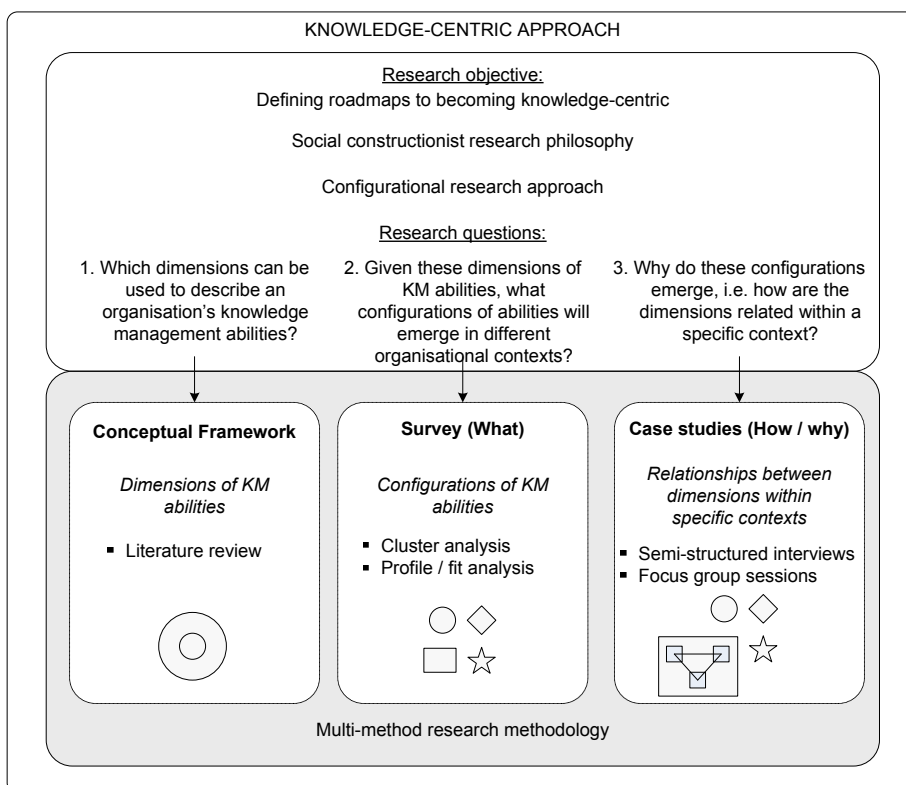


Figure 1: Multi-method research strategy

5.2 Conceptual framework

The conceptual knowledge management framework (figure 2) was developed with the theoretical framework as foundation and consists of three main dimensions. The first dimension, knowledge-orientation,

investigates the basic attitude of an organisation towards knowledge. The second dimension, intent, investigates the inclination of an organisation to manage and use knowledge as a strategic resource. The third dimension, enactment, investigates the processes an organisation has in place to manage and use knowledge as a strategic resource. An organisation's ability to manage and use knowledge as a strategic resource will emerge from the interaction between all the entities within and between each dimension.

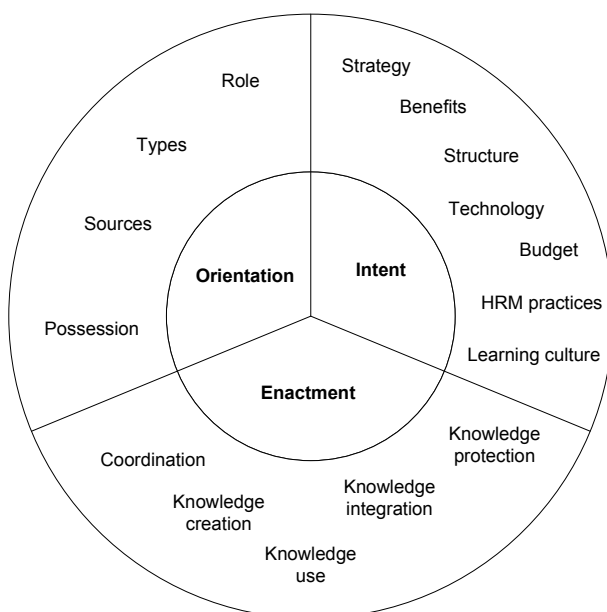


Figure 2: Conceptual knowledge management framework

An organisation's knowledge-orientation is investigated by looking at four entities. It investigates the role knowledge plays within the organisation by establishing its importance in the organisation's ability to grow and compete. It further establishes what types of knowledge and forms of knowing are prevalent within the organisation, by assessing the importance of explicit and tacit knowledge, as well as the importance of four forms of organisational knowing, i.e. knowing what, knowing how, knowing why and knowing why, described by Powell & Swart (2005). The dominant sources of knowledge are investigated to establish the importance of external knowledge sources to the organisation. Finally the organisation's view of the ownership of knowledge is investigated to establish the importance of individual knowledge and organisational knowledge.

The second dimension, intent, establishes whether an organisation is inclined to use knowledge as a strategic resource, and what benefits it intends to obtain from this usage. It further looks at the actions take within an organisation to build an environment conducive to using knowledge as a strategic resource. These include the structure that an organisation has in place to manage knowledge; the prevalence of technologies that facilitate knowledge management activities; the availability and growth or decline of financial resources that might impact on an organisation's capacity to management knowledge; human resource management (HRM) practices and incentives that facilitate and encourage the creation, sharing and use of knowledge; and the intentional development of a learning culture within an organisation.

The third dimension, enactment, investigates the prevalence of knowledge management processes within an organisation. Specifically the focus is on an organisation's processes to integrate, build and reconfigure internal and external knowledge to address changes in its external environment.

Although the conceptual framework describes the dimensions of knowledge management abilities, another mechanism is required to investigate the configuration of the three dimensions and their underlying parts in different organisational contexts.

5.3 Survey

A survey will be used to collect the data from which the emerging configurations of knowledge management abilities will be identified. The survey items will be developed from the dimensions and entities defined in the conceptual framework.

Although all industries are dependent on knowledge inputs to some extent, the study will focus on organisations that are highly-dependent on the intensive use of knowledge and skills as input. An adaptation

(figure 3) of the classification system used by Eurostat (Amil et al., 2007) to classify manufacturing and service industries according to their global technology and knowledge-intensity will be used to choose the industries to be included in the sample.

The sample will consist of organisations whose head office is located in South Africa, or whose operational capacity is largely based in South Africa. The sample will consist of small, medium and large organisations.

<p><i>High-technology manufacturing</i></p> <ul style="list-style-type: none"> ▪ Aerospace ▪ Computers ▪ Office machinery ▪ Electronics ▪ Communications ▪ Pharmaceuticals ▪ Biotechnology 	<p><i>High-technology knowledge-intensive services</i></p> <ul style="list-style-type: none"> ▪ Post and telecommunications ▪ Computer and related services ▪ Research and development
<p><i>Medium high-technology manufacturing</i></p> <ul style="list-style-type: none"> ▪ Scientific instruments ▪ Motor vehicles ▪ Electrical machinery ▪ Chemicals ▪ Other transport equipment ▪ Non-electrical machinery 	<p><i>Medium high-technology knowledge-intensive services</i></p> <ul style="list-style-type: none"> ▪ Water transport ▪ Air transport ▪ Advertising ▪ Consulting engineers ▪ Management consulting ▪ Accounting services ▪ Legal services

Figure 3: Adapted industry classification system

Cluster analysis will subsequently be used to identify the configurations of knowledge management abilities or clusters that emerge from the data. The cluster solution will be validated for reliability, external validity and criterion-related validity based on the recommendations made by Ketchen and Shook (1996).

5.4 Case studies

Using profiling techniques described by Doty, Glick and Huber (1993) a number of organisations will be selected whose profiles are similar to the clusters that were identified. These organisations will be the subject of in-depth field studies to further explore the nature of the emerging configurations of each of the main clusters in more detail.

Using the survey items as a point of departure, unstructured interviews will be used to explore the relationships between the various dimensions within a specific context, and to arrive at an understanding of how these interdependencies contribute to the emergence of a specific configuration of knowledge management abilities. The resulting case studies can be used to describe roadmaps to becoming a knowledge-centric organisation, thereby concluding the knowledge-centric framework.

Case study research cannot use the same criteria used to test the credibility of research findings in a positivist paradigm. The requirements for evaluating case studies described by Klein and Myers (199) will be used to evaluate the credibility of the research findings.

The proposed multi-method approach will also enable triangulation to take place. The unstructured interviews conducted as part of the field studies could be a valuable way of triangulating the data collected by means of the survey.

6. Conclusion

This paper has described an approach to developing a knowledge-centric framework. The framework is aligned with the characteristics of a best-fit approach and consists of three main components. First, a conceptual framework describes knowledge management along the dimensions of knowledge-orientation, knowledge management intent and enactment. The second component of the knowledge-centric framework is a typology of organisational configurations of knowledge management capacity. The third component of

the framework is a description of the knowledge management approaches most suited to the configurations identified in the typology.

This knowledge-centric approach is based on key concepts from systems theory and configurational theory and will enable organisations to choose the most appropriate approach to knowledge management, based on their specific context.

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Information Anxiety: Fact, Fable or Fallacy

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Abstract: The aim of this paper is to compare and contrast the findings of three recent empirical studies that examined the construct of information anxiety. The concept of anxiety created from information has been studied for hundreds of years; however, this paper views this complex relationship based on the foundation provided by Richard Wurman's book *Information Anxiety* (1989). The three studies explored the five subcomponents of information anxiety as described by Wurman: not understanding information; feeling overwhelmed by the amount of information to be understood; not knowing if certain information exists; not knowing where to find information; and knowing exactly where to find the information, but not having the key to access it. In order to gauge the level of information anxiety a survey instrument was designed using eight management scenarios suggested by Davenport and Prusak in *Working Knowledge* (1998). Four of the eight scenarios examine the creation of information from data and four scenarios focus on the transformation of information into knowledge. Of specific interest to these studies was the question *is there a difference between information overload and information anxiety*. In other words, is the issue simply one of quantity or do other information related challenges make a difference. To this end, the researchers sought to determine if respondents perceived a difference between information overload and the other components of information anxiety. The first of these studies determined that respondents reported a statistically significant difference between information overload and several other components while the second study's respondents did not report such a difference. The conflicting results begged the question: is information anxiety a fact, fiction, or fallacy? The third study reinforced the finding of the initial study suggesting information anxiety is a real organizational malady worthy of the attention of senior leaders. Clearly additional research is required to further refine the malady, its causes, and ways to combat its debilitating effects.

Keywords: information anxiety, knowledge management, information overload

1. Introduction

That in spacious knowledge there is much contristation, and that he that increaseth knowledge increaseth anxiety.

Sir Francis Bacon, 1605

The broad issue of information or knowledge anxiety and its effects on individuals and organizations has been studied since at least 1605. Possibly the first mention of this challenge was in Sir Francis Bacon's book entitled *The Advancement of Learning* (Bacon, 1915). It was nearly 400 years until the term information anxiety emerged in the popular press as the title of Richard Wurman's best-selling book (1989). Wurman defined *Information Anxiety* as "the black hole between data and knowledge," a definition that attracted the attention of many business leaders as many were struggling with challenges of organizational memory loss. As interesting as Wurman's hypothetical notion seemed, there was no empirical evidence to support his hypothesis. As a result, the concept was considered by some to be pure fiction, perhaps building upon Bacon's unsubstantiated claim of four centuries earlier, and relegated to the abyss of business hype.

Three recent empirical research projects have focused on the concept of information anxiety. The first project (Study A) examined the issue of knowledge management in a Canadian government setting (Girard, 2005a), the second project (Study B) considered high performance teams in the United States Air Force (Allison, 2006), while the third project (Study C) focused specifically on information anxiety of mid-level officers of the United States Air Force (Allison, 2008). Although the scopes of the three projects were very different, each study shared the common dependent variable of information anxiety.

The findings of Study A indicated that information anxiety was a distinct entity, quite different from the more commonly studied notion of information overload. This finding suggested information anxiety was not fiction, but rather a fact. The findings of Study B challenged Girard's findings and suggested that information anxiety was synonymous with information overload – such a discovery could suggest Study A's conclusion about information anxiety was a fallacy. However, the result of Study C reinforced the original findings. The aim of this paper is to compare and contrast the findings of the three studies with regard to the dependent variable - Information Anxiety. Of particular interest is the differentiation between information overload and information anxiety. Are these two terms synonymous or are they very different?

2. Literature review

As long as the centuries continue to unfold, the number of books will grow continually, and one can predict that a time will come when it will be almost as difficult to learn anything from books as from the direct study of the whole universe. It will be almost as convenient to search for some bit of truth concealed in nature as it will be to find it hidden away in an immense multitude of bound volumes.

Diderot & d'Alembert, 1755

2.1 Information anxiety

What is information anxiety? This is a difficult question because this construct has been pursued and studied under various headings (Bawden, 2001). Depending on context, where most modern researchers use the term "information," some discussions of information anxiety used terms such as "books," "ideas," "knowledge," "species," "things," or even "truth itself." The sheer number of these terms makes categorization and definition somewhat difficult. Should it be measured by something tangible such as the number of written texts, or is it more accurately determined by a more abstract measurement such as ideas or facts? Some believe it is better to dwell on the broader concepts rather than the specifics. In other words we should not focus too much on the individual trees, but rather on the larger forest (Rosenberg, 2003).

Observed in the aggregate, organizational information overload occurs when "the extent of perceived information overload is sufficiently widespread within an organization as to reduce the overall effectiveness of management operations" (Wilson, 2001: 113). In turn, "information overload occurs when the amount of input to a system exceeds its processing capacity" (Speier et al., 1999: 338). An important consideration in this research is that the type of information being received is unimportant; it is entirely reliant on the amount of information being processed. However, additional research has determined that quantity is not the only consideration when measuring information challenges. The work of Schick, Gordon, and Haka (1990) suggested that time is a factor. They point out that information concerns occur when the time to do a particular task is constrained to levels below what is required. This ultimately results in poor decision-making.

2.2 Wider categorization

Wurman introduced a novel notion whilst describing information anxiety by stating, "Information anxiety can afflict us at any level and is as likely to result from too much information as too little information" (Wurman, 1989: 44). This concept is essential to understand; as many researchers focus entirely on the idea of information overload and therefore deduce that the only challenge is too much information. Wurman notes that a major cause of information anxiety is the uncertainty surrounding the existence of a particular piece of information.

Based on recent knowledge management studies a wider classification appears more fitting. For example, the authors of Gartner Research's Information Overload Survey concluded there are four information issues affecting competition: siloed information; too much information; unindexed information; and ineffective searching procedures (Linden et al., 2002). In a second report, Linden (2001) suggests there are seven drivers of information overload: quantity; relevance; redundancy; information illiteracy; unqualified information; distraction by the obvious and the glossy; and business models struggling

The consideration of the wider categorization of this information challenge is supported by extensive research and is more pertinent than a study focused solely on some of the narrow definitions provided (Wurman, 1989; Kirsh, 2000; Linden, 2001; Linden et al., 2002). The focus on overload alone seems to imply a technological solution to reduce the quantity of information, perhaps by eliminating duplicate data. This may ease the size of the problem and may well be a part of the ultimate solution; however, the challenge is more complex and not merely an issue of quantity. Wurman, Kirsh, and Linden underscore other associated concerns, which from a management point of view are equally important. For example, simply reducing the quantity of information will do nothing to assist Wurman and Kirsh's concerns of not knowing where to find information.

Research has shown that information anxiety can occur under several different circumstances. Specifically, according to Wurman (1989), there are five broad scenarios which may create an atmosphere where information anxiety may occur. They are: not understanding information; feeling overwhelmed by the amount of information to be understood; not knowing if certain information exists; not knowing where to find information; and knowing exactly where to find the information, but not having the key to access it.

2.3 Task complexity and frequency

Further research has broken down the concept of information anxiety by analyzing the issues that further exacerbate the overall dilemma. The complexity of the task is often discussed as a contributing factor when studying information anxiety. While it is fairly intuitive, the fact that complex tasks create a heavier burden on people and systems has nonetheless been researched and the results support the intuition—subjects are more likely to develop information anxiety as the tasks they are completing become more complex (Baron, 1986; Wood, 1986). The work of Groff, Baron, and Moore (1983) has taken the research a step further by analyzing the effects of distractions on the level of information anxiety. Their research shows that, in relation to task complexity, the level of information anxiety in complex tasks increases as the quantity and force of distractions increases.

One recent study determined that although no relationship between the type of managerial task and the level of information anxiety existed, another relationship was discovered. A statistically significant negative relationship existed between frequency of task and the level of information anxiety reported. In other words as the task frequency increased there was a proportional reduction in the level of information anxiety reported. This important finding underscores that the frequency of task and not the type of task, is the predominant factor in the level of information anxiety (Girard, 2005b).

3. Research methodology

3.1 Overview of studies

The brevity of this paper precludes a detailed description of the research methodology; however, nor is it not central to this analysis. Each project was a traditional quantitative study based primarily on a survey instrument. The dependent variable for each study was Wurman’s delineation of information anxiety, which may be graphically depicted as illustrated in Figure 1. Supported by considerable research, Wurman’s conceptual framework includes five subcomponents (Linden, 2001; Linden et al., 2002; Kirsh, 2000). Collectively these five may gauge the level of information anxiety within a population. Each study asked respondents to rate each of the five elements of the dependent variable of Information Anxiety (IA). Based on their responses, each respondent was assigned an Information Anxiety score, which was the mathematical sum of the five components. This may be expressed mathematically as:

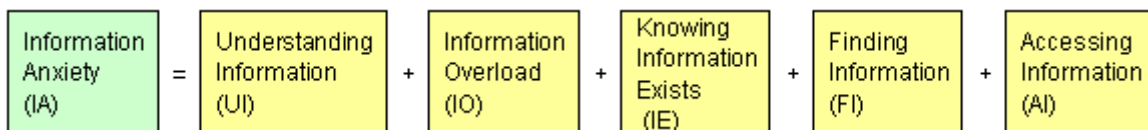


Figure 1: Information anxiety components

Study A analyzed the specific construct of information anxiety utilizing an empirical study of Canadian Public Service middle managers (Girard 2005a). Specifically, the study analyzed whether some types of middle managers reported lower levels of information anxiety as a result of knowledge management. A conclusion of the study was the finding that middle managers reported accessing information (a subcomponent of information anxiety) as a far more significant problem than information overload (also a subcomponent of information anxiety). Girard concluded this was a managerial problem and not simply a technical problem (Girard 2005a).

A limitation of Study A was the population under examination (Canadian Public Service middle managers) and therefore it was recommended that other researchers consider different populations. A subsequent project, Study B, was designed, which expanded upon Study A in many ways (Allison 2006). First, its setting was in the United States rather than Canada. Second, Study B measured information anxiety relative to quality improvement high performance team participation. Third, the sample was Air Force military personnel located at Luke Air Force Base in Phoenix, Arizona. Finally, Study B examined this construct in terms of its relationship to productivity, hierarchical position and education level. It was hoped that by exploring these new avenues of analysis, new boundaries could be pushed and further areas of research could be uncovered.

Study C built on the foundation of the two previous studies and was designed with a view to explaining some of the inconsistent findings of the first two studies (Allison 2008). Study C focused specifically on information anxiety with a sample that shared some characteristics from both of the previous studies. The sample for Study C was United State Air Force officers attending the Air Command and Staff College. The experience

and education of this group was similar to the sample of Study A, though the nationality and vocation of the sample mirrored that of Study B.

3.2 Management scenarios

The instrument for the dependent variable in each study included eight management scenarios (see Table 1 for an overview or Appendix A for more detail). The scenarios were based on Davenport and Prusak's (1998) definition of data, information, and knowledge combined with the activities associated with each term. According to Davenport and Prusak's operationalization, there are four major ways that managers may transform information into knowledge. This transformation may occur through comparison, consequences, connections, or conversation. Similarly, Davenport and Prusak contend that data may metamorphose into information through a series of activities that increases its value. These methods include contextualization, categorization, calculation, correcting, or condensing. Building on Davenport and Prusak's segmentation eight scenarios were developed as show in table 1.

Table 1: Management scenarios

Management scenarios focused on how respondents:
<ol style="list-style-type: none"> 1. Compared information with previous information. 2. Determined the consequences or repercussions of information on decisions. 3. Considered how information connects or correlates to other information. 4. Through conversation, concluded what people think about the information. 5. Categorized the data by describing the breakdown or the essential components of the data 6. Calculated data (mathematically or statistically). 7. Corrected errors found in previously reported data. 8. Condensed data by providing a summary of the entire collection of data.
Based on segmentation in <i>Working Knowledge</i> (Davenport and Prusak, 1998)

For each of the eight management scenarios, the respondents were asked to answer five questions related to the subcomponents of Information Anxiety. Based on responses to the following statement; each participant was assigned a level of information anxiety.

Table 2: Dependent variable questions

How much do you agree/disagree with the following statements [based on the scenario described]?
<ol style="list-style-type: none"> 1. I would not understand information required to complete tasks. 2. I would feel overwhelmed by the amount of information to be understood. 3. I would not know if certain information exists. 4. I would not know where to find information. 5. I would know exactly where to find the information, but I would not have the key to access it.

4. Analysis

4.1 Overview

For each of the eight scenarios contained in the survey instrument, respondents answered questions related to the five subcomponents using a five-point Likert scale where the higher score represents tasks that are more common (1 = strongly disagree; 2 = disagree; 3= neutral; 4 = agree; and 5 = strongly agree). Based on these responses, each subcomponent was assigned a numerical value, from which the ultimate value for Information Anxiety was derived (see Appendix B Tables 1, 2, 3).

Of particular note was the very low level of information anxiety reported in each study. When the means are converted to an equivalent five-point scale, where 1 indicates a very low level and 5 indicated a very high level, the low levels reported become obvious – see Figure 2. For example, means of 2.5 and below indicate the average respondent “disagreed” that the task appreciably contributed to information anxiety.

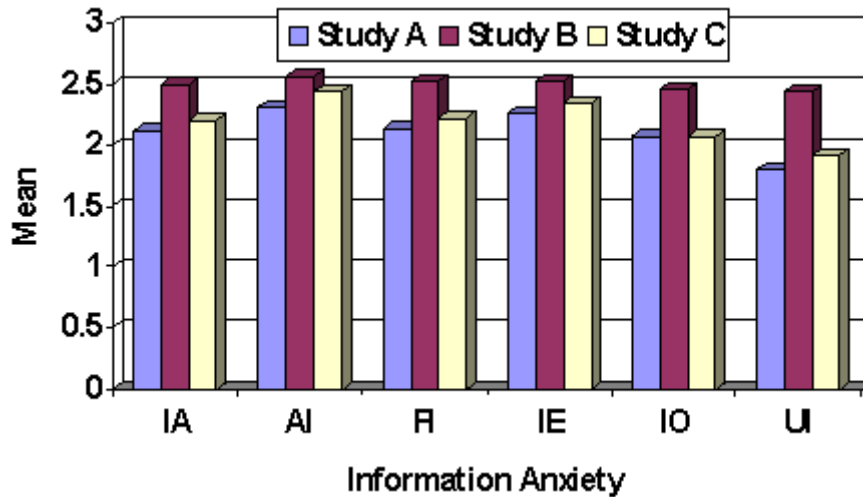


Figure 2: Information anxiety by component

4.2 Study A findings

In Study A, an analysis of the variance indicated that a significant difference existed between the components of Information Anxiety (see Appendix B Table 8). A one-factor ANOVA between the components was performed to determine whether there was a significant difference between their means. The F-statistic was significant at the .05 critical alpha level, $F(4,490) = 7.962, p = .0000$. Subsequent post-hoc least significant difference t-tests between group means revealed Understanding Information (UI) was significantly less than all other components (see Appendix B Table 9) and that Information Overload (IO) was significantly less than Accessing Information (AI) - defined as knowing exactly where to find the information, but not having the key to access it.

Table 3: Significant difference between components of information anxiety (Study A)

	AI	FI	IE	IO	UI
Accessing Information (AI)		No	No	Yes	Yes
Finding Information (FI)	No		No	No	Yes
Knowing Information Exists (IE)	No	No		No	Yes
Information Overload (IO)	Yes	No	No		Yes
Understanding Information (UI)	Yes	Yes	Yes	Yes	

This finding led Study A’s author to conclude “As this was the first project to use the information anxiety instrument, one must not draw many conclusions from the raw values. Rather, one should consider the relative and significant order of the five components. Using information overload as the baseline, this project gauged how the other components compared to the well-understood phenomenon of information overload. Over time, it would be useful to refine the instrument and to perform a comparison between these data sets and others; however, at present, the central issue is the ordinal relationship of the elements” (Girard, 2005b: 76).

4.3 Study B findings

In Study B, the relative order of the components was very similar to those of Study A; however, an analysis of the variance indicated that a significant difference did not exist between the components of Information Anxiety (See Appendix B Table 10). The F-statistic was not significant at the .05 critical alpha level, $F(4,490) = 0.746, p = .561$. This discovery questioned the findings of the initial project. Given that both studies explored the issues of validity and reliability, it seemed prudent to hypothesize the cause of conflicting findings.

Several factors could explain the conflicting findings. First, the sampling techniques may have caused problems because both studies were based on convenience samples, which may not have been representative of their respective populations. Second, the samples were very different - Study A's sample contained survey participants from a variety of organizations compared to Study B's sample that focused on a single location and type of respondent. Third, related to the homogeneity/heterogeneity issue is one of organization type. Study A's sample were predominantly civilian union members while Study B's sample was composed entirely of Air Force personnel. Another major difference was education, Study A's sample was relatively well educated with 75.2% of respondents possessing at least a bachelor's degree compared to Study B where just 10.6% of respondents had earned a bachelor's degree. Finally, one study was conducted in Canada using middle managers and the other study was conducted in the USA using a large number of non-managers.

4.4 Study C findings

In Study C, the relative order of the components mirrored the findings of the previous two studies; however, an analysis of the variance indicated that a significant difference existed between the components of Information Anxiety (see Appendix B Table 11). Subsequent post-hoc least significant difference t-tests between group means revealed Understanding Information (UI) was significantly less than all other components except Information Overload (IO); that Information Overload (IO) was significantly less than Accessing Information (AI) and Finding Information (FI); and Knowing Information Exists (IE) was significantly less than Accessing Information (AI). Of particular interest is the similarity of the findings between Studies A and C.

Table 4: Significant difference between components of information anxiety (Study C)

	AI	FI	IE	IO	UI
Accessing Information (AI)		No	Yes	Yes	Yes
Finding Information (FI)	No		No	Yes	Yes
Knowing Information Exists (IE)	Yes	No		No	Yes
Information Overload (IO)	Yes	Yes	No		No
Understanding Information (UI)	Yes	Yes	Yes	No	

The results of Study C proved to be very enlightening when compared to these previous studies. With regard to the changes in the United States Air Force population, many of the conclusions drawn raise additional questions. Specifically, although the level of information anxiety dropped a statistically significant amount during a 2-year span, this may be attributable to many different reasons. Also, the fact that the Maxwell sample was composed entirely of officers who were much older and possessed a much higher degree of post-secondary education than the primarily enlisted sample at Luke may have caused the drop. Additionally, the Maxwell sample was comprised of personnel competitively selected to attend the Air Command and Staff College (a very selective advanced education program for promising officers). The same factors that led to their selection may, in fact, have mitigating effects on the levels of information anxiety they recognize and display.

Similarly, when the results of Study C are compared to Study A in order to measure the changes in society as a whole, further questions arise. Why are the levels relatively similar between the two studies? One explanation may again rest in the realm of education level. The education level of the Study C sample was very high, with a full 100% possessing at least a bachelor's degree. Likewise, the Study A sample also had a high level of post-secondary education, with 75.2% possessing at least a bachelor's degree. This is in contrast to the Study B sample, where only 10.6% of respondents possessed a bachelor's degree or higher. This is significant and may point to an area requiring further analysis and study.

5. Conclusion

The aim of this paper was to compare and contrast the findings of three recent empirical studies that examined information anxiety. Of most interest to the body of knowledge in the domain is the question: is there a difference between information anxiety and the more common concept of information overload?

Information anxiety is an intuitive fact of life in the modern workplace, but to what magnitude? The combined findings of these three studies indicate that information anxiety has remained relatively unchanged across society, though there is some evidence that the levels have dropped dramatically within the smaller population of the United States Air Forces. There is clear evidence to suggest that certain variables may affect the level of information anxiety, but to what extent is difficult to predict at this point. Understanding these variables could pay huge dividends in the development of approaches to deal with work-related concepts such as stress and job performance.

Findings of this research may be important to managers and leaders in both the public and private sector, but there is still much work to be accomplished. Future studies should try to explore this phenomenon from new perspectives and with regard to the many mitigating factors that may impact its development. Future research should examine additional samples to ensure the effects measured in this study are applicable to the wider population. Also, more analysis should be done to develop ways to mitigate this phenomenon by creating experimental designs that allow the introduction of outside factors. Through the use of control groups, these outside factors could then be measured to determine if they have any impact on the levels of information anxiety. Research should also explore the effects of information anxiety in the workplace. Does it impact output, production, or finances? Can it lead to increased stress and physical problems? These questions require researchers with a strong background in the social sciences and a full understanding of the physical, emotional, and psychological impacts of this problem. It is necessary for researchers in the fields of social and physical sciences, economics and information technologies to continue to explore this issue in the hope of developing a greater understanding.

At this point it is not possible to pronounce whether information anxiety is a fact, fiction, or fallacy. Clearly there is some empirical evidence that the construct developed by Wurman has merit; however, the conflicting results of these studies mean that more research is required. Ironically after more than 400 years of learning we may not be any further forward than when Bacon wrote *That in spacious knowledge there is much contristation, and that he that increaseth knowledge increaseth anxiety.*

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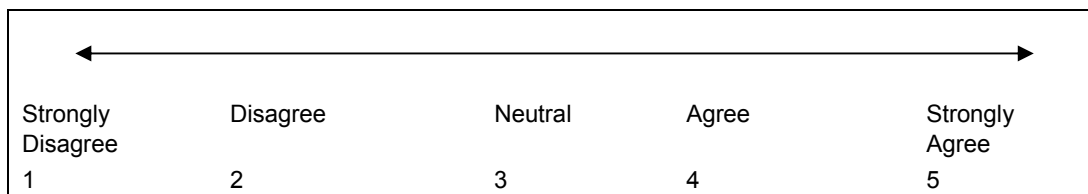
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Appendix A – Survey instrument scenarios

This section of the survey includes eight groups of questions based on the type of tasks you complete on a daily basis. As there are no correct or incorrect responses, please simply respond with the answer you feel most closely resembles your real world response.

The procedure for each group of questions will be the same. First, a brief scenario is presented which sets the scene for a group of questions. Read the scenario carefully and then respond to the questions. For each scenario, a general picture will be described, but you should think of a real life scenario. As an example in the first scenario, you are asked to summarize data into a more concise form. Think of a real world example of this sort of task and then answer the questions. For example, if you work in a training area, perhaps you have been asked to summarize data including the number of people that have completed various courses. Perhaps it is something more generic, like counting the number of employees that have missed one or more days due to recurring training. If you are a mechanic, perhaps the task is summarizing the number of aircraft you have worked on over the past six months.

Be sure to answer each of the questions under each scenario. For each question, you will use a scale from 1 to 5 to respond, where 1 is Strongly Disagree, 3 is Neutral, and 5 is Strongly Agree as shown below.



1. Your immediate supervisor asks you to compile a report that summarizes data into a more concise form. In this case, your boss asks you to collect the data for the past six months and to develop a one page report. How much do you agree/disagree with the following statements?

	Strongly Disagree					Strongly Agree				
	1	2	3	4	5	1	2	3	4	5
I routinely complete tasks similar to this scenario.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not understand the data required to complete this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would feel overwhelmed by the amount of data to be understood to complete this task	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know if certain data necessary for this task exists.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know where to find data necessary for this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would know exactly where to find data, but I would not have the key to access it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(Optional) Please describe an interesting success story or challenge that you have experienced while completing a task similar to this scenario.

2. Your boss passes you a report created by another organization and states that s/he thinks the report contains errors. S/he asks you to review the original data and make the necessary corrections. How much do you agree/disagree with the following statements?

	Strongly Disagree				Strongly Agree
	1	2	3	4	5
I routinely complete tasks similar to this scenario.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not understand the data required to complete this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would feel overwhelmed by the amount of data to be understood to complete this task	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know if certain data necessary for this task exists.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know where to find data necessary for this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would know exactly where to find data, but I would not have the key to access it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(Optional) Please describe an interesting success story or challenge that you have experienced while completing a task similar to this scenario.

3. Your manager sends you an e-mail asking you to develop a report that categorizes data for your organization over the last year. How much do you agree/disagree with the following statements?

	Strongly Disagree				Strongly Agree
	1	2	3	4	5
I routinely complete tasks similar to this scenario.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not understand the data required to complete this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would feel overwhelmed by the amount of data to be understood to complete this task	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know if certain data necessary for this task exists.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know where to find data necessary for this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would know exactly where to find data, but I would not have the key to access it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(Optional) Please describe an interesting success story or challenge that you have experienced while completing a task similar to this scenario.

4. This time your superior asks you to analyze some data mathematically or statistically. You must find the relevant data and then create a one page report which summarizes your calculations. How much do you agree/disagree with the following statements?

	Strongly Disagree				Strongly Agree
	1	2	3	4	5
I routinely complete tasks similar to this scenario.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not understand the data required to complete this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would feel overwhelmed by the amount of data to be understood to complete this task	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know if certain data necessary for this task exists.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know where to find data necessary for this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would know exactly where to find data, but I would not have the key to access it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(Optional) Please describe an interesting success story or challenge that you have experienced while completing a task similar to this scenario.

5. Your immediate supervisor asks you to compare one report with a similar report from another organization. In order to complete the comparison you must first verify the original data. How much do you agree/disagree with the following statements?

	Strongly Disagree				Strongly Agree
	1	2	3	4	5
I routinely complete tasks similar to this scenario.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not understand the data required to complete this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would feel overwhelmed by the amount of data to be understood to complete this task	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know if certain data necessary for this task exists.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know where to find data necessary for this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would know exactly where to find data, but I would not have the key to access it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(Optional) Please describe an interesting success story or challenge that you have experienced while completing a task similar to this scenario.

6. Your boss passes you a report that indicates some changes in some sort of information since last year and asks you to develop a report that explains the consequences of the changes. You decide that you should review the original information before considering the consequences. How much do you agree/disagree with the following statements?

	Strongly Disagree				Strongly Agree
	1	2	3	4	5
I routinely complete tasks similar to this scenario.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not understand the data required to complete this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would feel overwhelmed by the amount of data to be understood to complete this task	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know if certain data necessary for this task exists.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know where to find data necessary for this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would know exactly where to find data, but I would not have the key to access it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(Optional) Please describe an interesting success story or challenge that you have experienced while completing a task similar to this scenario.

7. Your superior gives you two summary reports and asks you to explain how one connects to the other. For example, Report 1 is about employee absenteeism and Report 2 is about client satisfaction. Before responding you decide to review the original information. How much do you agree/disagree with the following statements?

	Strongly Disagree				Strongly Agree
	1	2	3	4	5
I routinely complete tasks similar to this scenario	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not understand the data required to complete this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would feel overwhelmed by the amount of data to be understood to complete this task	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know if certain data necessary for this task exists.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know where to find data necessary for this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would know exactly where to find data, but I would not have the key to access it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(Optional) Please describe an interesting success story or challenge that you have experienced while completing a task similar to this scenario.

8. Your immediate supervisor tells you about a proposed change within your organization. S/he asks you to speak with others in your organization to determine the implications of the change. How much do you agree/disagree with the following statements?

	Strongly Disagree				Strongly Agree
	1	2	3	4	5
I routinely complete tasks similar to this scenario.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not understand the data required to complete this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would feel overwhelmed by the amount of data to be understood to complete this task	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know if certain data necessary for this task exists.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would not know where to find data necessary for this task.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would know exactly where to find data, but I would not have the key to access it.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

(Optional) Please describe an interesting success story or challenge that you have experienced while completing a task similar to this scenario.

Appendix B – Statistical data

Table 5: Information anxiety descriptive statistics – Study A

Variable	Mean	SD	Variance	Median	Total
DV - Information Anxiety (IA)	84.72	22.94	526.02	84	99
DV* - Accessing Information (AI)	18.51	6.15	37.86	17	99
DV* - Information Exists (IE)	18.11	5.83	34.02	18	99
DV* - Finding Information (FI)	17.14	5.53	30.53	17	99
DV* - Information Overload (IO)	16.56	6.30	39.74	16	99
DV* - Understanding Information (UI)	14.40	4.49	19.92	14	99

* = component of Dependent Variable - Information Anxiety

Table 6: Information anxiety descriptive statistics – Study B

Variable	Mean	SD	Variance	Median	Total
DV - Information Anxiety (IA)	99.95	28.19	794.71	108	202
DV* - Accessing Information (AI)	20.54	6.22	38.65	22	202
DV* - Information Exists (IE)	20.03	6.60	43.54	22	202
DV* - Finding Information (FI)	20.14	6.61	43.64	22	202
DV* - Information Overload (IO)	19.65	6.70	44.93	21	202
DV* - Understanding Information (UI)	19.57	6.20	38.43	21	202

* = component of Dependent Variable - Information Anxiety

Table 7: Information anxiety descriptive statistics – Study C

Variable	Mean	SD	Variance	Median	Total
DV - Information Anxiety (IA)	87.92	17.74	314.88	86	61
DV* - Accessing Information (AI)	19.56	5.03	25.25	20	61
DV* - Information Exists (IE)	18.69	5.08	25.85	18	61
DV* - Finding Information (FI)	17.77	4.39	19.25	18	61
DV* - Information Overload (IO)	16.54	5.09	25.89	16	61
DV* - Understanding Information (UI)	15.36	4.00	16.00	15	61

* = component of Dependent Variable - Information Anxiety

Table 8: Analysis of variance for information anxiety – Girard Study

Component	N	Mean	SD		
Understanding Information (UI)	99	14.404	4.486		
Information Overload (IO)	99	16.556	6.304		
Information Exists (IE)	99	18.111	5.833		
Finding Information (FI)	99	17.141	5.525		
Accessing Information (AI)	99	18.505	6.153		
Source of Variation	DF	Sum of Squares	Mean Squares	F-Ratio	Significance Level
A	4	1033.588	258.397	7.962	0.000
Error	490	15902.828	32.455		
Total	494	16936.416			

Table 9: Post-hoc least significant difference t-tests between group means - Values of p are for a two-tailed test. Note: Statistics are shown only if p is less than or equal to .05

t(196)=2.657, p=0.009	Understanding Information - Information Overload
t(196)=4.578, p=0.000	Understanding Information - Information Exists
t(196)=3.381, p=0.001	Understanding Information - Finding Information
t(196)=5.065, p=0.000	Understanding Information - Accessing Information
t(196)=2.408, p=0.017	Information Overload - Accessing Information

Table 10: Analysis of Variance for Information Anxiety – Study B

Information Anxiety Component	N	Mean	SD		
Understanding Information (UI)	202	19.57	6.20		
Information Overload (IO)	202	19.65	6.70		
Information Exists (IE)	202	20.03	6.60		
Finding Information (FI)	202	20.14	6.61		
Accessing Information (AI)	202	20.54	6.22		
Source of Variation	DF	Sum of Squares	Mean Squares	F-Ratio	Significance Level
A	4	124.941	31.235	0.746	0.561
Error	490	42063.371	41.854		
Total	494	42188.312			

Table 11: Analysis of variance for information anxiety – Study C

Component	N	Mean	SD		
Understanding Information (UI)	61	15.36	4.00		
Information Overload (IO)	61	16.54	5.09		
Information Exists (IE)	61	17.77	4.39		
Finding Information (FI)	61	18.69	5.08		
Accessing Information (AI)	61	19.56	5.03		
Source of Variation	DF	Sum of Squares	Mean Squares	F-Ratio	Significance Level
A	4	683.110	170.777	7.604	0.0000
Error	300	6737.250	22.458		
Total	304	7420.360			

Table 12: Post-hoc least significant difference t-tests between group means - Values of p are for a two-tailed test. Note: Statistics are shown only if p is less than or equal to .05 (^ indicates similar finding in Study A).

t(120)=2.809, p=0.006	Understanding Information - Information Exists ^
t(120)=3.881, p=0.000	Understanding Information - Finding Information ^
t(120)=4.895, p=0.000	Understanding Information - Accessing Information ^
t(120)=3.519, p=0.001	Information Overload - Accessing Information ^
t(120)=2.086, p=0.039	Information Exists – Accessing Information
t(120)=2.506, p=0.014	Information Overload – Finding Information

Aligning Knowledge Management with Competitive Strategy: A Framework

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Abstract: This paper presents a hybrid approach to understanding the knowledge management requirements for a knowledge intensive service organization. It proposes a strategy-knowledge management alignment framework grounded in literature. The framework was constructed by studying four published case-studies that tackle knowledge management at world class management consulting firms. The paper then applies the framework to two cases in the knowledge intensive services sector. The first case studies a young management consulting firm needing to formalize its knowledge management policies and processes. The second case studies the creation of an IT Outsourcing Services Division by a traditional telecommunications company that needs to expand its product offering to increase its opportunities for growth in a small market.

The two case studies support the proposed framework and show that it can be used to obtain practical solutions in a business environment. One of the case studies also contributes to developing the case method in research by using the Socratic Dialogue as a means to collecting and analyzing evidence.

Keywords: Socratic dialogue, knowledge management, alignment, professional services, knowledge for competitive advantage

1. Introduction

Although knowledge management has attracted much attention in academic and practitioner circles in recent years, it has been around for somewhat longer. Some diehard extremists may say it all started one million years ago with hominines' first tools and guttural communications; others may say it started with writing three thousand years ago; still others would vote for the advent of the press in 1450 for Westerners, but 450 years earlier for the Chinese; or the computer in 1950; or in the early years of the 21st century when business intelligence in our organisations became a seriously issue (Friedman, 2005; Seabright, 2004; Bhagawati, 2004; Collins, 2002; Fischman, 2005).

As fascinating as this debate on the origins of knowledge management may be there is a challenge that our ancestors did not have: the knowledge base doubles every 4 to 5 years. At this ferocious rate, students will actually "know less" of the total body of knowledge when they emerge from their university course than when they entered it. Although this is true of knowledge in general knowledge management is especially important in professional services organizations because these are a people-based business whose service delivery is intimately linked to the knowledge and skills of the staff delivering the service (Ezingard *et al.*, 2002). As Nachum, (1999) pointed out

"The production processes of these services are based on manipulation and application of knowledge by highly educated employees to provide a one-time solution to specific clients' problems".

This paper addresses KM in management consulting firms. This type of firm has several special characteristics within professional services firms. In the first place they are particularly knowledge intensive. While medical clinics or legal buffets meet their clients and carry out most of their work on their own premises that can give some differentiation, management consultants are working nomads that more often than not work at the Client's site. Secondly, the client's staff does not only take an active role in the full cycle of delivery of the service, but it often demands knowledge transfer from the consultant. Finally, the work is usually won through a competitive bidding process

The objective of this paper is to address the following research questions: How do professional services firms approach knowledge management? How does their approach to knowledge management relate to their competitive strategy?

2. Methodology

This paper reviews the literature on knowledge management in management consulting firms, from which it develops a framework for understanding knowledge management in this type of organisations. It then tests the framework by means of two case studies: Alpha Consulting and Beta-Telecom (these are pseudonyms as the firms have not authorised disclosure of their real names).

Four published case studies on knowledge management in management consulting firms are reviewed. They are the following cases:

- Davenport, T.H. & Hansen, M.T. (2002) *Knowledge Management at Andersen Consulting*, Harvard Business School Case Study 9-499-032
- Bartlett, C.A. (2000) *McKinsey & Company: Managing Knowledge and Learning*, Harvard Business School Case Study, No. 9-396-357
- Haas, M.R. & Hansen, M.T. (2005) When Using Knowledge can Hurt Performance: The Value of Organisation Capabilities in a Management Consulting Company, *Strategic Management Journal*, Vol. 26, pp. 1-24
- Ezingard, J-N., Leigh, S. & Chandler-Wilde, R. (2002) *Knowledge management at Ernst & Young: Getting value through knowledge flows*, ICIS 2002 Conference Proceedings

Key lessons are extracted from each case using cross-case analysis to find common trends and differences in approach. From this analysis and critique there emerged a framework to understand the interactions of *People-based networks* and *Technology-based networks* and how these two different approaches relate to competitive strategy. This framework is later enriched with lessons learned by the authors through their personal experience as practitioners in this field.

The empirical part of this research applies the framework to Alpha Consulting, a Strategy -Technology alignment consulting boutique with a global footprint; and to Beta-Telecom, a telecoms company that has recently entered the IT Outsourcing Services space. While at Alpha-Consulting a technique called "Socratic Dialogue" was used to gather and analyze the evidence, at Beta-Telco a more traditional interviews and workshop approach was applied.

At Alpha Consulting, after collecting background information on the firm, the knowledge management framework derived from the literature was presented to a global planning meeting with the 12 leading partners. At that meeting the framework was validated in terms of its applicability to Alpha Consulting. The dynamics of the session was achieved by presenting the framework at the beginning, and then using the Socratic Dialogue as a process of learning through discovery that by its own nature requires more intellectual activity on the part of the learner than normal one-way situations. It allows for a greater degree of reflection, discovery and self learning, which normally has more meaning and has a greater chance of becoming internalized by the learner in a more enduring way (Remenyi, 2006; Remenyi & Griffiths, 2008). In this particular case, each participant was asked to think of a personal experience in knowledge management. Because Alpha Consulting is a relatively young firm, and the 12 participants had rich experience at other firms before joining Alpha Consulting, some of the cases brought forward were not Alpha Consulting experiences. The participants took turns to explain their example in detail while the remaining 11 listened carefully and asked for clarifications when necessary. After each of these sessions discussion was held with an aim at extracting concepts of general application that were used to improve the framework that emerged from the literature review.

At Beta-Telco the unit of analysis is only the relatively young Corporate Services Division of the telecom's firm, which is a highly knowledge intensive area of the company, and in that sense has similarities with the strategy and IT consulting services cases used to derive the knowledge management framework. The frame was used on a consulting engagement to derive some guidelines on how the Division should design its knowledge management. The fieldwork to gather and analyze evidence was more in line with conventional qualitative case-study research and consisted of performing seventeen semi-structured interviews to senior managers and carrying out four management workshops, in all involving some 50 managers. This activity took place between September 2007 and January 2008.

3. Knowledge management in management consulting firms

3.1 Definitions

Facts on their own provided an incomplete understanding: 'A fact acquires meaning only once it is associated, linked to other facts' (Greenfield, 2003, p.158). The more structure that is added to a pool of information, the more it can be referred to as knowledge. Knowledge in this paper is characterized as information plus the causal links that help to make sense of the information (Sarvary, 1999). So if data is information devoid of context, and thus information is data in a context, knowledge is information with causal links. Knowledge management is a business process through which firms (a) create, synthesize and share their collective information, insights and experience; (b) combine them with knowledge from external sources; and (c) put all this knowledge to use in solving business problems (Ruggles, 1998; Ezingear *et al.*, 2002; Sarvary, 1999).

3.2 Analysis of the cases

The four cases analysed refer mainly to US and UK practices. The Ezingear *et al.*, (2002) refers to the Ernst & Young UK practice. Davenport & Hansen (2002) cover Andersen Consulting's US practice, while Haas & Hansen (2005) cover the US consulting practice of a Big-5 accounting and consulting firm whose identity they have disguised as Centra Consulting. Bartlett's (2000) McKinsey case has a global reach.

Working with the four published cases as secondary data using the Strauss & Corbin (1998) coding process at the phrase level six core concepts emerged:

1. The interaction of Knowledge Management and Strategy
2. The importance of developing a Knowledge Culture
3. The Knowledge Management dilemma: *Looking Backward* vs. *Looking Forward*
4. The relationship between Knowledge Management and Value
5. The relationship between Knowledge Management and Technology
6. The relationship between Knowledge Management and People Networks

The derivation of each of these concepts and its description and analysis can be seen in Griffiths & Remenyi (2007).

3.3 Synthesis of the cases: A knowledge management alignment framework

Two clear trends emerge from the cases studies: While some organizations rely on a knowledge codification strategy that seeks to make knowledge independent of individuals and store it in repositories for users to access through information and communications technology (ICT) tools, others rely on a personalization strategy that emphasizes the channeling of individual expertise to the right place at the required time through person-to-person interaction.

The issue of how outward looking the organization has to be in its knowledge management also emerged as a core concept. Organisations need to find the right balance, the most effective blend, between internal and external content, and avoid the trappings of being too introverted, too satisfied with their own view of the world. Their internal networks need to link up with other networks in their areas of expertise (Ezingear *et al.*, 2002; Bartlett, 2000; Collins, 2002, 1998)

This can be represented in a two-dimensional space as shown in Figure 2. One axis represents the degree of development of knowledge management founded on Technology-based networks, from Low to High. The other axis represents the degree at which the organization has developed its person-to-person knowledge sharing capabilities. In both cases the "High" development indicates a robust integration with other knowledge networks.

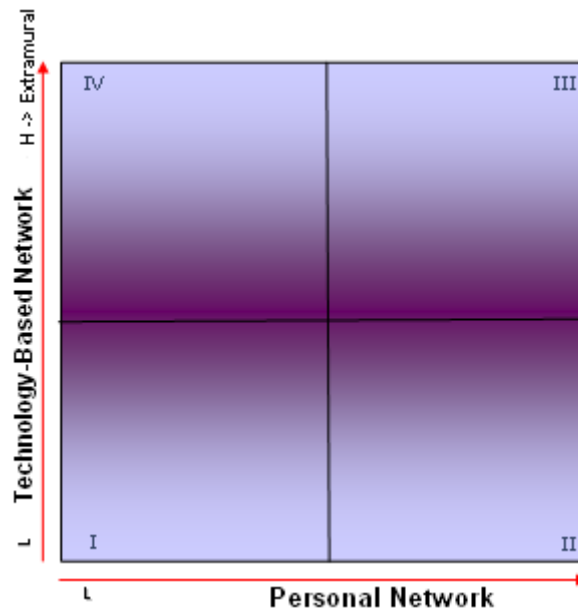


Figure 2: Knowledge Management founded on Technology-based networks vs. Personal networks

The description of the approach to knowledge management of each firm given in the four cases studies, enables placing each one of the firms on this plane (Figure 3). Andersen Consulting is the one that has gone furthest in codifying and de-personalising knowledge. Ernst & Young has also gone a considerable way in making knowledge explicit and placing it in repositories, but it also promotes some degree of people-networks on top of its technology-based networks. And from the description of Centra Consulting, it has applied a similar knowledge management strategy, but with still stronger interpersonal relationships. On the other extreme, McKinsey can be placed strongly on the personal-network dimension with a less developed technology-enabled knowledge infrastructure. Interestingly, from comparisons with Boston Consulting Group (BCG) in the McKinsey case, it is also possible to place BCG on this plane. BCG's close links with MIT appear to make it more outward looking.

The link of knowledge-management-approach to business-strategy emerges clearly from this representation. Business consulting firms that build their competitive positioning on delivering tailor-made, one-off services to their Clients, place themselves in quadrant II. That is they approach knowledge management by developing strong people-based networks. They create knowledge by motivating their staff to write thought leadership pieces that crystallise the products of their interaction with external research centres and reflections on the outcomes of their projects. Knowledge is shared in person-to-person relationships within and across communities of practice. As a result, knowledge creation and sharing is a bottom-up process that promotes creativity and originality, and requires a relatively low investment. Producing original solutions to Client problems are a core process of these firms and technology investments are focused on supporting this process through groupware and person-to-person communications. As a result the organization is based on a small ratio of consultants-to-partners. The strategy consulting firms are typical of this model.

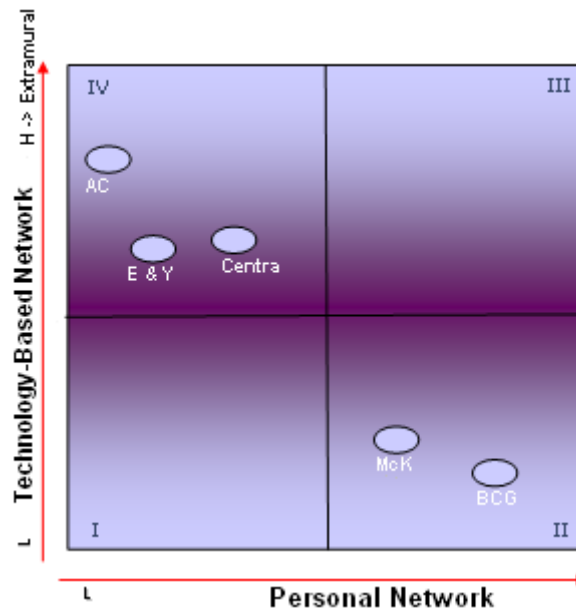


Figure 3: Placing the players

Business consulting firms that compete by building scale and efficiency, and found their value proposition on replicating proven solutions place themselves in quadrant IV. Their knowledge management initiative is top-down, with standards and rigid guidelines created at the centre. They make significant investments in ICT networks aimed at producing large document repositories and powerful search engines. They populate these repositories by motivating their staff to upload the deliverables of their projects, which their colleagues can later use as “accelerators” for subsequent engagements. The more extreme of these firms attempt to completely automate the search processes and eliminate interpersonal knowledge sharing. Others tend to prioritise technology networks but complement them with people-based networks. The core process is managing projects to replicate solutions as fast and efficiently as possible. As a result the organization is based on a large ratio of consultants-to-partners. The enterprise resource planning (ERP) implementation firms are typical of this business model.

Start-up and boutique consulting firms are forced into quadrant I. Their value proposition to clients is based on trust from the clients’ management, or on specific expertise of their partners. Their staff tends to have strong interpersonal relationships, but they are placed at the low end of the “People-based network” axis because they do not have formal knowledge sharing processes, policies for promoting knowledge creation, or structured communities of practice. They are also at the low end of the “technology-based networks” because they do not have the substantial resources required for investments to move up this axis.

The hybrid approach to knowledge management of quadrant III is probably a utopia, and utopias are dangerous: they mobilize in the short but paralyze in the long term (Romano de Sant’ Ana, 2006). A hybrid approach to knowledge management appears to be a reflection of ambiguity and avoiding decisions on business strategy (e.g., going after every opportunity, without being realistic on the firm’s ability to deliver value), or falling to the siren call of offering a “one-stop-shop” to its client base. There were a few highly visible failures in the 1990s: For example EDS trying to move up the value chain by acquiring AT Kearny to offer business strategy services as well as ICT outsourcing; or Booz-Allen & Hamilton trying to take advantage of the ERP wave by moving down the value chain from business strategy to implementation services. But it is by now clear that the factors that make a firm good at creating personalized products makes it inefficient at replicating solutions and, vice-versa, those factors that make it effective at replicating standard solutions introduces rigidities that make its bespoke services blunt and colourless (Treacy & Wiersema, 1995). This paper proposes that, precisely, one of these factors is how it manages knowledge.

This relationship between business strategy and approach to knowledge management is summarized in Table 1.

Table 1: Linking knowledge management approach to strategy

Business Strategy	Approach to Knowledge Management	
Trust or Narrow Expertise Based	Quadrant I	Low on Technology-based networks Low on People-based networks
Thought Leadership/Personalisation	Quadrant II	Low on Technology-based networks High on People-based networks
Hybrid/Utopia	Quadrant III	High on Technology-based networks High on People-based networks
Productivity/Re-usability	Quadrant IV	High on Technology-based networks Low on People-based networks

4. Alpha Consulting case study

4.1 The firm

Alpha Consulting is a young firm, barely 3 years old at the time that this research was launched. It was founded in the UK by several experienced consultants who left one of the large ERP implementation firms, with an aim at offering IT Value Management services¹. At the time of its founding its leaders thought that “independence from IT vendors” was an essential value of the firm.

In its second year the firm expanded into continental Europe through the acquisition of a mid-sized technology solutions implementation consultancy, with some niche products for the retail and fashion industries based on integrating SAP, Siebel and other industry-specific solutions. This move brought into question the feasibility of simultaneously being independent from vendors and implementing their solutions. The partners of the firm were struggling with this question at the time of the meeting where the fieldwork of this research took place.

In the months before the mentioned meeting, the firm also expanded into Asia Pacific and into America by incorporating local partners and starting operations from scratch based on those partners’ local connections and intellectual capital provided by the centre. One of the lessons from this growth process is that the background of the local partners influences the particular slant of the firm. In this vein, the Americas practice was founded and developed as an IT Value Management firm similar to the UK model, but the Asia Pacific one is closer to a strategy and process improvement practice. For the Asia Pacific partners the stress on “IT” in “IT Value Management” is a hindrance, and they would rather the service of the firm be described simply as “Value Management” or “Business Value Management”. This again was one of the discussions taking place at the time of the meeting.

The governance, organization and equity ownership schemes of the firm are probably closer to a franchise than to a traditional professional services partnership. The acquisition of the continental Europe implementation services took the consultant-to-partner ratio from 1:12 to 1:15, which falls in between the ratios for traditional strategy firms (1:5 to 1:7) and IT integration and implementation firms (in excess of 1:20).

4.2 The process

The meeting was opened by presenting the definition of knowledge, and the framework developed in section 4 of this paper, and explaining how it was developed. The participants were then asked to think of a relevant personal experience in KM.

As described in the Methodology section, each individual presented his example which was later discussed in terms of the framework. The first experience to be analysed was that of one of the UK partners, followed by one of the Australian ones, then one of the continental European experiences, and in fourth place one from the Americas.

¹ IT Value Management services refers to helping organisations realise the benefits of their IT investments, and comprises actions from evaluating whether its IT investments are aligned with its business strategy, to implementing training programmes to enable better use of its information systems.

When the continental European case was being discussed a vivid discussion emerged around the issue of whether the firm should be in the business of implementing solutions; how that affects independence; and whether it would be possible to grow at the expected rate on purely IT Value management consulting services.

When the fourth experience was being discussed, the group decided it agreed with the framework presented, and that it was not worth continuing down that line but that they would find the session more productive if they now focused on developing some principles for KM at Alpha Consulting.

Agreement was reached to move in this new direction. However the group was asked to place Alpha Consulting on the 2X2 framework and, after brief discussions, consensus was reached that it sits deep in quadrant 1.

4.3 The outcome

The group finally agreed on nine KM development principles.

1. Alpha Co will favour People Networks over Technology Networks in its approach to Knowledge Management
2. Staff will have access to all knowledge, directly or indirectly
3. Knowledge will be organised along a 2-dimension matrix, comprising industries and competences. Each industry and competence will have an expert lead reference.
4. There will be a repository with the latest Methodologies; it will have an owner and will be updated regularly
5. There will be a people repository with the CVs of all consulting staff; responsibility for keeping the CVs updated will be placed upon the individual
6. There will be a Client repository with a brief description of each Client and what work Alpha Co. has done with them. The Partner responsible for the Client is given responsibility for its updating
7. There will be a rudimentary but reliable repository tool for all re-usable material
8. Each geography will define who has access to the re-useable material knowledge system
9. Only Alpha Co.-developed, Alpha Co.-licensed and public domain documents will be uploaded onto the re-usable knowledge repository

The implementation of these principles was broken down into activities which were distributed among the partners who were given responsibility for achieving them.

5. The Beta-Telco case study

5.1 The company

Beta-Telco is one of the largest telecom companies in Chile. The country fully privatised and opened the telecommunications services in the late 1980s and early 1990s, in what is generally known as one of the most successful cases of its kind. Success here is used in the sense that it resulted in a much improved quality of service and reduced cost of service for the population, and established the telecommunications service as part of the platform that enabled the radical transformation to efficiency and growth of the Chilean economy. Chile has for many years had one of the most competitive telecom sectors in the world. Beta-Telco, previously a state-owned land-line telecom service provider, has specialized in serving the corporate sector in its voice and data communications needs. Beta-Telco has also set up a successful mobile-telephony service but that is managed through a separate business unit, not included in this case study.

Beta-Telco has a high degree of penetration in the corporate market, where it masters close to 60 percent market share in its traditional telecom products. Its leadership team thus realized that in order to grow it would need to have new products to offer its client base and decided to incorporate IT Outsourcing Services to its product offering.

5.2 The Engagement

Responding to the strategy implied in the previous point, some three years ago Beta-Telco entered the IT Outsourcing Services market and won several projects, some of them large and highly visible. It created its

Corporate Services Division (unit of analysis of this case study) with its sales and delivery capabilities by recruiting individuals with experience in the service, and by setting up ad-hoc partnerships to tackle each opportunity, but without making the structural and organizational changes that entering this new product market required. So in 2007 it decided to engage consultants to design the required changes. In the diagnostic stage it quickly emerged that one area that needed attention was knowledge management and the leadership of Beta-Telco agreed to apply the strategy-knowledge management alignment framework given above to do so.

5.3 Applying the framework

The first step in applying the framework was to understand what the value discipline of Beta-Telco is. The this end the second section of the semi-structured interview guide was designed to make the informants give their individual interpretations on this issue (the first section was aimed at capturing background information on the informant and her role in Beta-Telco). Treacy & Wiersema's (1995) "Value Discipline of Market Leaders" model was used to frame the discussion. The first two interviews were conducted by the researchers as a means of "fine-tuning" the semi-structured interview guide; the other fifteen interviews were carried out and documented by two consultants operating together. The remaining sections of the semi-structured interview guide touched on issues such as the informants' view of Beta-Telco's "go-to-market" strategy and how it tackles knowledge management. The interview transcripts were coded and as a result of the coding process the researchers were able to understand some shared values amongst senior management on what is the value proposition to Clients and place Beta-Telco on the Knowledge Management framework given in figure 2.

The resulting view of the Division's value discipline was used as a straw-man to generate discussion in four workshops held between October and December 2008. The workshops were used to place Beta-Telco's competitors on the 2 X 2 frame and to generate consensus on how it should tackle knowledge management, as described in the following section.

5.4 The outcome

Through the workshops a consensus was reached with the management team that Beta-Telco Corporate Solutions should adopt a value discipline of "customer intimacy", and thus make a value proposition to Clients based on "best total solution." By doing this it was thought that Beta-Telco would position itself to compete with large international IT Outsourcing providers operating in Chile such as IBM, EDS, TCS (that come to the market with global, standard, 'leading practice' solutions), by leveraging its better knowledge of the local market and its clients, to offer tailor-made solutions.

Discussion then moved on to how Beta-Telco should approach knowledge-management. The participants in the workshop applied the framework of figure 2 and, as expected, it emerged that Beta-Telco should favour a people-driven knowledge networks approach, rather than technology-based ones. It was decided to set up six Communities of Practice (CoP) on key knowledge areas for the company, one of which would be taken as a pilot, and the other five would follow incorporating lessons learned from the pilot. It was decided to give the pilot CoP a 5 month period for design and implementation, and that the 6 CoPs would be operating in a year. It was also decided that all 140 professionals in the Division would be encouraged to belong to at least one CoP, and that membership of a CoP would be voluntary.

6. Reflections

This research combination using previously published case studies to synthesize a KM framework and then apply it in two different empirical settings is novel. At Alpha-Consulting the framework provided a useful spring board with which to commence an in-depth conversation among the partners in the organization and this led directly to a useful result. From an evidence analysis and narrative creation perspective the Socratic Dialogue offers the case study researcher a way of overcoming the problem posed by polyvocal narratives of organizational change that typically emerge from individual interviews. This does not mean that the Socratic Dialogue substitutes interviews; it means that it is a complement to interviews.

At Beta-Telco the use of the Knowledge Management Framework together with Treacy & Wiersema's (1995) "Value Discipline" model proved to be effective in helping managers visualize the link between business strategy and knowledge management strategy. The combination of individual interviews to construct a "straw-man" model for managing knowledge in the Division, with workshop type discussions within the

management team, also resulted in an effective way to focus discussion and arrive at a solution of consensus.

Moving from method to content, the paper highlights the dynamics of the competitive value of knowledge: The value of knowledge bases is debatable – they are static and by the time knowledge components have been uploaded, they may have lost some value. It can be theorised that knowledge objects, as competitive tools, have two dimensions of value. An absolute value (intrinsic value, derived from their verisimilitude) and a relative value (derived from few people knowing them). It follows that knowledge objects lose value gradually, at the rate that other people get to grips with them (erosion of relative value); but at a certain point in time they will lose value abruptly (loss of intrinsic value) as the knowledge object is falsified and superseded by a knowledge asset of greater verisimilitude.

From the perspective of this research project, the two management teams (some 50 managers and senior managers at Beta-Telco and 12 partners at Alpha Consulting) were deeply exposed to the Knowledge Management Alignment Framework and explicitly manifested that it makes sense to them, helped them visualise the link between strategy and knowledge management, and is straight forward to use, which is a powerful validation of the model by practitioners.

7. Conclusions, limitations and future research opportunities

The conclusion of this research is that the Knowledge Management framework developed in section 3 of this paper is partially validated and was of use to generate some practical guidelines to design knowledge management at two real-world organisations.

This paper thus contributes to the body of knowledge in the field of knowledge management by (a) establishing that there is a relationship between the business strategy that a knowledge intensive service firm wants to pursue and the approach to knowledge management that it needs adopt to support the strategy; and (b) proposes a framework to understand the link between knowledge management and strategy, and one that can be used by practitioners to support practical applications.

The paper also contributes to the development of research methods, by applying the Socratic Dialogue as a method for collecting and analyzing evidence in qualitative, case study research. It complements in-depth interviews and helps interpret polyvocal narratives on things and events. It could also prove to be a powerful means of building theory grounded on personal experiences. It is a vehicle to do research *with* rather than *on* organizations and thus useful in research approaches such as Action Research.

As in all case studies this research has the limitation that it is context dependent. The issues that emerge most strongly are those that were pressing the two organizations analysed at the time of the case studies. However, this research will continue through several fronts. On the one hand, there is an opportunity to do a review of the implementation of Knowledge Management at Alpha Consulting to see if new insights on the framework arise; on the other, it has been agreed to set up an Action Research project at Beta-Telco for the implementation of the CoPs from where there should arise opportunities to further develop the framework. In addition to this, it would be interesting to test whether this framework would work in other industries such as those with a manufacturing base.

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Reconsidering Knowledge... and Business Improvement

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Abstract: The ever growing complexity of market processes continues to increase the importance of knowledge as the organization's core capability to maximize business performance. Current conceptions of knowledge and knowledge representation, however, prove to be highly unproductive. A fundamental problem here is that insight into the nature of knowledge is an inevitable requirement for adequate knowledge management that, nevertheless, is hardly met in business. In this article, we claim that adopting a functional view of the nature of knowledge reveals and restores the relation between knowledge and corporate effectiveness.

In a functional approach to conceptualization, functional equivalence instead of observable similarity serves as the basis for classification. The sets of conditions that have to be met in a particular situation are here taken as functional demands. These functional demands may vary across situations, thus precluding the valid possibility of a static one-on-one connection between functions and individual objects. Not the objects as potential instances of classes, but the relationships between objects given their properties and situations, defined in terms of functional demands, become central. These relationships define the concepts, and thus what we know. Classification amounts to relational matching of specified situations to specified objects.

The functional view not only enables content improvement through rational classifications, but also enhances process designs, implementations and process maintenance. It also aligns information technology to the new demands set by the knowledge economy by enabling goal-oriented, transparent and easy-to-use-and-modify knowledge structures. The paper further describes a real world case taken from the financial services industry to exemplify how a functional analysis of knowledge -including to the functional view aligned Match™ Technology- realizes great improvements in business performance.

Keywords: knowledge representation formalisms, functional view, rational classifications, functional equivalence, Match™ technology

1. Introduction

Maximising the performance of a company involves managing both its functioning in the short term and the company's long-term competitive position. Many authors have recognized that a focus on knowledge provides the adequate conceptual backdrop for combining both management objectives (e.g. Zack, 1999; Hislop, 2005). Adequate knowledge management (KM) therefore precedes optimal business performance and, so we argue, an adequate definition of the nature of knowledge precedes adequate KM. Yet to date, views on the relation between business improvement and knowledge on the one hand and knowledge and knowledge representation on the other hand are not convincing. What hampers knowledge realizing its full potential is the lack of systematic attention for knowledge in business. As a consequence, current KM initiatives tend to produce more information yet less knowledge.

What appears as a fundamental problem haunting KM debates is that adequately defining knowledge remains problematic. Definitions are either too specific to distinguish knowledge from information or too vague to warrant the design of truly knowledge-based management practices. In this article we argue that an interesting middle-ground between rigidity and vagueness emerges when knowledge is defined functionally. The functional approach allows flexible categorization by relating knowledge about referents to the functions these referents should perform, instead of treating referents around which organizational knowledge is developed and used as given objects.

The objective of the paper is to show that in-depth analysis of functional characteristics of knowledge helps to design smarter classifications in business processes and enables rational choices for knowledge representation formalisms. In addition, the paper explores which methodologies are needed to let knowledge structurally improve processes (transparent descriptions, clear relations between process levels, smooth

work instruction integration in process steps) and Information and Communication Technology (ICT, improved software requirements engineering, shorter and better application development, and flexible architectures). A case taken from the financial services industry illustrates how a functional analysis of knowledge and the Match™ Technology make the organization's knowledge the basis of business performance.

2. Functional classification as knowledge model

KM debates have produced a plethora of definitions of what knowledge is, and perhaps even more of what knowledge is not. Alvesson and Kärreman (2001, p. 997) warn us that the great diversity of approaches to knowledge has made the concept 'inconsistent, vague, broad, two-faced and unreliable' and that going for all too tangible definitions of knowledge may be unwise or counterproductive. Alvesson and Kärreman's complaint is reminiscent of Dewey and Bentley's lamentation in 1949 that 'knowledge is one of those vague words one is at times compelled to use, a loose name that has been used to refer to a great many, often different things' (cited in Gourlay, 2006, p.1424). In fact, if it is management that we are interested in, engaging in philosophical debates regarding the nature of knowledge should be avoided because knowledge by its very nature cannot be managed. "Knowledge management is thus threatened by falling into pieces if both the two ingredients are taken too seriously" (Alvesson & Kärreman, 2001, p. 1015). Yet because knowledge matters and because many KM discussions indeed are built on highly debatable definitions of knowledge, not taking knowledge seriously is no option either. Indeed knowledge is different from information, and any knowledge manager should avoid using the terms interchangeably because that would involve downplaying knowledge.

When considering the need and possibility of defining knowledge in a KM context, it is important to note that the general distinctions used in the KM debates have only limited value. For instance, the distinction between tacit and explicit knowledge is used most often to separate information from knowledge. Particularly tacit knowledge is then heralded as the most valuable organizational resource, because it can produce a competitive edge (e.g. Zack, 1999). However, as Achterbergh and Vriens (2002) rightly stress, the fact that knowledge is tacit as such cannot guide an inquiry into which knowledge will gain value for the individual organization. The tacitness of knowledge as such cannot help decide which knowledge is relevant for management, and which is not (James and Lucardie, 2004). The same criticism applies to the numerous other taxonomies that have been proposed, sometimes related to the tacit-explicit dichotomy, leading to such distinctions as overt versus covert knowledge, declarative versus procedural knowledge, object versus process knowledge and so on. Exactly because of their general nature, the relevance of these distinctions to KM debates is rather limited. What is needed therefore is (1) a broadly accepted, general definition of the concept of knowledge and (2) a specification of that general definition that may serve to draft management tools, and particularly the ICT tools for KM that are the focus of this paper.

No taxonomy of knowledge types can produce a general definition of knowledge, but only a specification of the roles or functions knowledge plays. Allen Newell (1982) offers such a functional definition in his famous discussion of the 'knowledge level' at which artificially intelligent – or knowledge-based – systems should be defined according to Newell. He argues that knowledge is 'whatever can be ascribed to an agent such that its behaviour can be computed according to the principle of rationality', explaining that thus knowledge 'is characterized entirely functionally, in terms of what it does, not structurally, in terms of physical objects with particular properties and relations' (Newell, 1982, p. 9-11). While Newell's definition has been the object of criticism, for instance for lacking a crisp delineation of rationality, it should be noted that it contains a valuable referral to behaviour. It is in line with the pragmatists' approach that knowledge has no existence separate from behaviour. The strong connection between knowledge and behaviour is specified in John Dewey's concept of productive inquiry. As Cook and Brown (1999, p. 388) explain, "productive inquiry is that aspect of any activity where we are deliberately (though not always consciously) seeking what we need, in order to do what we want to do." Dewey maintains that when our experiences are non-reflective, as is characteristic of our everyday living, they produce know-how or result from know-how. On the other hand, when our experiences are reflective, as is typical of the professional behaviour of academics, they shape and are shaped by know-that (Dewey, 1922). Thus the artificial separation of tacit (know-how) from explicit (know-that) knowledge is lifted when knowledge is not treated as something that in a Cartesian sense is fully separable from behaviour. It is important to note that these functional approaches to defining knowledge can only sketch the confines of the knowledge landscape, but do not produce any tangible guidelines for engaging in or abstaining from KM activities.

An important step towards KM tool design can be made when linking to the distinction of knowledge-as-possession versus knowledge-as-practice (Cook & Brown, 1999; Hislop, 2005). This distinction appears to have become the standard divide in KM debates separating the older, ICT-focused approaches to KM from the newer, people-centred ones (Chiva & Alegre, 2005). When seen as possession, knowledge is treated as an entity, as objective facts, and as derived from intellectual process (cf. Hislop, 2005; Chiva & Alegre, 2005). Practice-based approaches stress that knowledge and knowing are inseparable, knowledge is embedded in practice, and it is socially constructed, culturally embedded and situated (cf. Hislop, 2005; Chiva & Alegre, 2005). They see tacit and explicit knowledge as aspects and not types of knowledge. Knowledge is both at the same time. Newell et al. (2002) show how the two knowledge models lead to distinct understandings of KM. Following a possession approach, KM's primary aim is to codify and capture knowledge, and the critical success factor is technology. From a practice stance, KM's primary function is encouraging knowledge sharing, and the critical success factor is trust and collaboration.

Given the basic connection of knowledge to behaviour, any satisfactory approach to KM will need to connect the two approaches (Cook & Brown, 1999; Chiva & Alegre, 2005). A key concept in linking a possession to a practice approach is that of 'dynamic affordance', which refers to what becomes possible when knowledge is used as a tool for action in concrete situations (Cook & Brown, 1999). 'Affordance' refers to how a situation "affords" doing. For instance, a doorknob (Cook & Brown, 1999, p. 389), when appropriately designed, affords opening a door smoothly. Dynamic affordance adds the notion that actual doing is established through interaction in concrete situations or concrete contexts. The same doorknob may prove functional to one person, yet dysfunctional to another with different physical abilities (e.g. a midget or someone with arthritis). What then is a doorknob? Is it the well-crafted, appealing physical object or a string hanging above the keyhole that opens the door? What is a table? Is it the flat stone in the countryside or the elaborately decorated Louis Seize piece of furniture that facilitates eating and writing? The answer can only be that the crafting and design are important, but only when we link them to the purpose these objects may serve in factual situations, can we say what doorknobs, tables or any other objects 'are'.

What then does this imply for drafting intelligent, knowledge-based ICT tools for KM? As we will argue, the line of reasoning developed above (1) shows the prime importance of classification as manifestation of knowledge, and (2) points to relational matching as the key mechanism in achieving classification. Both points will now be elaborated. Figure 1 serves to illustrate the argument.

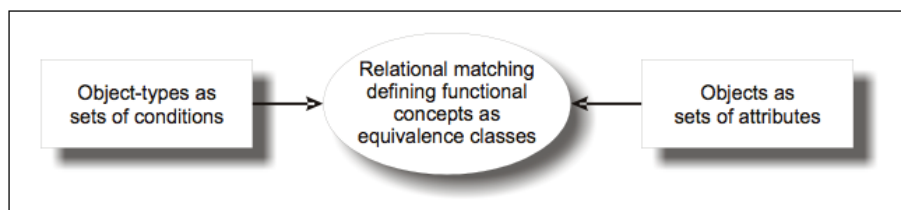


Figure 1: Functional classification (adapted from Reitsma, 1990; Lucardie, 1994)

What the argument proposes is to reverse our common way to look at knowledge and knowing. Knowledge is not defined as separately existing entity with particular perceptions, e.g. problem detection, and actions, e.g. problem solving, as potentially useful by-products. Rather knowledge appears as a particular way in which human behaviour deals with circumstances. Therefore what guides actions and behaviour, whether these are seen as directed by goals and objectives or conceived as opportunistic and chaotically-reactive, embraces knowledge and simultaneously defines the potential value of knowledge.

What defines knowledge is not some taxonomy of related insights deposited in concepts and conceptual relations, with ignorance being defined as the lack thereof. Instead, the problems to be detected and solved, the opportunities to be seen and seized, or any other objectives to be perceived and achieved, provide the more appropriate starting point for understanding knowledge and thus for modelling it. Knowing then amounts to classifying objects with respect to a given objective, and knowledge to the rules that guide classification (Lucardie, 1994). Particulars of this functional approach, which centres on establishing functional equivalence classes via matching contexts and objects, are discussed below (see also Reitsma, 1990, and Lucardie, 1994). This approach is at odds with the standard practice of understanding and building ontologies that describe instances, concepts, attributes and relations between concepts (e.g. Sharman & Kishore, 2007). These focus on the structural similarities of objects in an unduly static fashion. They look at the right hand side of Figure 1 in isolation, instead of on the relational matching mechanism that gives the right hand side its meaning. The underlying model is one that has been labelled above as the

possession model. Therefore, ontology-based knowledge representation cannot escape possession approaches to knowledge and KM.

3. Business enhancement viewed from a functional knowledge perspective

By disentangling knowledge (content) from knowledge representation formalisms (data structures and access mechanisms), the functional view on knowledge systematically changes the ways business performance enhancements can be realised. Firstly, it helps to re-organise knowledge by installing the rationality principle in the content that is a key driver for business performance. Secondly, it helps to map knowledge to representation formalisms as human resources, documents, (formal) techniques and applications such as database management systems and flow engines.

3.1 Creating rational classifications

Business cannot do without classifications and associated interactions. Due to lack of transparency and because historical artefacts have crept into classifications, many classifications that are operational in business are flawed. The overwhelming volume of information that classifications can generate, their often doubtful validity and unnecessary complexity are important problems that, when viewed from a positive angle, provide space for significant business improvements.

A strong asset of the functional view is that it helps organisations to start working from a goal or system of goals. A goal-oriented approach disentangles the confusion that often occurs when an organization attempts to execute an object-type such as 'valid service request' or 'optimal product (portfolio) offering' while not taking into account that defining object-types can and should only be accomplished through a goal or multiple goals.

This leads to the phenomenon of functional equivalence, which involves the assessment that objects are identical—even if they possess quite different attributes—because they can perform the same function. In other words, objects may vary in attributes, but if they match one of the constructs of a goal-constituted object-type, they are functionally equivalent. Functional equivalence involves three basic mechanisms: conditional relevance, conceptual interaction and variation limited to goal-constructed categories.

- *Conditional Relevance.* Under specific conditions, other attributes may become important for determining class membership. Their relevance is conditional upon circumstances that also need to be incorporated into the object-type.
- *Conceptual Interaction.* Categorizations of attributes of objects may influence each other.
- *Variation limited to goal-constructed categories.* Objects may have different attribute values, but this variation is limited to, or falls within, goal-constructed categories.

What benefits does the installation of goal-oriented and functional equivalence principles yield? We argue that the advantages relate to transparency of classifications, sparseness of information, simplification and correctness of classifications.

As an example, consider the case of a computer system that had been developed to determine a students' eligibility for university scholarships. The object-type 'scholarship student' as it had been incorporated into the system led to complaints from students who were overlooked for a scholarship because the system mistakenly failed to classify them as a 'scholarship student' (mismatch). It subsequently appeared that the rather complex object-type was constructed using the government's goal 'should suit budget,' while the universities linked to the scholarships had the implicit goal to acquire as many scholarship students as possible. Analysis revealed that at least two distinct object-types 'scholarships' should have been distinguished based upon the different goals of the actors involved.

In addition to the efforts spent handling students' complaints, the costs to reconcile both object-types in an adapted system were substantial. The inclusion of goals and the related distinction of several object-types (and objects) would have eliminated irrelevant information, reduced complexity and increased transparency of knowledge. When goals determine which conditions are relevant for the definition of an object-type, knowledge becomes something in use as a function of the organization's goals. This prevents knowledge from becoming obsolete, or just a sitting stock of information: for when the goals change, knowledge changes with it. This is true irrespective of whether knowledge is processed through humans, systems or both.

The correctness or validity of classifications is often damaged by reification, which underlies the sometimes highly cloaked tendency to use taxonomies in goal contexts that are different from the ones for which they were created.

Unfortunately, a huge number of classifications in business processes display the characteristics of reification creating exceptions as a rule. And dealing with exceptions is not cheap. Processing them requires the employment of additional human resources. What in fact occurs is a compensation of (partly) invalid classifications by additional human resources in operations departments of organisations!

3.2 Boons and limits of codification and automation

What about the roles of codification, formal knowledge representation and automated support via ICT? Are they out of the picture once the predominance of tacit knowing has been recognized and its social-practice character accepted? We claim that in the process of enriching limited possession thinking with conceptually richer social-practice elements, codification has lost nothing of its appeal. In an interesting essay on performance variability, or the phenomenon that businesses cannot maintain the same level of performance even if circumstances appear familiar, Matson and Prusak (2003) distinguish between situations of high and low predictability and of high and low frequency. In the terminology of this paper, these distinctions would refer to classifications for which the rules (knowledge) are known (=predictable) or not (=unpredictable) and those that have to be made often (=frequently) or not (=rarely). Matson and Prusak describe how content-based ICT (e.g. implementing a decision algorithm) can be economically helpful for dealing with high-frequency problems, and person-targeted ICT (e.g. expert-locator systems) for low-frequency problems. The approach described here is best applicable to the high-frequency class of problems. In situations where a specific classification has to be made only occasionally it would probably not be economically interesting to support it with an automated system.

However, the intrinsically more interesting dimension is that of high and low predictability. Matson and Prusak identify different classes of ICT applications for dealing with predictable and unpredictable solution paths. For the former they suggest decision algorithms and best practice databases, and for the latter case-based learning and Q&A databases. We agree with Matson and Prusak's implicit assertion that codification can be useful for any performance-variability-related problem class, but we disagree with treating the various predictability-frequency combinations as fundamentally different, as they – also mostly implicitly – do. What we argue instead is that in all situations – whether predictable or not, and whether frequent or not – tacit knowledge is indispensable and suitability of ICT support lies in how well it connects to that aspect of knowledge. Therefore not different application types are needed in different situations, but a similar knowledge modelling approach with a different focus on the amount and perhaps nature of expertise required in the applications' users. Automated systems cannot and should not replace individual knowing; they are knowledge-based to the degree that they allow hooking into subsidiary background knowledge that gives meaning to the content of the systems. Tacit (or background) knowledge is not just required to deal with situations of low predictability, also a predictable classification that is exclusively or mostly based on existing knowledge cannot do without tacit knowledge – at least as this was understood by Polanyi (1966), who introduced the concept. Tacit knowledge – or subsidiary background knowledge – is always needed to be able to understand the generalizations, to make exceptions, to check the appropriateness of descriptive accounts of the individual objects, to verify the completeness of the classification-decision table, and to assess the suitability of the resulting classification. Obviously, functional modelling does not and cannot result in codifying the indispensable tacit aspects of knowledge into a system. However, what it can claim to achieve is that it offers a perspective on the explicit or focal aspects of knowledge that does not unduly separate those explicit aspects of knowledge from tacit knowing. The focal knowledge is here not represented starting from the generalizations, the rules, but taking the goal as a context for using these generalizations as the starting point. Thus the logic of classification follows the practice of knowing, and needs no extra translation step to see how individual situations make use of or alter existing 'knowledge as generalization'.

3.3 Mapping rational classifications

Improved rational classifications should be mapped to well-chosen knowledge representation formalisms, and supported by smart technologies. Software tools that follow a functional view enable the development of smart classifications. The Match™ Suite of technologies is an example of a well-elaborated tool kit to do exactly this. It offers a range of representation formalisms that are function-oriented and can deal with functional equivalence. Basically, it enables capturing smart classifications through digital knowledge bases (Match™ Developer) and ensures that classifications are interactively executable (Match™ Player).

Match™ Developer allows constructing and maintaining a knowledge-based system consisting of knowledge tables that are linked together. A knowledge table is a table that represents the exhaustive whole of mutually exclusive conditional statements within an a priori defined problem domain (Verhelst, 1980). Match™ Developer adheres to that definition. Therefore it can perform automated checks on domain completeness, exhaustiveness and consistency of created knowledge tables.

Figure 2 is an example of a knowledge table created with Match™ Developer where a goal is assessed and used as a guideline for establishing the relevant conditions and their respective alternatives. In case of our example: determine the 'Type of Client'.

Type of Client						
C1	Duration of account (in months)	≤12			>12	
C2	Business performance (C/I ratio)	≤50	>50 AND ≤75	>75	≤60	>60
C3	Wealth	-	Wealthy	Not wealthy	-	-
A1	Type of Client	Special	Special	Normal	Problem	Special
	Rules	1	2	3	4	5

Figure 2: A Match™ table defining 'Type of Client' based on functional equivalence

This table also shows the concept of functional equivalence as it was unfolded above into the three mechanisms of conditional relevance, conceptual interaction and variation limited to goal-constructed categories. Firstly, conditional relevance shows in how the condition 'Wealth' is introduced in the decision logic, since that condition is only relevant in case the 'Duration of account' is less than 12 months and the 'Business performance' is between 50 and 75. In other circumstances, wealth is not relevant for classifying clients. Secondly, conceptual interaction becomes visible in the fact that the categorization of 'Business performance' is influenced by the value of 'Duration of account'. When account duration is less than 12 months, 4 categories of business performance become relevant. When the account duration is over 12 months, differences in business performance are considered to be accurately captured by only 2 classes. This phenomenon of conceptual interaction becomes manifest in the mutual influence of the attributes' categorizations. Thirdly, reduction in variation through goal-constructed categories is established by the fact that clients who are described by very different combinations of characteristics will still be categorized into a limited number of goal-constructed categories. Regardless of the duration of the account, the height of the client's cost-income (C/I) ratio or that person's wealth, all clients will be classified in one of the categories 'Problem', 'Normal' or 'Special'.

With Match™ Player the knowledge bases that are created with Match™ Developer, can be executed through the use of a meta-interpreter (or inference or reasoning engine). This interpreter will allow for automated evaluation of the goal of the knowledge base. In the example of Figure 2, it will try to assess the goal 'Type of Client', by evaluating the conditions C1-3. The conditions can receive their value in several different ways: for instance by asking an end-user to provide an answer, or retrieving it from a database. This will allow for several business improvements ranging from process optimizations to streamlining a company's ICT-organization.

3.4 Business improvements

The functional theory and the Match™ Suite of technologies especially improve business in the domains of processes and ICT.

3.4.1 Process improvements

A functional conception of knowledge supports the alignments of processes to goals. First of all, a rational classification can be a process description taking care, for instance, of conditional relevance, which points to the fact that in certain contexts a process step does not need to be performed. Secondly, it helps to keep the levels in process descriptions transparently connected, so that implications of changes in different layers are traceable. Thirdly, the usual but artificial separation between a process description and the knowledge relevant to perform a step in the process is being eliminated which gives space for transparent interaction between 'process' knowledge and 'execution' knowledge. A smooth and flexible integration of work

instruction and process is the result. Fourthly, flow analysis with large volumes of objects flowing through the process, is possible using the Match™ Player in batch mode even before the process is implemented.

3.4.2 ICT improvements

ICT may produce a multitude of benefits, such as faster and more transparent requirements engineering, shortened application development, rationalisation of the application portfolio and increased flexibility of IT architectures. The benefits of ICT-based functional modelling in all these domains will be shortly addressed now.

Requirements engineering is one of the most critical activities in software development (Hickley & Davis, 2004). Here, the functional view does not only help to organise the software requirements specifications, but it also supports the selection of techniques that increase transparency for non-computer-oriented persons. In Match™ Developer, for instance, we carefully selected knowledge tables, frames and a logic programming language to assist the analyst dealing with functional equivalence in unprecedented visual and iterative ways. In all stages of requirement engineering -from elicitation up to verification- the chosen combination of techniques proved to be fruitful in various application domains. Especially when it comes to determining completeness and consistency in the verification stage and to provide a sound basis for design and implementation and testing.

An essential ‘side effect’ of the approach described above is that the addition of a meta-interpreter forms a new dimension to the efficiency of application development. While the data structure component consisting of hierarchical knowledge table systems, frames and logic programming is extremely powerful and expressive already, the meta-interpreter as the process component render the specifications executable. This takes application development to a level beyond model-driven architectures (MDA) where specifications, for instance written in UML, are stepwise and semi-automatically translated into code bases (.NET and/or J2EE). In all these cases the programme itself will need to be repaired to deal with flawed classifications or new insights. Apart from a stronger business/ICT alignment, the approach advocated here leads to considerable reductions in resources used for designing, testing and programming applications and especially in their maintenance (Figure 3).

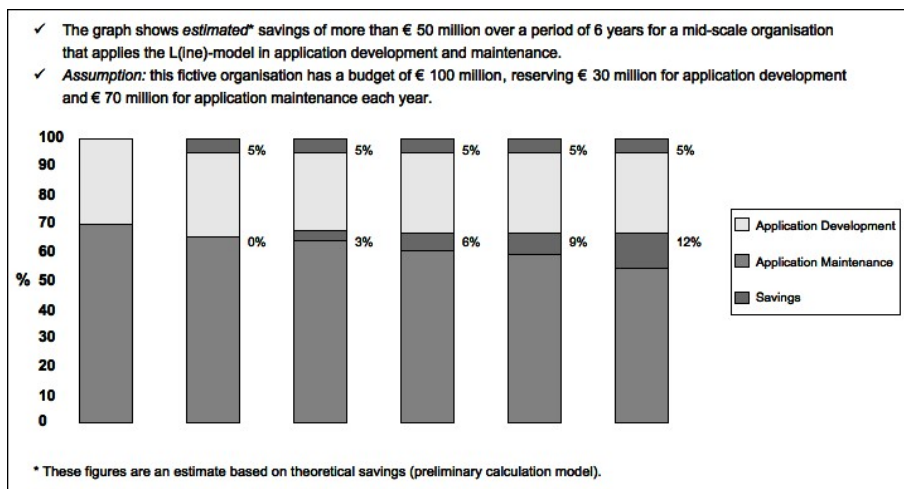


Figure 3: Effectiveness of knowledge-based application development

Current IT systems often do not meet organisations’ objectives concerning functionality and flexibility. Executive management is therefore taking measures to improve their performance (Debevoise, 2005). One option is to rationalise a company’s application portfolio by replacing legacy IT systems with more intelligent systems that allow business rules and processes to be abstracted and formalised in such a manner that they can be improved without the necessity to re-develop the complete system. This can be done by the concept of flexible IT architectures: building a layer of agile knowledge bases on top of legacy systems and below the end users in various processes! Another approach is to deploy functional knowledge bases as web services that function as self-describing, self-contained software modules available via a network such as the internet for fully automated complex transactions. (Papazoglou, 2008).

4. Case study: Intelligent debtor management

We now turn to a case study to illustrate ICT-supported modelling of functional equivalence classes. That case study concerns the debtor management process for a financial service provider. Debtor management comprises three sub processes (see Figure 4): signalling (identifying debtors), decision-making (selecting a debtor strategy) and execution (conducting a selected strategy). In the case organisation a variety of applications supported these processes, with a dedicated Cobol application specifically functioning as the decision-making engine. That application was the source of many problems. The knowledge of the decision-making process was spread out over multiple Cobol modules that were often inconsistent and hardly accessible. The original functional specifications were largely outdated. Deciphering the original Cobol code would have been the only way to access vital knowledge, and to alter or expand it. Since many of the original Cobol programmers had been hired from outside or had left the company, their argumentation was not easily accessible.

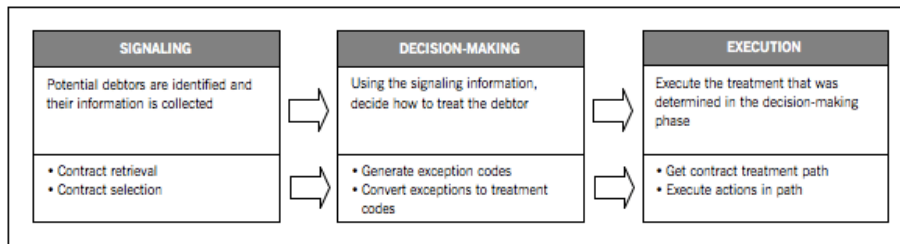


Figure 4: Debtor Management Process at a global financial institution

4.1 Phase I: Extracting knowledge from systems

The first phase towards a more intelligent debtor management process was the extraction of relevant knowledge out of the various sources and formalise it into knowledge bases through use of the Match™ Suite. A thorough analysis of the working of the Cobol application was performed to ensure that the signalling/decision-making rules in the knowledge base produced the same results as the Cobol modules before the system became operational.

This could be tested and simulated by using a Match™ Player to process a batch of debtors while recording the results and comparing them to the output of the old system.

By restructuring the knowledge and processes according to certain design principles (Lucardie et al., 2004) handled by the Debtor Management decision-making engine in goal-oriented, transparent and easy-to-modify digital knowledge bases knowledge fragmentation was eliminated and costs driven down significantly, highlighting the optimisation opportunities of the efficiency of debt collections.

Additional benefits are:

- Increased process maintenance efficiency: Using digital knowledge bases, process changes can be efficiently and transparently specified and tested before actual programming takes place further reducing operational costs.
- Clear insight into process flow and structure: Possible omissions and irrelevant process steps become immediately noticeable enabling process optimization.
- Increased leverage of organisational knowledge: Knowledge previously residing in the heads of individuals and stored in hard-coded applications becomes transparent and accessible organisational knowledge leveraged through digital knowledge bases.
- As maintenance of the Cobol modules was outsourced due to complexity that now disappeared, outsourcing can be viewed from a different perspective.

4.2 Phase II: Smart functional classifications

Phase II starts by identifying the goals of the debtor management process. Once these have been determined, variables that are required to establish these goals can be identified.

A single set of generic conditions is used to determine the class of a debtor. Based on this classification, strategy assignment takes place. By intelligently choosing the generic classification conditions, strategy redundancy is eliminated and the number of strategies can be limited. Due to reduced decision-making

complexity, the transparency of the process is greatly enhanced. Because of the goal oriented nature of the knowledge base, product specific information is retrieved only when the goal requires it (Figure 5).

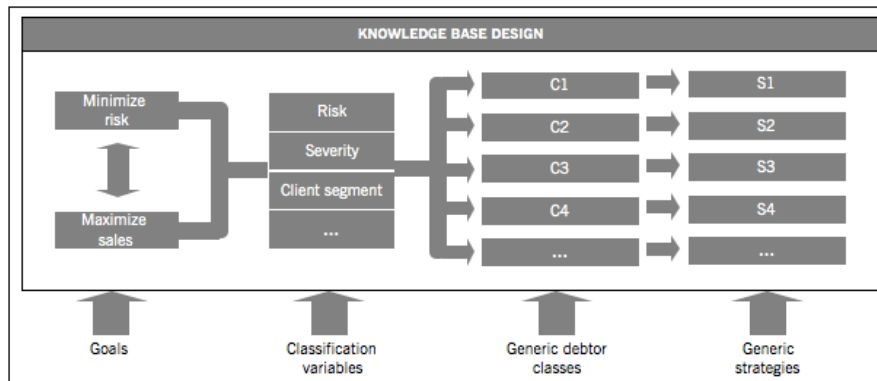


Figure 5: Using smart functional classifications to reduce complexity

As a result of increased transparency and flexibility, maintenance and modifications require fewer FTE. Increased flexibility also makes it possible to shorten the time to market of new strategies thereby enhancing debt collection efficiency.

5. Conclusion

In this paper a functional approach to knowledge modelling has been described and illustrated. That approach is characterized by a focus on classification as combined knowledge and knowing, the concept of relational matching as the basis for classifying individual objects into object-types, the notion of functional equivalence as the basis for understanding sameness and difference, and conditional relevance and conceptual interaction as descriptive of how characteristics of objects feed into their classification. Knowledge by its nature combines abstraction with concreteness, and group elements with individual elements. Tsoukas' (2001, p. 983) definition of organizational knowledge neatly shows all these elements: "Organizational knowledge is the capability members of an organization have developed to *draw distinctions* in the process of carrying out their work, in particular *concrete contexts*, by enacting sets of generalizations (*propositional statements*) whose application depends on historically evolved *collective understandings* and experiences" (emphasis in the original). A functional modelling approach fits seamlessly in the combined possession-practice approach to knowledge this definition reveals. As to the abstract side of knowledge, the key focus of a functional approach lies on modelling classification, and not generalization. Generalization comes into the picture as the argument leading to classification decisions, and the justification of resulting class composition. Thus, a functional approach may help cross the divide between cognitive codification and social-practice approaches to KM where these two perspectives engage in the kind of generative dance that Cook and Brown (1999) describe. In parts of the KM discussion, knowledge codification and knowledge exploitation appear to have received a bad name. This applies particularly to those contributions to the KM debate that focus on power, emotions, situatedness and conflict in relation to knowledge questions. We claim that, by definition, advanced knowledge services based on smart codification are a prerequisite for business enhancement. Services that permit knowledge level analysis according to the functional view, will lead to improved engineering of knowledge representation formalisms, moving beyond yet encapsulating ontological engineering topics as semantic web (Gomez-Perez et al., 2004). Social-practice approaches to KM should embrace codification and ICT with as much vigour as the indeed flawed and inherently limited cognitive-possession tradition of KM did (and partly still does). Adequate knowledge services require the disentanglement of knowledge and knowledge representation, the availability of a knowledge theory and ICT aligned to this view. Impressive business improvements are indeed feasible, by reconsidering knowledge and thus.... business performance.

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On Measuring Organizational Relationships: Threats to Validity in the Use of Key-Informants

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Abstract: The measurement of organizational characteristics in empirical studies that focus on inter-group, knowledge-based collaboration requires research methods different from those used for measuring the characteristics of individuals. As an answer to that, key-informant methodology is a frequently adopted approach that has been associated with qualitative methods. However, recently organizational researchers have used the technique to obtain quantifiable information on organizational structure, internal power distribution, within the group, and external relationships among groups that base their collaboration on the knowledge they share.

This paper focuses on the threats to validity, which are inherent in empirical studies that adopt the key-informant methodology as a social science tool. In particular, the paper thoroughly examines the effects that the Bagozzi and the Cook and Campbell construct validity criteria as well as the Huber and Power key-informant validity criteria have during the two important phases of a research, i.e. developing valid measures of the theoretical constructs, and testing the relationships between theoretical constructs. The empirical results used in this paper stem from an investigation that aimed to evaluate the contribution of Shared Knowledge and Information Technology to Manufacturing Performance. Mutual Trust and Mutual Influence, among the collaborating groups (in this case manufacturing, quality and R&D), which were used in our study, as the two antecedents of shared knowledge. For the purpose of this research, an evaluation model was developed and survey data was collected from 51 medium to large size industrial companies with a total of 112 manufacturing groups, representing five industrial sectors (alimentation, automotive, chemical and pharmaceutical, electro-mechanical, and textile), were analyzed to test the model.

The key-informant methodology that has been used for the selection of research responders was tested against threats to validity. As a conclusion, the paper exhibits the implications of the above widely accepted construct validity criteria and specific key-informant validity criteria, building upon the results of the above industrial empirical research. The lessons learned are presented in a way that may lead future organizational researchers to error preventive measures.

Keywords: inter-group collaboration, key-informant methodology, threats to validity, lessons learned

1. Introduction

It is typical for scientific investigations to begin with the formation of the concepts comprising the hypotheses and theory. At a later phase, upon testing the hypotheses, the concepts of 'validity' or 'invalidity' emerge, whenever researchers refer to the best available approximation of the 'truth' or 'falsity' of propositions, including propositions about cause and effect. As Cook and Campbell (1979, p. 37) suggest, the modifier 'approximately' should always be used when referring to validity, since we can never know what is true. This paper examines a set of formal criteria –usually termed construct validity- addressing two issues: the measurement scheme in use and its validity as well as threats to validity in key informant analysis.

Bagozzi (1980) states that "... the observational meaningfulness of concepts refers to the relationship between theoretical variables (which are unobservable) and their operationalizations (which, of course, are observable)" (p. 121). Operational indicators that are observable have been used in the empirical industrial research, upon which this paper is built, as long as we could demonstrate the link to theoretical constructs. In addition, the constructs used have either been validated in previous studies, or systematic pilot-testing was carried out for the constructs introduced for first time.

The methodology used in this paper addresses the most common construct validity issues and provides answers to the question of whether key-informant reports achieve construct validity, by estimating the reliability of each individual informant and modeling measurement error explicitly when testing inter-group relationships.

The rest of this paper is organized as following. In the following section the methodology that has been used for our empirical study is briefly presented. In section three we exhibit the opinion of pioneer researchers who have applied the key-informant methodology and we justify why we have chosen to use this method. In section four we report important findings on threats to validity, with an emphasis on the lessons learned. The last two sections encompass conclusions. We have chosen to briefly present them there as lessons learned

and, right after, in section five to tabulate them as error preventive measures based on the way the certain validity criteria were successfully addressed in our study.

2. The empirical study

The empirical results used in this paper stem from an investigation that aimed to evaluate the contribution of Shared Knowledge (SK) and Information Technology (IT) to Manufacturing Performance (MP). Mutual Trust (MT) and Mutual Influence (MI), among the collaborating groups, have been used in our initial study as the two antecedents of shared knowledge. For the purpose of this research, an evaluation model was developed and survey data collected from 51 medium to large size industrial companies with a total of 112 manufacturing groups, representing 5 industrial sectors (alimentation, automotive, chemical and pharmaceutical, electro-mechanical, and textile), were analyzed to test the model. The key elements of the methodology deployed for that investigation are summarized here below.

Two symmetrical relationship questionnaires, worded in a reverse form, were addressed to Production and Quality or R&D managers -and their assistants- and aimed at portraying the opinion and the attitude of the two collaborating groups towards each other, in reference to sharing knowledge. In addition, the role and level of contribution of Information Technology, both as a tool and/or enabler in supporting sharing knowledge among the collaborating groups, was investigated. A last, ad hoc question evaluated the use of commonly used IT infrastructure for inter-firm knowledge sharing.

A third, performance questionnaire, attempting to measure manufacturing group performance, was addressed to senior managers or their assistants. They were asked to compare the manufacturing group under question to other comparable manufacturing groups they had managed. In addition, the level of contribution of Information Technology to manufacturing group performance was investigated. Again, a last ad hoc question evaluated the use of specific IT functions on four knowledge sharing issues, closely related to the group performance.

Design of the indicators was carried out using two types of measures, for every variable: a general one, where each informant was asked to assess the overall level of interaction for a specific characteristic of a particular relationship; and a multiplicative or interaction measure, where each informant was asked, for example, to assess the role of manufacturing and either R&D or quality group for each characteristic separately. Using the conceptualization of fit as interaction, proposed by Venkatraman (1989), the measurements were operationalized as 'manufacturing role X R&D or quality role', by multiplying the two responses. There are a number of advantages to such a measurement scheme, as indicated by Churchill (1979) and Campbell and Fiske (1959). First, the two types of measures (general and multiplicative) can be thought of as different methods; second, it provides a stronger test for the validity of the measurement scheme, and third, it balances possible threats to validity inherent in either type alone.

Key-informant methodology was used for the selection of our research responders, and path analysis was applied for the testing of the investigation hypotheses that were found to be fully or partially supported, by the degree of significance of the relevant paths, as indicated in Figure 1. IT constructs that were measured with the relationship questionnaires, Type A and B are marked ITsk. Those measured by the performance questionnaire, Type C, are marked ITmp.

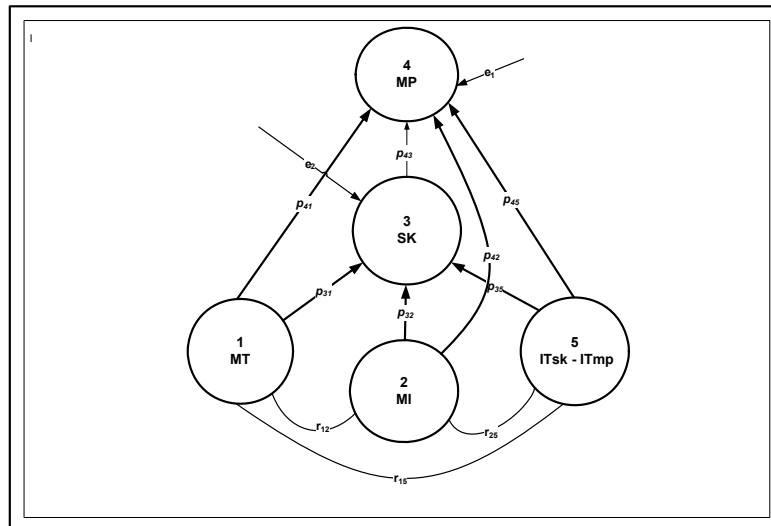


Figure 1: The proposed causal model

Finally, confirmatory tests were conducted in order to further secure the validity of the hypotheses. Three of them are mentioned here, as they are related to threats to validity. Cronbach's alphas were utilized to check the reliability of the instruments used for each of the constructs measured. The MTMM (Multi-Trait Multi-Method) correlation matrix for all construct indicators was used to check convergent and discriminant validity. Finally, analysis of variance was applied on each variable in order to test the homogeneity of variance among the key-informants.

The main research instruments (questionnaires Type A, B and C) are presented in the Appendix together with an example of a construct measurement calculation. Details of the study (the regression equations, the construct measurements, the complete statistical analysis and the confirmatory tests) are presented in the relevant sections and Appendixes of a Doctoral Thesis available in the data base of the UPC (Universidad Politécnic de Catalunya, in Barcelona) at <http://www.tdx.cesca.es/TDX-1019105-081507>.

3. The key-informant methodology

As the measurement of organizational characteristics requires research methods different from those used for measuring the characteristics of individuals, key-informant methodology is a frequently adopted approach. Campbell (1955), by whom the use of the informant has been interpreted as a general social science tool, states that "... the technique of the informant means that the social scientist obtains information about the group under study through a member who occupies such a role as to be well informed but who at the same time speaks the social scientist's language." Campbell considers the use of informants as an alternative sampling technique "... epitomized by the use of one or a few *special* persons who are extensively interviewed and upon whose responses exceptional reliance is placed and, thus, is to be most clearly distinguished from randomly or representatively sampled interviews" (p. 339).

Phillips and Bagozzi (1986) describe the method as "...a technique of collecting information on a social setting by interviewing a selected number of participants. The informants are chosen not on a random basis but because they possess special qualifications such as particular status, specialized knowledge, or accessibility to the researcher" (p. 313). According to the authors, the measurement of group-level properties has often required the use of key-informant method, as a technique for collecting information from a selected number of participants.

Initially the use of key informants was associated with qualitative methodology. In these situations, the key-informant assumes the role of reporting on the behavioral patterns of a group (manufacturing, quality and/or R&D) after summarizing either observed or expected organizational relationships. At a later stage organizational researchers have used the technique to obtain quantifiable information on organizational structure, technology, environment, internal power distribution and external exchange relationships. Phillips (1981), Silk and Kalwani (1982), Phillips and Bagozzi (1986), among others, have often used key-informant methodology in conjunction with procedures for collecting survey data to obtain quantifiable measures on organizational characteristics. In these situations, survey responders assuming the role of key-informants provide information at the combined or collective unit of analysis (i.e. group or organizational properties) rather than reporting personal feelings, opinions, and behaviors.

At an early stage, due to the nature of the investigation, certain concerns aroused from the above literature review over the following potential sources of measurement error in key informant reports:

- Reliability of informant reports may be affected by factors such as the types of questions asked and the personal characteristics of informants.
- Informants may often be asked by the researcher to perform complex tasks of social judgment, instead of answering into simple questions.
- Questions which require an informant to aggregate over many events, persons, tasks, or organizational subunits may increase measurement error due to fatigue effects etc.
- Collection of data from only a single informant per unit of analysis may be regarded as insufficient data collection.

As the primary target was to investigate the relationship among manufacturing, R&D and quality groups, the relationship questionnaires were addressed to managers, and their assistants, of the three groups involved. Research responders were chosen based on the key-informant methodology and two relationship dyads for each one of the 112 manufacturing units, the unit of analysis of this study, were used. In relation to the second target (manufacturing group performance), data has been collected from 'stakeholders' in each company: senior managers or their assistants (general directors, plant managers, technical or quality directors, etc). These stakeholders, positioned at the upper levels of the company organization, were also chosen based on the key-informant methodology, as according to Huber and Power (1985) "... they have important information about organizational events. Their retrospective reports are accounts of facts, beliefs, activities and motives related to prior events." (p. 171).

As an answer to the previously expressed concerns, the following measures were taken in an effort to minimize all above sources of distortion in our investigation:

- Questionnaires were thoroughly checked prior to the investigation's final phase using a pilot questionnaire. This permitted clarification of all possible points of misunderstanding.
- Questionnaires were kept simple and in manageable size: Twelve questions for the inter-groups relationships and only nine for the stakeholders.
- Four informants for every unit of analysis were questioned.
- Questionnaires were customized. The actual department names of every unit and the related group were used, in order to avoid misunderstandings.
- Questionnaires were sent, completed and received in electronic form.

Although the precaution measures did not make participation in the investigation an easy task, they did minimize to a very large extent the number of cases where responders had to get back to the research team for clarifications.

4. Threats to validity and lessons learned

In order to test the proposed model, we had to measure each theoretical construct and analyze the relationships between the measured constructs. This task was completed in two phases: while developing valid measures of the theoretical constructs, and through testing the relationships between theoretical constructs.

In the literature on industrial group relationships, in particular, and in organizational research, in general, a considerable amount of attention is paid to the statistical analysis of the relationships between measured variables, but the objective of measuring validity is only partially carried out (Bagozzi 1980, Cook and Campbell 1979, Churchill 1979, Huber and Power 1985). This practice assumes that the measures are valid and adequately reflect the theoretical constructs under consideration. But, as Phillips and Bagozzi (1986) note, a possible lack of correspondence between the operational measures and the theoretical concepts they are intended to measure may result in the rejection of a hypothesis as either weak or totally absent.

4.1 Bagozzi construct validity criteria

Bagozzi (1980) who defines construct validity "... as the degree to which a concept (term, variable, construct) achieves theoretical and empirical meaning within the overall structure of one's theory" (p. 114), is proposing six criteria or 'components of construct validity':

- Theoretical Meaningfulness of Concepts

- Observational Meaningfulness of Concepts
- Internal Consistency of Operationalizations
- Convergent Validity
- Discriminant Validity
- Nomological Validity

We shall briefly introduce Bagozzi's six criteria while, at the same time, we shall demonstrate the facts or parameters upon which the validity of the constructs used in this study is proved.

The first two criteria of validity involve semantic issues, not statistical tests, and refer to the internal consistency of the language used to represent a construct and the conceptual relationship between a theoretical construct and its operationalization. The theory, upon which this research is based, has derived from previous research on organizational theory (from the resource-based to the knowledge-based theory), so the constructs used are consistent with prior theories.

The third criterion is a strictly empirical one designed to determine the degree of internal consistency which requires more than one observational indicators or variables for each theoretical construct. The most commonly used summary statistic of internal consistency is the Cronbach's *alpha* coefficient. For attitudinal measurements, Cronbach's *alphas* above 0,6 are generally considered acceptable, whereas Nunnally (1978) suggests the adoption of a higher cutoff value of 0,7 in cases where these instruments have been adopted previously, as in our case. When this minimal level of internal consistency is not achieved, the implication is that these variables could be measuring more than one construct, a threat we did not face in this study as all *alphas* were found above 0,78.

Criteria number four and five, are traditional objects of the Multi-Trait Multi-Method Matrix (MTMM) approach. Convergent validity refers to the degree to which two or more measures of the same theoretical construct are in agreement. Discriminant validity refers to the degree to which one theoretical construct differs from another. Campbell and Fiske (1959) proposed a Multi-Trait Multi-Method matrix to assess convergent and discriminant validity of data gathered on multiple traits (theoretical constructs), using maximally dissimilar methods such as self report and unobtrusive observation. To assure that convergent validity and discriminant validity have been achieved in an empirical study, researchers should use more than one theoretical constructs and more than one method. Unfortunately, in many areas of organizational relationships research, multiple methods of measuring a theoretical construct are not applied, although most studies do include more than one theoretical construct.

As already mentioned, in our study we used two different methods and at least two constructs for each variable. The criterion for convergent validity is that the correlation between measures of the theoretical construct should be different from zero and significantly large to encourage further investigation. The criterion for discriminant validity is that a measure should correlate with all measures of the same theoretical construct higher than it does with any measure of another theoretical construct. Both criteria are successfully met in this study.

Bagozzi's final component of construct validity is nomological validity which refers to the degree to which predictions from a formal theoretical network containing the concept under scrutiny are confirmed. Nomological validity can be interpreted as whether one's own theory, once it has been found semantically and empirically valid, is consistent with a wider body of theory and whether it contributes to that theory. Assessment to nomological validity takes place with reference to related research. The theoretical background of our research is founded upon the resource- and knowledge-based theory of the firm (Wernerfelt 1984, 1995; Prahalad and Hamel 1990; Grant 1997).

4.2 Cook and Campbell construct validity criteria

Cook and Campbell (1979, pp. 37-39) focus on four types of validity threats for, what they call 'quasi-experiments' and is more universally understood as empirical methods:

- Statistical Conclusion Validity
- Internal Validity
- Construct Validity
- External Validity

Although they consider all four criteria of equal importance, they recognize a "... special stress on internal validity" (p. ix). We shall briefly introduce Cook and Campbell's four criteria, and at the same time we shall compare them with the ones of Bagozzi. We shall also indicate the facts or parameters which reveal the validity of the constructs used in this study.

Statistical conclusion validity refers to conclusions about whether it is reasonable to presume covariation between two variables, given a specific probability level (i.e. 0,05, or 5 per cent) and the obtained variances. Threats to statistical conclusion validity are threats to drawing valid conclusions about whether two variables covary. These threats closely correspond to Bagozzi's criterion of internal consistency and add an explicit focus on the assumptions underlying the statistical techniques used. In our study, statistical conclusion validity is addressed by employing multi-item scales tested with Cronbach's *alphas*.

Internal validity is a criterion that does not appear in Bagozzi's framework. Internal validity includes the consideration of alternative explanations –other than the theory being tested– which might account for study consequences such as selection bias, historical reasons, etc. Cook and Campbell (1979, pp. 51-55) list a vast number of threats to internal validity that apply both to randomized and quasi experiments. The ones most suitable to empirical studies, like this, are: history; instrumentation (i.e. changes in the measuring instrument: the questionnaire, in our case) and selection (i.e. differences between the people in one group as opposed to another). In this study, it is addressed by the variety of industry sectors, companies and units of analysis as well as the range of management levels that key- informers derive from.

Construct validity, for Cook and Campbell (1979), refers to the possibility that the operations which are meant to represent a particular cause or effect construct can be constructed in terms of more than one construct. It plays an especially crucial role in empirical experiments which only aim to test causal propositions. The criterion of construct validity is well covered by Bagozzi's six criteria and it has already been addressed as such, in this study.

External validity refers to the approximate validity with which we can conclude that the presumed causal relationship can be generalized to and across different types of organizational settings, persons, and times. As the issue of external validity is not addressed by Bagozzi we have relied upon Cook and Campbell (1979, pp. 73-74) who are listing three threats to external validity in terms of statistical interaction effects. Interaction of selection and treatment –or method, in our terminology- relates to the categories of persons (i.e. social, geographical, or personality groups) on which a cause-effect relationship can be generalized. Interaction of setting and treatment (method) is of particular relevance to our study, as its settings are on such different levels as the organization, the group, and the individual. Finally, interaction of history and treatment (method) relates to the periods in the past and future that a particular causal relationship can be extrapolated. As this study focuses on industrial organizations, the above threats have been addressed by selecting a variety of sectors and implementing easy-to-understand questionnaires in relevantly 'similar' groups. As our sample could not be a random one, the self-selection bias can not be totally dismissed.

As our investigation is heavily built upon the key-informant methodology, we consider it appropriate to discuss one more set of validity criteria that focus on this specific method.

4.3 Huber and power key-informant validity criteria

A number of threats to validity simply exist due to the very use of key-informants. Unlike the respondent method which requires the respondent to report about himself or herself, the collection of data on group properties or relationships from individual key-informants may introduce considerable measurement errors. This occurs because questions which require a person to combine data on many events, persons or tasks may place unrealistic demands on survey responders (Silk and Kalwani, 1982; Philips and Bagozzi, 1986). Huber and Power (1985, pp. 172-174) have identified the following three criteria, each one corresponding to a threat to validity.

- Motivator Barrier
- Perceptual and Cognitive Limitations
- Lack of Information

We shall briefly introduce Huber and Power's three criteria and we shall indicate the facts or parameters which reveal the validity of the constructs measured in this study.

Motivator Barrier: Huber and Power claim that key-informants may believe that providing certain information could have an undesirable impact on their careers. To a certain extent, this constitutes a bias in the form of a motivation barrier to their participation and they suggest that investigators should remove as many motivational ‘disincentives’ to participation as possible. These suggestions have been considered very seriously, no self-report was included and strict confidentiality was guaranteed to every key-informant, who e-mailed his/her responses directly to the research team.

Perceptual and cognitive limitations are, according to Huber and Power the second reason for biased or inaccurate reports. Since key-informants are asked to provide the researcher with group-level properties, this can increase the burdens of their information processing activity. They suggest that investigators should use pre-tested questions that should, at the same time, be as specific and simple as possible. In this study the validity of a number of the questions used have been previously tested and the ones specifically invented for this research have been pilot tested.

Lack of information is the third source of data inaccuracy, as in many studies researchers do not select those key-informants whose positions give them access to the required information. Often key-informants are chosen because of their proximity to the researcher. In this study, all key-informants were senior members of the groups of which the relationships were to be measured and, thus, they were very well informed about the constructs under investigation.

5. Conclusions

The research experiences presented in this paper aim to provide a basis for assessing the construct validity of empirical research using key-informant methodology for the measurement of organizational properties among collaborating groups. It is true that previous research has significantly improved methodology in situations where individuals constitute the unit of analysis. Little work, though, has been done to apply the same standards for valid inference to situations where more complex units of analysis are involved, as it is the case with the manufacturing unit, in this research. This paper contributes to the resolution of this problem by providing guidelines for assessing the validity of measures of organizational properties of industrial groups obtained through key-informant methodology.

As already explained in the introductory section, we have chosen to briefly present the lessons learned through this research in sections three and four. In this section we are tabulating our conclusions either as error preventive measures or as ways by which the three, above examined, validity criteria have been successfully addressed in this study. Recommendations and lessons learned are tailored to each one of the three validity criteria.

5.1 Bagozzi construct validity criteria

As Bagozzi (1980) clearly states, referring to his criteria: “The achievement of construct validity (...) requires satisfaction of all six of the above criteria.” (p. 114). That means that after empirical research is undertaken, the internal consistency of operationalizations, convergent validity, discriminant validity, and nomological validity criteria should be ascertained before the relationships among theoretical construct are analyzed on the basis of the empirically measured constructs. Table 1 summarizes Bagozzi’s criteria and briefly indicates how these have been applied in this research.

Table 1: Bagozzi’s Criteria and how addressed in our study

Bagozzi’s Six Criteria	How Addressed in our Study
Theoretical Meaningfulness of Concepts	Built upon the emerging discipline of the firm’s resource- and knowledge-based theory.
Observational Meaningfulness of Concepts	Used previously validated measures, together with new measures that had been pilot tested.
International Consistency of Operationalizations	Employed multi-item scales and tested with Cronbach’s alphas
Convergent Validity	Employed multi-methods and tested with MTMM (Campbell and Fiske, 1959)
Discriminant Validity	Employed multi-methods and tested with MTMM (Campbell and Fiske, 1959)
Nomological Validity	The results of the study are consistent with a large body of theory and contribute to the reference field

5.2 Cook and Campbell construct validity criteria

Table 2 summarizes Cook and Campbell's criteria and briefly indicates how these have been addressed in this research.

Table 2: Cook and Campbell's criteria and how addressed in our study

Cook and Campbell's Criteria	How Addressed in our Study
Statistical Conclusion Validity	Employed multi-item scales and tested with Cronbach's alphas
Internal Validity	Cross-sectional study, variety of industry types (5 sectors, 51 companies, 112 manufacturing units)
Construct Validity	Tested by the six Bagozzi's criteria
External validity	Variety of organizations and industries, still degree of generalization is low due to self-selection bias. (Use of random sample was impossible.)

The analysis and comparison of the above two sets of criteria indicates that there is a significant overlap between them, although they both make unique contributions. Specifically, there are several areas where Cook and Campbell add to Bagozzi's criteria and for this reason it is important to consider both the Bagozzi and the Cook and Campbell sets of validity criteria upon designing research to test theories.

5.3 Huber and Power key-informant validity criteria

Table 3 summarizes Huber and Power's criteria and briefly indicates how these have been addressed in this research.

Table 3: Huber and Power's criteria and how addressed in our study

Huber and Power's Criteria	How Addressed in our Study
Motivator Barrier	No self-report included and guaranteed strict confidentiality
Perceptual and Cognitive Limitations	All questions anchored to group relationships and pilot-tested
Lack of Information	All key-informants were members of the group under investigation All stakeholders (for the performance questionnaire) have had relevant experience.

We believe that the above tabulation format facilitates future researchers to benefit from the lessons we have learned on threats to validity issues related to the use of key-informant methodology in empirical studies that focus on the organizational characteristics of collaborating groups.

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Appendix: Research Instruments

1. **Relationship questionnaires** (Type A and B) included twelve questions aiming to measure:

- dependent or mediating variable Sharing Knowledge (3 questions)
- independent variable Mutual Trust (2 questions)
- independent variable Mutual Influence (4 questions)
- the role and level of contribution of Information Technology (ITsk),
- both as a tool and/or enabler in supporting sharing knowledge
- among Manufacturing, Quality and/or R&D groups (2 questions)
- the use of IT infrastructure –under the above described concept
- (1 question with multiple sub questions)

2. **Performance questionnaire** (Type C) included nine questions aiming to measure:

- operational manufacturing performance (3 questions)
- service manufacturing performance (3 questions)
- the level of contribution of Information Technology (ITmp)
- to Manufacturing group performance (2 questions)
- the use of IT functions –under the above described concept
- (1 question with multiple sub questions)

3. An example

The Mutual Trust Construct measurement, using two indicators, is presented as an example here below. The two indicators of predisposition measure the extent to which the two partner groups trust each other. The first indicator directly assesses the level of trust between the groups, through a general assessment. The second indicator is a multiplicative assessment that evaluates the reputation of each group for meeting its commitments.

Mutual Trust Indicator 1:

(General Assessment, Mean 5,4509; SD 0,8620; Range 4)

A4/B4. The level of trust that exists between the [Manufacturing] group and the [Quality or R&D] group is:

- A4: Mean 5,54464; SD 1,10599; Range 5
- B4: Mean 5,35714; SD 0,92860; Range 4

Mutual Trust Indicator 2:

(Multiplicative Assessment, Mean 28,304; SD 8,374; Range 43)

The product of the responses to the following:

- A5. The reputation of the [Quality or R&D] group for meeting its commitments to the [Manufacturing] group is: Mean 5,44643; SD 0,96646; Range 4
- B5. The reputation of the [Manufacturing] group for meeting its commitments to the [Quality or R&D] group is: Mean 5,13393; SD 0,97256; Range 6

Mutual Trust Construct:

The mean of the above indicators, Mean 16,877; SD 4,452; Range 21,5

Note: Questionnaire items for shared knowledge, mutual trust and mutual influence used in our study had been validated and used by Nelson and Coopriider (1996) upon exploring the concept of shared knowledge between Information Systems (IS) groups and their line customers as a contributor to IS performance.

Relationship Questionnaire (Type A)

(Manufacturing)

Please characterize the general working relationship that currently exists between the [Manufacturing] group and the [Quality or R&D] group.

Use the following scale to measure constructs:

1	2	3	4	5	6	7
Extremely Weak	Weak	Moderately Weak	About Average	Moderately Strong	Strong	Extremely Strong

- The level of appreciation that the [Manufacturing] group and the [Quality or R&D] group have for each other's accomplishments is:
- The level of understanding of the [Quality or R&D] group for the work environment (problems, tasks, roles, etc) of the [Manufacturing] group is:
- The level of appreciation that the [Quality or R&D] group has for the accomplishments of the [Manufacturing] group is:
- The level of trust that exists between the [Manufacturing] group and the [Quality or R&D] group is:
- The reputation of the [Quality or R&D] group for meeting its commitments to the [Manufacturing] group is:
- In general, the level of influence that members of the [Manufacturing] group and the [Quality or R&D] have on each other's key decisions and policies is:
- In general the ability of members of the [Manufacturing] group and the [Quality or R&D] group to affect each other's key decisions and policies is:
- In general, the level of influence that members of the [Quality or R&D] group have on key decisions and policies of the [Manufacturing] group is:
- In general, the ability of members of the [Quality or R&D] group to affect key policies and decisions of the [Manufacturing] group is:
- In general, the role and the level of contribution of Information Technology (IT) as a tool and/or enabler, to support shared knowledge between [Manufacturing] group and [Quality or R&D] group is:
- In general, the use of the Information Technology (IT) infrastructure in the [Manufacturing] group is:

12. Specifically, the use of the following IT infrastructure is:

Intranet Extranet Groupware , Workflow
 Internet , e-mail , ,
 Data warehouse ,
 Other ,

Relationship Questionnaire (Type B)

(Quality or R&D)

Please characterize the general working relationship that currently exists between the [Quality or R&D] group and the [Manufacturing] group.

Use the following scale to measure constructs:

1	2	3	4	5	6	7
Extremely Weak	Weak	Moderately Weak	About Average	Moderately Strong	Strong	Extremely Strong

- The level of appreciation that the [Quality or R&D] group and the [Manufacturing] group have for each other's accomplishments is:
- The level of understanding of the [Manufacturing] group for the work environment (problems, tasks, roles, etc) of the [Quality or R&D] group is:
- The level of appreciation that the [Manufacturing] group has for the accomplishments of the [Quality or R&D] group is:
- The level of trust that exists between the [Quality or R&D] group and the [Manufacturing] group is:
- The reputation of the [Manufacturing] group for meeting its commitments to the [Quality or R&D] group is:
- In general, the level of influence that members of the [Quality or R&D] group and the [Manufacturing] have on each other's key decisions and policies is:
- In general the ability of members of the [Quality or R&D] group and the [Manufacturing] group to affect each other's key decisions and policies is:
- In general, the level of influence that members of the [Manufacturing] group have on key decisions and policies of the [Quality or R&D] group is:
- In general, the ability of members of the [Manufacturing] group to affect key policies and decisions of the [Quality or R&D] group is:
- In general, the role and the level of contribution of Information Technology (IT) as a tool and/or enabler, to support shared knowledge between [Quality or R&D] group and [Manufacturing] group is:
- In general, the use of the Information Technology (IT) infrastructure in the [Quality or R&D] group is:
- Specifically, the use of the following IT infrastructure is:
 Intranet Extranet Groupware , Workflow
 Internet , e-mail , ,
 Data warehouse ,
 Other ,

Performance Questionnaire (Type C)

(Organizational Stakeholders)

The following questions ask you to compare the [Manufacturing] group to other such Manufacturing groups. In relation to other comparable groups you have observed, how the [Manufacturing] group rates on the following.

Use the following scale to measure constructs:

1	2	3	4	5	6	7
Non – Existant	Very Weak	Weak	About Average	Strong	Very Strong	Extremely Strong

1. In general, the quality of the work produced for the [Quality or R&D] group by the [Manufacturing] group is:
2. In general, the ability of the [Manufacturing] group to meet its organizational commitments (such as project schedules and budget) is:
3. In general, the ability of the [Manufacturing] group to meet its goals is:
4. In general, the ability of the [Manufacturing] group to react quickly to the [Quality or R&D] group's changing business needs is:
5. In general, the responsiveness of the [Manufacturing] group to the [Quality or R&D] group is:
6. In general, the contribution that the [Manufacturing] group has made to the accomplishment of the [Quality or R&D] group's strategic goals is:
7. In general, the level of the Information Technology (IT) contribution to the [Manufacturing] group performance is:
8. In general, the use of the Information Technology (IT) infrastructure, between the three groups is:
9. Specifically, the use of the following IT function is:
 - Coordinating business tasks: (collecting, facilitating, sharing, etc. information)
 - Supporting decision making: (reaching the right information at the right time)
 - Facilitating member' team to work together: (no matter where they are)
 - - Facilitating access of information in Data Bases: (no mater where they are)
 - - Other:
 - - Other:

Note for all three questionnaires: In every question, titles in brackets were customized to reflect the exact names of the participating organizations and functional groups, as they are used in every firm.

Mapping Social Networks among Crystallographers in South Africa

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Abstract: The author adopts the premise that technological innovation, a critical factor in the long-term economic growth of any country, can only function successfully within a social environment that provides relevant knowledge and information inputs into the innovative process. This is dependent on the efficient transfer and communication of knowledge and information which in turn relates to the amount and quality of interaction among scientists and technologists. These factors prompted a research project that used social network analysis techniques to investigate knowledge exchange and to map the knowledge network structure and communication practices of a group of scientists engaged with crystallographic research. This paper is based on this research project.

The findings provide clear evidence of a strong social network structure among crystallographers in South Africa. A core nucleus of prominent, well connected and interrelated crystallographers constituted the central network of scientists that provided the main impetus to keep the network active. This eminent group of crystallographers were not only approached far more frequently for information and advice than any of their colleagues, but they also frequently initiated interpersonal and formal information communication acts. It was clear that this core group had achieved a standard of excellence in their work, were highly productive; very visible in their professional community and they generally played a pivotal role in the social network. They generally maintained a high professional profile in the crystallography community and within the general field of science, published profusely, and generally emerged as the archetypal sociometric stars in their field. It is thus clear that high productivity, professional involvement, innovation capacity and network connectivity are intricately interwoven.

The crystallographers' work environment and concomitant work structure clearly affected network interaction. Working in a group structure stimulated network interaction, professional activity and productivity. A further benefit was that the leaders of these groups generally assumed gatekeeper roles that facilitated networking and ensured the importation and interpretation of new information and knowledge. It was clear that social networks operate more effectively in areas, such as Gauteng, where a sufficient number of scientists were amassed.

Keywords: knowledge transfer; information communication; social networks; crystallographers; scientists

1. Introduction

It is this author's conviction that technological innovation is a critical factor in the long-term economic growth of any country. Specifically, if South Africa wishes to compete and even survive in the prevailing competitive and globalised economy it is in urgent need of developing its science and technology endeavours. Concerted efforts should thus be made to create an environment that promotes scientific and technological innovation and development. It is further argued that this can only occur within a social environment that provides incentives and relevant knowledge and information inputs into the innovative process. This, in turn, is largely dependent on the efficient transfer and communication of knowledge and information which is directly related to the amount and quality of interaction among scientists and technologists. The escalating growth of scientific and technological enterprise over the last few decades has however resulted in a concurrent growth in and greater complexity of the communication process and this, in turn, has impacted on the effectiveness of information and knowledge exchange in science and technology.

All these factors thus prompted the author to study the efficacy of the communication process among a defined group of scientists in South Africa and this paper is based on the resultant research project.

2. Key concept clarification

Data, information and knowledge are viewed as points along a continuum of increasing value and human contribution. Data is equated to the lowest level of known facts with no intrinsic meaning. If organised, and structured they become information. Knowledge, in turn, implies that human intervention has taken place that interprets, understands, and adds value and meaning to information.

Science is that branch of knowledge that is based on objective principles which are primarily concerned with the functions of the physical world. It is regarded as the generic term that incorporates both *basic* and *applied science*, with the former denoting the more theoretical aspects and the latter the practical applications of science. *Crystallography*, in its general sense, relates to the study of the structure and arrangement of all

substances by means of various scattering methods. The utilisation of crystallography ranges from its application in technology to its use in basic science.

3. The communication process in science

The ability of all scientists to contribute to the advancement of science depends to a large extent upon the amount and quality of their interaction with fellow scientists. Science, furthermore, is cumulative and each scientist builds on the work of colleagues and predecessors and in the process the body of knowledge in the field grows as each scientist imparts his/her unique contribution to the broader science community. Several studies have, therefore, indicated that scientists spend a far larger proportion of their time on information and knowledge communication activities than most other workers (Gläser 2003; Eisend 2002; Hertzum & Pejtersen 2000).

Scientific endeavour is essentially a corporate activity and a distinctive feature and accepted social norm is the notion of a shared commodity that belongs to everyone (Ziman 2002). Gläser (2003) for example argues that scientific communities constitute a “distinctive mode of collective production which is characterized by decentralized action coordination” and based on this premise communication in science is thus not merely the exchange of previously produced knowledge, but “the transmission of material and components between producers”.

Eisend (2002) specifically distinguishes between individual cognition and scientific cognition where the latter relates to the transfer of knowledge in the scientific community after it has been validated and integrated into the body of verified knowledge. He further differentiates between the communication of content and the social and inter-personal dimension of the communication act. It is thus evident that in addition to dependence on the formal structure of knowledge, scientists value informal, interpersonal communication. The important role of interpersonal communication networks has been highlighted by a number of researchers, ranging from the groundbreaking work by Price (1961) on *invisible colleges* to a series of later investigations (Hertzum and Pejtersen 2000). The value of interpersonal communication lies in the interactive nature of the exchange process, the stimulation of collegiate interaction and the provision of an ideal forum to debate and evaluate ideas amongst peer groups. Such social networks assist with “the production of knowledge, dissemination of ideas, reputation building and growth of intellectual fields” (Fry 2006)

A number of studies have further indicated that there is a positive correlation between the intensity of collegiate communication and performance and that performance increases if informal communication links are encouraged (Tenopir and King 2004). Bathelt and others (2004) found that individuals (and even organisations) participating in network associations are more effective and innovative and Crane's (1972) study specifically showed an exponential increase in publication output when high levels of inter-personal interaction were maintained. There appears to be a distinct difference in the way that applied fields of knowledge and the basic fields communicate. According to Salasin and Cedar (1985) communication links in basic science occur horizontally by means of well-developed person-to-person networks, frequently crossing organisation and discipline boundaries and usually among peers of equal levels of expertise. Applied fields again tend to communicate vertically by exchanging knowledge and information between researchers, practitioners, and others through several different levels of expertise and communication is often constrained within the organisation due to confidentiality restrictions. To overcome the various communication barriers in applied fields, 'middlemen' (or gatekeepers) have thus evolved that bridge organisational and disciplinary boundaries to import and transfer appropriate knowledge and information to all levels in an organisation (Allen 1977).

A further distinction is that publication is regarded by the basic science community to be the culmination of creative effort and the end-product of the research process. This transfer of knowledge into the public domain underpins and drives the communication process (Hurd 2000). The end-product of applied science research, on the other hand, may in many instances never be published, and is often converted directly by industry into new procedures or products or into licences and patents for production purposes. The aim in applied science research is to provide the best solution to a problem. Another distinguishing factor is the difference in work environments. Applied scientists are generally employed by organisations that are profit motivated and the restrictions this imposes generally impedes the free flow of knowledge and information and often prevents the formation of cross-boundary social networks.

3.1 Social networks, elitism and gatekeepers

While it is reputed that Robert Boyle first used the concept *invisible colleges* to describe scientific meetings held in England in the 1640's, the modern use of the term with reference to social networks can first be attributed to Price (1961). The premise is that in each circumscribable area of basic science there exists a group of people, usually engaged in cognate research areas, who communicate often and intensively with each other. Such a network thus acts as a social circle of scientists brought together by their common research interests. Members are usually very productive and contribute materially to research in their field, not merely on a national scale, but also internationally. These scientists meet at select conferences, commute between research centres, collaborate, and often seek each other out to obtain information before searching the literature.

It has further been suggested that these networks are held together by the eminent leaders in the field and these *sociometric stars* or *elites* create a *gravitational force* that holds the field together and improves communication within their *invisible college*. Amick (1973) was one of the first persons who attempted to prove the premise that there is a positive relationship between scientific elitism and communication in basic science. It is presumed that scientific elites are intimately involved with (and often have control over) the scientific communication system and that they tend to cluster at the *basic* end of the basic to applied science continuum.

These elites comprise the eminent men of science who have been accorded recognition in their disciplines, they have achieved a standard of excellence in their work, they are highly productive, and are generally highly visible in their professional community. They process more information and have more narrowly defined and less diffuse research interests than their 'non-elite' counterparts. Allen and his colleagues first identified the *technological gatekeeper* as the intermediary in an organisation who indirectly ensures the flow of outside information into the organisation and the subsequent dissemination of that information within the organisation (Allen 1977). *Gatekeepers*, thus, accomplish the important function of coupling the organisation to outside activity and Bathelt and others (2004) have stated that "the role of internal gatekeepers and boundary spanners becomes crucial for translating externally produced knowledge into a form that can be internally understood within the organisation". *Gatekeepers* thus play a particularly significant role in closed environments and in situations where cognitive congruence is lacking among members of a group. They generally hold key positions in an organisation; are well integrated into both domestic and international networks; and they have the ability to cut through communications barriers that prevail in industry. By maintaining contact among themselves, they increase their effectiveness as linking agents. In this way a two-step information flow process is created by means of which the average worker in industry is enabled to stay abreast with external technological developments.

3.2 Pressure on the system

It is clear that the system of scientific communication that has evolved over several centuries is now undergoing a transformation catalysed by a number of environmental, economic, and structural factors. Of the most pervasive are those caused by the effect of increased collaborative practices, increasing specialisation and growth in interdisciplinary fields, the exponential growth rate of information and the concomitant information overload; ever changing and often decreasing funding models, and structural changes in employing organisations (Correia and Teixeira 2005, Hurd 2000). The effect of all these factors is further compounded by the electronic environment that we live in. The ubiquitous adoption of information technology has affected the communication system in a number of ways, ranging from new modes of one-to-one communication to electronic modes of publication, to the impact of the Internet and the World Wide Web (Smith 2007). The question thus arises to what extent these factors have affected communication behaviour in science. Has it created fundamental qualitative and quantitative changes to the process and affected behavioural patterns, or has it been absorbed by science communities as many other innovations have in the past? The author is further of the opinion that South Africa presents a number of unique environmental, socio-political and other factors that could impact on the communication process.

4. The empirical study

Social network analysis techniques (employing both qualitative and quantitative approaches) were used to investigate information transfer and knowledge exchange and to map social network structures amongst a group of scientists engaged with crystallographic research in South Africa. The decision to select this research community was based on the fact that these scientists manifested a variety of attributes that ranged from the various ways that they applied crystallography (the basic study of the field [the *pure* crystallographers], its utilisation as an analytical tool in various areas of science, and its application in industry), to variation in

their work environments (universities, research institutes, and R & D facilities in industry). A longitudinal research design was adopted and data was first collected in 1990/1 and again in 2001/2 to establish trends and changes over the designated time span. The International Union of Crystallography's *World directory of crystallographers* (1986; 1997) was selected as the appropriate sampling frame from which the study sample was selected. There was a 65% communality between the first study population of 80 crystallographers and the second group of 78 respondents. Data was collected by means of a series of focus group interviews, personal interviews, telephone interviews and e-mail questionnaires.

5. Findings of the study

5.1 Interpersonal communication

To obtain a picture of the dynamics of the communication process within the South African crystallographic community, the respondents were questioned on the personal contacts that they maintained and received with respect to their work situation. From this data a matrix was created for both studies. The contacts to crystallographers listed in the *World directory of crystallographers* were identified and a distinction was drawn between South African and foreign contacts. The total number of contacts as well as the average number of contacts for each category is represented in Table 1. It is clear that the level of interpersonal communication, and particularly the contacts maintained abroad, had increased from the first to the second study (the t-test for two dependent samples indicated significant results at $p \leq .05$). The increases in interpersonal communication in the second study can mainly be explained by the greater international mobility of South Africans since 1994, the general move to global interaction and collaboration, and the ubiquitous use of electronic modes of communication that has made communication over long distances feasible and far more affordable. It is further evident that the largest proportion of contacts was maintained between the crystallographers in South Africa (i.e. interaction between the respondents). In 2001/2 this was followed by contacts maintained with listed crystallographers abroad, while in 1990/1 the ratios were almost equal for the other three categories of contacts.

Table 1: Interpersonal contacts

TABLE 1. INTERPERSONAL CONTACTS						
	Sum	% of Total	Mean	Min	Max	Std.Dev.
1990/1 Data (valid N = 80)						
CONTACTS MADE						
Contacts made in SA	312	58	3.9	0	15	3.06
Contacts with SA Crystallographers	200	37	2.5	0	9	2.27
Contacts made abroad	223	42	2.8	0	12	2.8
Contacts: Crystallographers abroad	104	19	1.3	0	10	2.43
Total contacts with Crystallographers	304	57	3.8	0	18	3.61
Total contacts made	535	100	6.7	0	27	5.08
CONTACTS RECEIVED	205	38	2.6	0	25	4.45
2001/2 Data (valid N = 78)						
CONTACTS MADE						
Contacts made in SA	309	52	4.0	0	20	3.12
Contacts with SA Crystallographers	202	34	2.6	0	10	2.48
Contacts made abroad	284	48	3.6	0	18	4.09
Contacts: Crystallographers abroad	156	26	2.0	0	10	3.46
Total contacts with Crystallographers	358	60	7.6	0	22	5.13
Total contacts made	593	100	4.6	0	32	6.33
CONTACTS RECEIVED	239	40	3.1	0	29	4.87

Descriptive Statistics: Contacts maintained 1990/1 & 2001/2

5.1.1 Interpersonal communication according to sub-categories of the population

It was found that when the data for the two studies were further analysed according to the various sub-categories of the population and the different categories of interpersonal communication that the pattern of increased contact levels in 2001/2 was maintained for all sub-categories. ANOVA/MANOVA tests were further conducted to establish the effect of the independent variables on the dependent variables and it was seen that variation in work environment, work structure, position, age and qualification had all produced significant results ($p \leq .05$). The respondents in industry, closely followed by those at the research institutes, were generally more active in initiating and maintaining interpersonal communication links than their counterparts at the universities. The only instance where this pattern changed was for contacts with foreign crystallographers where the research institute respondents, followed by the university crystallographers, initiated more contacts. The situation is, however, reversed when the data relating to contacts received is examined. It is abundantly clear that the university respondents received by far the most contacts (the research institute respondents received approximately half and the industry respondents a quarter of the contacts that they received). Comments made during the interviews indicated that the industry respondents were very conscious of their closed work environments and their need to import new knowledge and to actively seek out scientists at the forefront of research in their field. The research institute environment was,

again, resolute that their scientists should interact with leading scientists both locally and abroad. It is thus clear that while there was a need for the other two environments to network so that they could tap into external expertise and knowledge, the university scientists were more self-reliant.

The type of work structure clearly affected interaction: the respondents who worked in more structured and group-forming environments were collectively the more active communicators and were approached by other crystallographers more frequently. The respondents working in unstructured groups ranked second, while those respondents who worked on their own made and received the least number of contacts. These results, together with observations made during the interviews, suggest that working in a group structure stimulates interpersonal communication and the flow and exchange of knowledge. The effect of qualification levels on communication showed that interpersonal interaction was at the lowest level for those respondents with the lowest qualifications and at a far higher level for the respondents with a doctorate. An interesting observation is that the respondents who held foreign doctorates were slightly more active in instigating contacts in South Africa, while the respondents with local doctorates maintained slightly more contacts with local crystallographers and received more contacts. This latter aspect can be attributed to the fact that all but one of the eight crystallographers that emerged as the leaders in the field held South African doctorates.

A strong correlation further emerged between the level of seniority of the respondents and interpersonal communication: the more senior the respondents, the more they received and initiated communication acts. This is not surprising as one would expect the more junior researchers to depend on their senior colleagues to maintain external links, interact widely and import new knowledge. When the data was analysed according to age categories, it emerged that interpersonal communication was at the highest level for the middle age category (36-50), followed by the oldest age group. This was an unexpected outcome since one would have expected that interpersonal networks are built up over time and thus with increase in age.

5.1.2 *The geographical spread of interpersonal communication*

When the geographical spread of communication activity was analysed it was seen that interaction was far higher in Gauteng and this would suggest that this area contained a sufficient critical mass of expertise in the field to obviate the need to communicate extensively outside the area. The respondents in all the other areas communicated far more widely with persons outside their own area. This could also be partially attributed to the fact that all the research institutes and the majority of the industries in the study were situated in Gauteng (the universities, however, were more evenly distributed throughout South Africa).

5.2 Active communicators

It further surfaced that there was a relatively small nucleus of crystallographers (approximately 25% of the population for both studies) who were the most active communicators and who were driving the communication process. Within this group eight crystallographers (approximately 10% of the population for both studies) further stood out as being even more highly connected and vigorous communicators. In Chart 1 the difference in intensity and level of interaction between the active crystallographers (top 25% and 10%) are compared with that of the population aggregate and it can clearly be seen that the core groups received and instigated far more exchanges than the population aggregate. It was further seen that a substantial majority of the contacts that were maintained were to listed crystallographers and that over half of these were South African (both studies). The identification of this core body of highly active communicators within the crystallographic fraternity would thus suggest the presence of an *invisible college* phenomenon within this community (cf. also Map 1 (Fig 2). that illustrates these links).

Chart 1. Comparison of contacts maintained & received
N 1990/1 = 80, N 2001/2 = 78

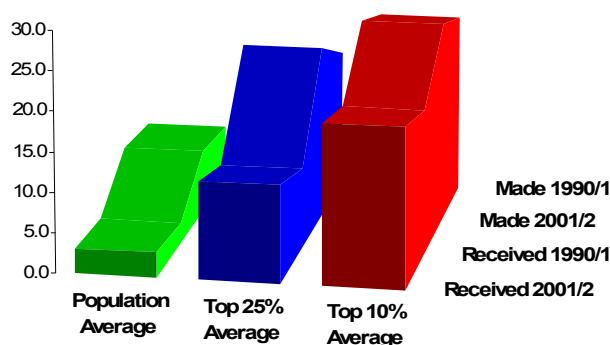


Figure 1: Comparison of contacts maintained and received

The nucleus of crystallographers who received the most contacts mostly worked at universities, usually in either a formal or loosely structured group, they were almost all basic scientists who were either 'pure' crystallographers (in chemistry or physics) or used it as a 'tool' (in chemistry, geology, or biology). Almost all of these respondents were in senior positions in the 36-50 age category with slightly more holding South African than overseas doctorates. The majority worked in Gauteng. This profile varied only slightly between the two studies and it was seen that there was a 75% correspondence between the central networks of the two studies.

When the profile of the core group of crystallographers who received the most contacts is compared with that of the respondents who initiated the most communication acts, a number of differences surface. The active communication initiators were far more equally distributed among the three work environments and as a consequence there was a shift away from a preponderance of respondents conducting *pure* crystallographic research and using it as an analytical tool in basic science, to those who applied crystallography in industry and the research institutes. The subject distribution thus also shifted more towards the applied disciplines such as materials science and mineralogy. Even more of this category worked in structured groups and none on their own. This category also mostly held senior positions (with only a slight shift to the middle position) and the predominant age was even more embedded in the 36-50 age category. There was further a shift to a large majority with South African doctorates and again most worked in Gauteng. There was hardly any variation between the two studies for this data.

The eight most highly connected crystallographers were contacted considerably more frequently than the other members of the central network and they generally also appeared to be the most prominent members of the crystallography fraternity. The membership of this nucleus of very active crystallographers did not vary between the two studies and they all held senior positions, mostly headed structured groups (6), or were leaders of unstructured groups (2), three held overseas doctorates and five held local doctorates, they were mostly between 36 and 50 years of age (there was a slight shift to the older age category in the 2nd study), they mostly conducted *pure* crystallographic research at universities, mostly worked in the field of chemistry and they were mostly located in Gauteng. Of these eight respondents, one crystallographer emerged as the person who was by far the most frequently approached for advice in general. A number of respondents referred to him as the "doyen" crystallographer in South Africa. This 'doyen' crystallographer and the other seven dynamic communicators all served on a number of important boards, committees, etc. within the general field of science, they were actively involved in their professional associations and played a leading role in these institutions, they published profusely, they served on editorial committees, were sought out for external examining purposes and generally emerged as the archetypal 'sociometric stars' in their field.

To graphically depict the interpersonal interactions that were maintained between the core actors in the crystallography community in South Africa a social network map was constructed using the CmapTools software (see Fig 2.).

The map indicates the key players as nodes and the linking lines the strength (thickness of the line) and direction (arrow and commentary) of the interaction. The nodes are shape- and colour coded, with the blue rectangular nodes indicating universities, green oblong nodes industry and the red squares the research

institutes. The eight key actors in the community are indicated as follows: UC1 was the so-called doyen crystallographer at a university in Gauteng, the other role players in Gauteng were UB1, UD1 (both at universities), RC1, and RB1 (at research institutes), IA1 (in industry); UH1 at a university in Natal; and UI1 at a university in Cape Town. The sub-networks that surround them are also depicted.

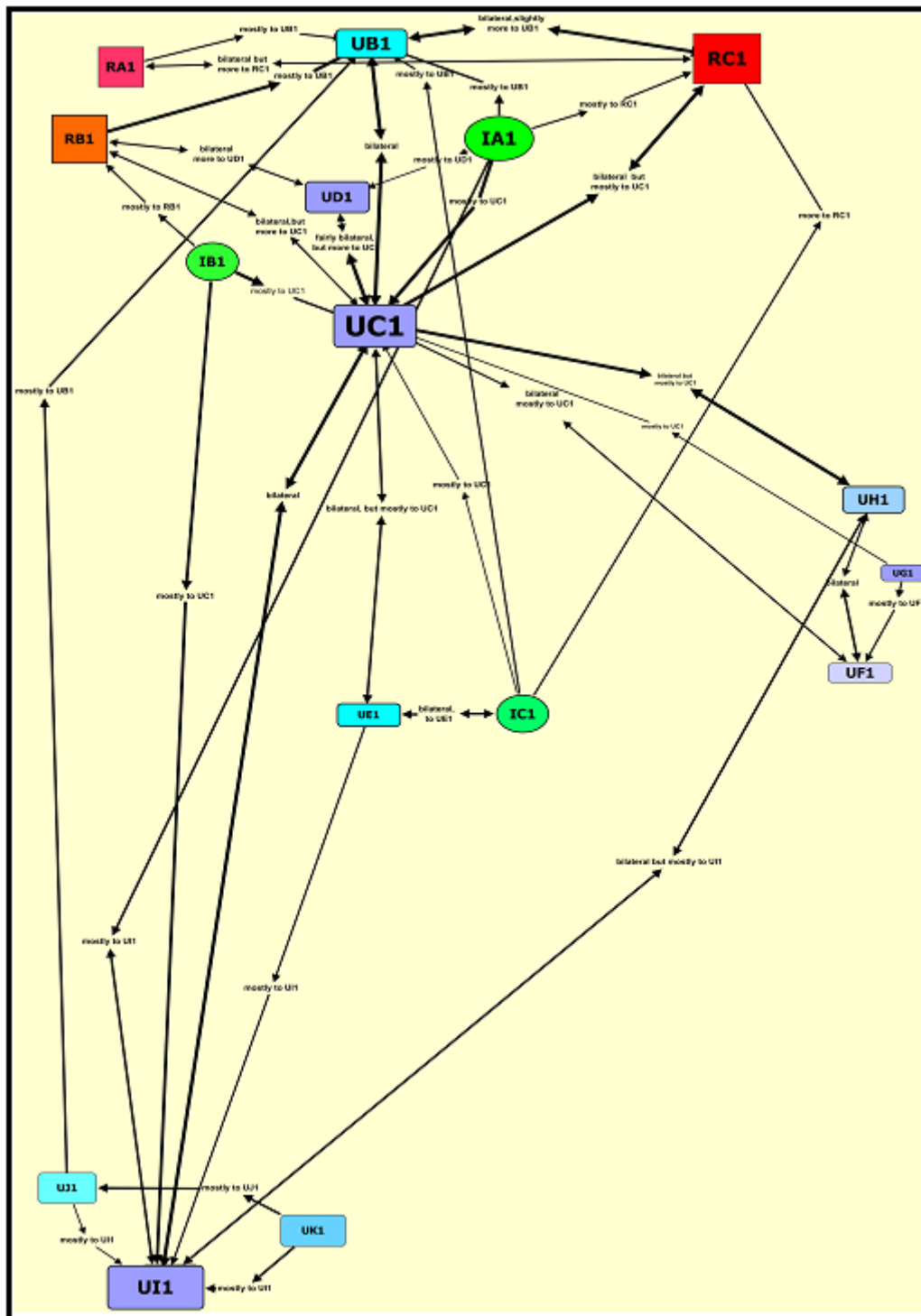


Figure 2: Main crystallographic network in South Africa

5.3 Professional activity and communication intensity

Reference was made in section 3 to the number of studies that have indicated that high levels of interpersonal interaction and professional activity or productivity are closely related. To establish whether these patterns were evident amongst the crystallographers the author queried the respondents on their involvement in professional activities (e.g. whether they had acted as journal referees or members of

editorial boards; involvement with professional institutions, etc.) and also asked them to provide research output details. This data was then compared with the communication activity data.

Correlation with the research output data showed that all the crystallographers who were the recipients of the most information communication approaches and 65% of those who initiated the most communication acts were among the group of crystallographers with the highest research output counts. The aggregate annual research output count of the most active communicators was 8.0 in 1991 and 10.1 in 2001/2 and this compares very favourably with Garfield's (1990) longitudinal study that established that the so-called *elite* scientists were producing approximately nine papers a year.

Correlation of the communication activity data with the professional activity data once again showed high levels of communality between the active information communicators (particularly the recipients of information contacts) and professional activity. It was further seen that there was a direct correlation between the professional activity and high research output data and thus also with the high communication data. It would thus appear that the more active a person is in interacting with colleagues, the more prominent a role such a person plays in his/her professional life and the more productive they are.

6. Concluding remarks

The findings provide clear evidence of a strong social network structure, or *invisible college* phenomenon, among crystallographers in South Africa. This network was driven by a core nucleus of prominent, well connected and interrelated crystallographers who provided the main impetus to keep the network active. These eminent crystallographers played a pivotal role - they were not only more frequently approached for information and advice than any of their colleagues, but they also regularly initiated communication acts; they had achieved a standard of excellence in their work; maintained a high profile in the crystallography community as well as in the general field of science; were highly productive and published profusely - they generally emerged as the archetypal *sociometric stars* in their field. This *elite* group of crystallographers thus clearly fit Price (1961) and Amick's (1973) profiles of scientific eminence. It was further observed that the *elites* tended to cluster more at the basic science (and specifically the 'pure' crystallography side) of the basic to applied spectrum and they mostly worked in environments that were conducive to collegiate interaction.

A distinctive feature of integration into the social network was the interrelation with productivity and professional involvement - the more vigorous the interaction with colleagues, the more productive and influential the crystallographers were. It is thus clear that high productivity, professional involvement, innovation capacity and network connectivity are intricately interwoven.

The crystallographers' work environment was clearly an important factor that affected network interaction. The organisational ethos that prevailed in industry, the research institutes and the academic institutions generally predicated specific work structures which again impacted in varying ways on interpersonal interaction. Working together in formal or loosely structured groups clearly stimulated network interaction, professional activity and productivity. A further benefit was that the leaders of these groups generally assumed *gatekeeper* roles that facilitated intra- and cross-boundary networking and further ensured that new information and knowledge was imported, interpreted and then disseminated internally. The *gatekeeper* phenomenon was particularly prevalent and important in the more applied environments where they assisted in overcoming communication barriers caused by confidentiality restrictions and in providing interpretive interventions to help transcend the divide between applied and basic science.

Other factors such as level of seniority, age and qualification also played a significant role in the dynamics of the network process. It is further evident that for social networks to coalesce and interact vigorously, a sufficiently large critical mass of contributors is required. The number of scientists was clearly sufficiently large in the Gauteng area to engender significantly higher communication activities than elsewhere in South Africa. It was further evident that although the basic social network model remained fairly constant from the first to the second study, certain changes did surface. These were predominantly caused by the impact of the escalating electronic environment, a new political dispensation in South Africa, as well as financial and structural changes in the work environments.

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Knowledge Management Practices and Challenges in International Networked NGOs: The Case of One World International

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Abstract: This paper is based on the outcomes of a study that explored the knowledge management practices and challenges in an international NGO network. The investigation constituted comparative case studies of two centres (one in Zambia and the other in the Netherlands) belonging to a single international network. An empirically grounded framework of knowledge management practices based on the taxonomy proposed by Holsapple and Joshi was utilised as the reference framework for the study. The framework provided guidelines to characterize factors that influence organizational knowledge management; knowledge manipulation activities (processes) and organizational knowledge resources. The results of the empirical study confirm that a variety of factors affect knowledge management behaviours in an organization. These factors include managerial and internal controls such as management styles and incentives for knowledge creation and sharing; resource influences; and environmental influences relating to an organization's culture and the needs of partner organizations. The study highlights important variation in diversity, gaps and perceptions in managing knowledge between centres in the network that are based in Europe and Africa. This is despite significant communality in knowledge management processes and infrastructures. The results further show that institutionalization of knowledge management practices within a network seem to enable or constrain knowledge management at centre and network level. Recommendations are proposed to improve knowledge management practices at local and international level and include enhanced technical and advisory services at international level; capacity building; creating greater awareness of knowledge management; decentralization of knowledge management processes; implementation of a knowledge management strategy at network level and improving relationships between centres.

The authors conclude that networked NGO's and specifically OWI could operate more efficiently and incrementally enhance service provision by leveraging their knowledge resources more effectively. It is in this light that knowledge management practices should be examined in NGOs and particularly networks with their complex structures and attendant reoccurring and unavoidable problems.

Keywords: non governmental organisations (NGOs), networks, development, knowledge management, Zambia, Netherlands

1. Introduction and background

Non Governmental Organizations (NGOs) are generally seen to be playing an increasingly important role in international development. The ongoing support given to NGO's by donors can be construed as evidence that they are considered to be more effective than state-owned organisations in implementing and sustaining developmental programmes. It has further been seen that NGOs and their operations have been influenced by the "New Policy Agenda" which according to Edwards and Hulme (1996) is characterized by two theories. The first implies that NGOs have been enabled by governments to be private providers because of their supposed cost-effectiveness and their ability to more effectively reach the masses than the public sector. The second suggests that since NGOs are vehicles for democratization they have a fundamental humanitarian role to fulfil which should counterbalance state power, protect human rights, open up communication channels and participation, and promote activism and pluralism.

The adoption of the "New Policy Agenda" has motivated NGOs to scale-up operations and this has given rise to NGOs in Europe and North America to expand their operations considerably and to incorporate both developed and developing countries in their programmes (Edwards & Hulme 2000). This has resulted in the establishment of NGO networks with branches all over the world. A further outcome has been that because NGOs are considered to be vehicles for "democratisation" they have become the preferred channel for service provision and government organisations have often been deliberately supplanted. This growth in recent years of developmental NGOs has, however, also meant increased competition for donor funding Ebrahim (2003) and the need for greater accountability and visibility not only at the local constituency level, but also internationally.

All these factors as well as external factors such as the fast changing environment and increased globalization have made the management of NGO operations very complex. This has forced NGOs to adopt new 'agendas' in order to survive (Mitlin, Hickey & Bebbington 2006) and they have, for example, been

implementing new and innovative ways to manage their operations. One such solution has been to employ knowledge management (KM) procedures and principles to try and ameliorate the situation. Such KM procedures are, because of the emphasis placed on information and knowledge sharing processes, particularly suited to enhancing the delivery of successful developmental programmes in a networked environment (Cummings, Heeks & Huysman 2003). KM processes further predicate greater participation by all staff, and the recognition of staff skills and capabilities in the decision-making process and NGO programme development (Sheehanm 1998).

Not all NGO's have however been equally successful at embracing knowledge management principles. There is often scepticism with regard to the effectiveness of knowledge management practices among NGOs. Knowledge sharing particularly at inter organisational level is often said to be hindered by "dynamics of power, opportunism, suspicion, and asymmetric learning strategies which can constitute processual barriers to collective knowledge development" (Larsson et al. 1998). It is further generally believed that the ineffectiveness of knowledge management practices among NGOs can be attributed to the adoption of the wrong knowledge management strategies for NGOs, particularly when they inappropriately copy KM strategies employed by profit-making organisations (Britten 1998).

All the factors discussed above prompted the authors to examine information and knowledge management practices at OneWorld International (OWI). OWI is an international NGO network currently comprising eleven centres that are distributed throughout Europe, Northern and Central America, Asia and Africa. It is a partner network that promotes social justice, human rights and sustainable development. The network's goal is to build a more just, global society through its partnership with local and international communities by providing access to information and connecting hundreds of organisations and tens of thousands of people around the world. OWI is driven by the people and organisations it supports. The network supports over 1600 civil society organisations and development and/or human rights based NGOs. It mainly utilises all types of communication media (typically ICTs) to implement development and human rights advocacy programmes. This study specifically studied two OWI centres, viz. OneWorld Africa (OWA) based in Zambia and OneWorld Netherlands (OneWorld.nl).

2. Context and objectives of the study

The purpose of the research project was to examine the role that knowledge management interventions play in an international networked NGO to achieve development objectives at a local and global level. The specific factors that were of interest to the study related to:

- the degree to which OWI centres practice knowledge management
- what external factors influence knowledge management policies and practices
- the major challenges that the centres and the network is facing in managing its knowledge.

The study was conducted utilising Holsapple and Joshi's (2004) knowledge management framework (presented in figure 1) as its conceptual model. The framework presents a cyclical three fold approach to knowledge management in organizations. In this context, the following aspects were studied: internal and external policies that may influence knowledge management practices in the targeted OWI centres; the various knowledge management processes that are in place to cultivate a learning environment; and finally the role of the various knowledge resources in the organisations.

Factors influencing knowledge management		Knowledge activities		Knowledge resources		
Managerial Influences	govern	Knowledge selection, acquisition, use, transfer, and internalisation	create	Intellectual capital	achieve	organisation learning & projection
Resource Influences				Culture		
Environmental Influences				Infrastructure		

Figure 1: Holsapple and Joshi's knowledge management framework

3. Methodology adopted

The research design was based on a comparison of two OWI centres; viz. OWA and OneWorld.nl. The targeted study population was drawn from the employees at management level of the two centres. A

triangulated approach, using both qualitative and quantitative methodologies, was adopted. Open ended questions were used during in-depth face to face and e-mail interviews to obtain insight into the various knowledge management issues pertaining to the conceptual model. This approach gave participants the opportunity to expand on their views regarding how knowledge was managed within the OWI network. A questionnaire containing attitude statements in a Likert scale format was further also distributed by e-mail to all respondents. The interviews and questionnaire were based on the conceptual model and consisted of the following eleven themes: Management and control systems; finances and resources; stakeholder relationships; internal knowledge processes; external knowledge processes; knowledge needs; communication processes; communication infrastructure; strategy and policy formulation; applying learning and developing organisational memory or intellectual capital.

4. Results of the study

The results are derived from a synthesis of the information obtained from the interviews and the responses to the attitude statements (cf. Figures 2 & 3). The reporting framework is based on the knowledge management model adopted for the study.

4.1 Factors influencing knowledge management

A number of factors such as the financial situation, emerging technologies, and the GEPSE (governmental, economic, political, social and education) climate can influence knowledge management practices in organisations. Our case studies revealed that the main factors that had an impact on knowledge management at OWI were financial or economic factors, partner's knowledge needs, awareness of knowledge sharing techniques, control and governance of knowledge management practices, and strategy formulation.

4.1.1 Financial or economic factors

While it was noted that both centres indicated that financial factors were impacting on their ability to scale up and scale out their programmes, OWA was clearly more affected by financial constraints (cf. Figures 2 and 3). This can largely be attributed to their greater dependency on outside donor funding. Financial restrictions at OWA appeared to have the greatest impact on their staffing situation. It was evident that they were forced to use more volunteer staff than OneWorld.nl and this meant a higher staff turnover which in turn meant that staff were not able to learn and reflect on past and future work. OneWorld.nl's better financial situation was due in part to fewer bureaucratic restrictions, and more direct access to donor funding than what was the case at OWA. It was further evident that they had better fiscal control systems and they were able to attract partners who were willing to pay for the services they appreciated. Another factor could be that OneWorld.nl were able to secure better support from policy makers and this can be attributed to government policies in the Netherlands that actively supports and promotes development goals at the local level.

4.1.2 Partners' knowledge needs

Although it was clear that both centres were aware of their partners' knowledge needs, the fulfilment of these needs was affected by financial constraints. Furthermore, both centres, particularly OneWorld.nl felt that they could improve on the application of existing knowledge. OWA's rating for satisfying knowledge needs was slightly lower than OneWorld.nl's (cf. Figures 2 & 3) and this can be attributed to the fact that their service delivery spanned a greater geographical area. This suggests that the geographical extent of a network could have a direct effect on knowledge management practices in an organisation.

4.1.3 Knowledge sharing culture

It was found that while knowledge sharing was relatively well established at local level, articulating local tacit knowledge into explicit concepts was not handled as well and this impacted negatively on knowledge sharing between centres. It further emerged that OneWorld.nl generally exhibited a more positive attitude towards knowledge sharing than OWA. This might be due to socio-political differences between the Netherlands and African countries. In the Netherlands values that are conducive to knowledge sharing and generation, such as cultural, political and educational factors, are highly esteemed. It is thus submitted that an organisation that operates in a culture that is receptive to knowledge sharing and knowledge generation would also be more receptive to knowledge management principles in general.

4.1.4 Control and governance of knowledge management practices

It was clear, that while OWI exerted good general management control measures (e.g. for staff and finances), there were no uniform control measures that applied to knowledge management practices across the network. As a result, each centre within the network performed knowledge management activities differently and individuals generally had different perceptions of the role of KM. This aspect was identified as a severe impediment to knowledge sharing within the network. A typical example relates to virtual communication where it was found that because of the lack of controls and standardisation, virtual team work, a supposed feature of OWI, was not operating at the required levels of effectiveness. It was further clear that at local level the control measures and policies reflected the environment and culture from where they emanated. The staff in the Netherlands was for instance more receptive to open sharing and 'criticism' than staff at OWA and this it is suggested relates to cultural differences between the two environments. It can thus be argued that the knowledge sharing culture within each of the OWI centres [and NGOs] replicated their societies and further that exposure to multiple cultures created a blend of influences.

4.1.5 Strategy formulation

The staff at OWA and OneWorld.nl generally provided different answers with regard to their understanding of the relationship between strategy formulation and knowledge management issues. OWA staff indicated that OWA's four main strategy areas automatically meant that the organisational strategy could be applied to the knowledge management processes within the organisation. OWA staff also felt that OWI and donors had considerable influence on their strategy and its implementation since it was intricately related to externally generated proposals. Although the OneWorld.nl, staff made no reference to a knowledge management strategy as such, they did indicate that "*in the end, it [knowledge management] is all related to our overall mission and goals.*" The OneWorld.nl team further indicated that they realised the importance of strategy formulation and reflection and indicated that more time should be given to these issues.

4.2 Knowledge manipulation activities (processes, collaboration and networking)

The study further focused on obtaining information from the respondents on the means they use to identify, present and share knowledge within and outside their centres. This set of questions specifically set out to establish evidence of team work, collaboration and networking via intra and inter organisational means.

4.2.1 Communication processes

The centres generally follow a number of direct and indirect communication processes to share knowledge between and amongst individuals, internal and external structures. The direct methods of communication that were commonly used were: face to face dialogue, email discussions and the use of simple technology such as the telephone, SKYPE, yahoo messenger and chat technology.

There was however evidence that there is a need to better manage tacit knowledge communication. Most employees from the two OWI centres indicated that, despite having access to the appropriate technology, they were not skilled in converting tacit knowledge to information. The lack of skills to capture tacit knowledge in a standardized format reduces the efficacy of knowledge transfer and the ability to leverage tacit knowledge. Invaluable knowledge is then lost to the organisation when individuals with that 'know-how' leave the organisation. It was further found that processes were not generally in place to map knowledge flows, or to identify knowledge needs and resources. According to Weidner and Rahman (2000), mapping knowledge flows, needs and resources enables an organisation to determine what knowledge is needed by whom; what knowledge an organisation has in what format; where it is (in people, libraries, or system repositories); what knowledge is missing and the best ways to obtain it.

4.2.2 Communication infrastructure

According to Groff & Jones (2003) technology is an important factor to ensure that knowledge management procedures function effectively, particularly in a large and/or geographically dispersed network. It was therefore important to obtain the respondents' perceptions with regard to the use of technology. It was found that technology is more effectively integrated into the processes and tasks at OneWorld.nl than at OWA and as a consequence it was clear that the OWA employees were less comfortable with using the available technology than those at OneWorld.nl. This would suggest evidence of a 'digital divide' between the centres in Europe/North America and those in developing countries.

The OneWorld.nl respondents were, however, also critical of certain aspects of the technology infrastructure, particularly with reference to the unsophisticated, stand alone technology that was used and which created network communication problems. OWA respondents further noted that the technology was cumbersome to use and in their view too little attention was spent on the development of technologies that enhance internal work processes. It was further clear that although many of the respondents were using simple technology such as 'chat' for interpersonal communication, they would rather use more personal means of interaction and knowledge transfer. This is a universal problem and the reason why, according to Srinivas (2005), many organisations focus on creating connections which allow knowledge to be shared easily.

4.2.3 External knowledge processes: collaboration and networking

The respondents at both centres indicated the importance of obtaining external knowledge (cf. Figures 2 & 3) and indicated that this was mainly achieved by means of collaboration and networking, particularly with various stakeholders. However, this process is complex as both centres serve many stakeholders. The complexity of the situation was however felt more acutely at OWA where they were accountable to a more diverse range of stakeholders spread over a far wider geographic area than OneWorld.nl. It was however clear that, despite the complexities involved, both OWA and OneWorld.nl maintained good relationships with their various stakeholders (e.g. donors, partners, beneficiaries, and governments) (cf. Figures 2 & 3). It was seen that team work and networking was a common feature and work mode at the OWI centres. This was not an unexpected outcome and as Holmen (2002) has indicated an essential means of operation for a geographically dispersed NGO network if it wishes to maintain satisfactory performance levels and avoid disintegration.

4.3 Knowledge resources

The aim of this section was to obtain information from individuals regarding how the knowledge management processes outlined above operated on the knowledge resources in the organisations. It was evident that the main areas of impact related to how intellectual capital and culture were embedded and valued in the knowledge management practices of the OWI network.

4.3.1 Intellectual capital

Intellectual capital is undisputedly one of the most important assets of any organization. The two centres, however, exhibited different views with regard to the manner in which their centres valued intellectual capital and knowledge creation.

In the instance of OneWorld.nl it was seen that employees were compensated for their contribution to the organisation's intellectual capital and it can be assumed that such compensation served as motivation for staff to contribute to the knowledge base. The literature generally indicates that firms that compensate knowledge workers for their input to the firm's intellectual capital are at a significant competitive advantage (Demarest 1997) and that financial rewards provide good incentives to encourage individuals, teams, etc. to contribute to the knowledge pool (Figallo & Rhine 2002).

OWA staff, in contrast, stated that their knowledge contributions were not in any way linked to monetary compensation or other rewards and it can thus be implied that staff motivation was driven by and linked to individual motivation rather than some reward system. OWA staff, were however being trained in 'Leadership' skills, a key means in which individuals are empowered to contribute to organizational learning, and according to Saint-Onge and Armstrong (2004), "leadership mobilises and determines the quality and rate of knowledge flow, providing a catalyst for staff to exercise their responsibilities, encourage self-initiation, trust, interdependence and partnering across an organisation".

The different motivational models and value systems for intellectual abilities, it is suggested, is the reason why OneWorld.nl staff gave higher scores for developing intellectual capital than the OWA staff (cf. Figures 2 & 3).

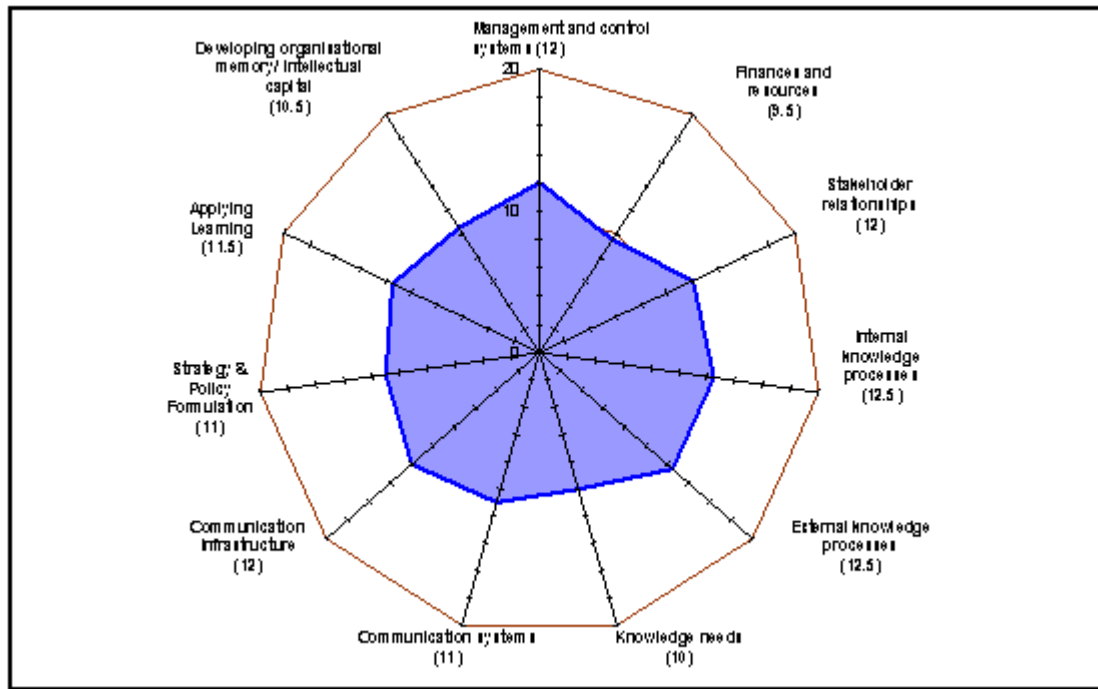


Figure 2: Summary of OWA's Attitude Statements

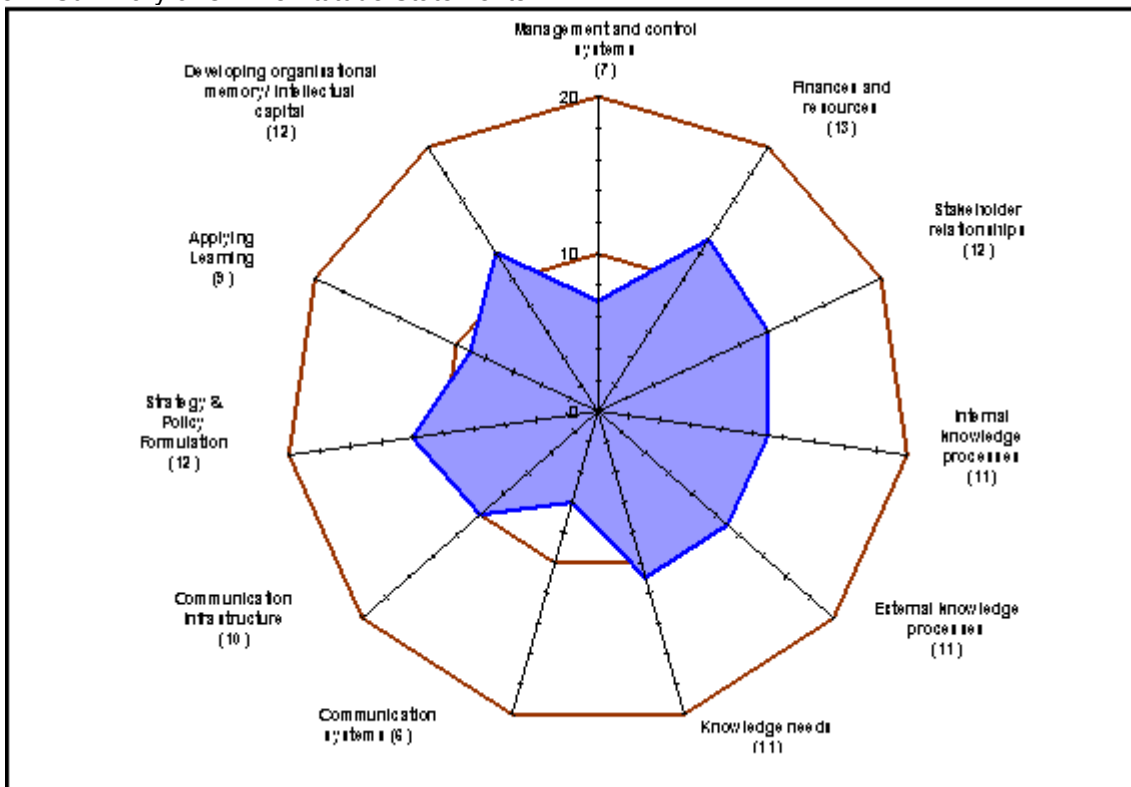


Figure 3: Summary of OneWorld.nl's attitude statements

4.3.2 Culture

Since the employees at both centres indicated that an open and free knowledge sharing environment prevailed within their organisations, it is suggested that their organisational cultures can be regarded as valuable assets that enhance the creation of new organizational knowledge. However, despite OWA's open culture, there were certain social elements and human connections lacking that are essential to ensure that knowledge acquisitions and sharing is fully harnessed. For example, a major behavioural obstacle relates to the rigid and 'rushed' manner in which business processes are carried out by OWA staff. Such an overly organised environment leaves very little time for reflection and according to Laporta (2002) this is not an

unusual situation within the NGO environment and one of the main inhibitors that contribute to the lack of learning among NGOs.

5. Recommendations emanating from the study

The various issues that surfaced during the study have prompted the authors to put forward the following recommendations that they think could further strengthen the knowledge management practices both at individual centre level and within the overall OWI network.

5.1 Implement a knowledge management framework and strategy

In general terms it is suggested that the network should implement a network-wide policy document that would serve as a framework for knowledge management in the network. Such a framework should outline the vision, aims and objectives for knowledge management at both the general network level and at centre level. A more directed and focussed approach to knowledge management would be achieved, knowledge sharing throughout the network would be facilitated and structures that are currently impeding knowledge sharing and knowledge creation could be streamlined. OWI should further institute a knowledge management strategy that would cover critical components to empower employees in human resource areas (e.g. training and learning); to create incentives to promote a knowledge sharing culture; to identify processes to embed knowledge (e.g. mapping knowledge flows, identifying best practices and promoting innovation); and to effectively utilise technology (e.g. for collaboration and knowledge sharing purposes). A strategy will ensure that the basic knowledge transfer processes are co-ordinated in a coherent way.

5.2 Implement a knowledge management structure

OWI should also recognise the complexities of operating knowledge management programmes in a decentralized network environment. One solution would be to implement a more rigorous knowledge management framework that could serve as a platform to facilitate knowledge sharing at both local and international levels. The authors further propose that high quality, multidisciplinary experts be trained or hired at local level to enhance the various knowledge management functions, particularly networking between centres. It is further recommended that to achieve a more unified approach to knowledge management, a network manager be employed at OWI to coordinate and facilitate the knowledge management duties of the local experts. This person should be tasked to institute an awareness campaign among all stakeholders to ensure that the network has a uniform vision of the role of knowledge management and further create awareness among employees of the value of knowledge sharing and the benefits that it creates for an organisation. It is further recommended that a knowledge management council consisting of various staff representatives with diverse skills be constituted to drive the knowledge management processes. This is to avoid knowledge management being relegated to being, for example, purely 'a technology' or 'human resource' affair. Such a council would draw expertise from key stakeholder groups; technology representatives; human resources; board and top management representation; partner representation; and, not least of all, knowledge management expertise.

5.3 Map information and knowledge flows

The diversity of the network suggests that it should have an ongoing programme to identify knowledge and information gaps; bottlenecks in the flow of knowledge; information about present and future knowledge required; and the formats and location where information may be found within the network. The function of knowledge auditing and mapping should therefore be introduced into the network. The auditing and mapping process should be extended to include the creation of a network-wide 'best practice' database containing lessons learned from the various centres. It was evident that OneWorld.nl and OWA could have benefited from the lessons learned within each centre and which are currently 'hidden' from each other.

5.4 Capacity enhancing activities

Congruent with the previous point is the necessity to implement capacity enhancing activities where centres that are better endowed (e.g. for example those in North America & Europe) share 'best practices' and expertise with those that are relatively disadvantaged (e.g. certain African centres). For instance, OWI should consider staff exchange programmes as a means of sharing best practice. Such programmes could be mutually beneficial as NGOs operating in disadvantaged areas (e.g. OWA) could learn technical skills and media knowledge, while NGOs from the developed world (e.g. OneWorld.nl) could obtain first hand knowledge about development issues.

Skills building and knowledge development should also be directed at board members and donors so that they can appreciate the meaning and importance of effective governance and its contribution to NGO accountability. For example board members should be encouraged to attend strategic meetings and they should be included in strategic planning and capacity building interventions.

5.5 Investigate technology functionality and use

OWI should take advantage of the array of technologies that are constantly emerging to enhance knowledge management processes. They should implement critical assessment strategies to evaluate new technologies to establish whether they are suitable and able to facilitate knowledge management activities or whether they require adaptation to suit local requirements.

5.6 Strengthen the finance base of the centres

Due to the complexity of financial challenges, OWI centres should consider adopting creative financing strategies. For example, centres should investigate the viability of consortium funding, endowments, partnerships with the corporate sector, and more effectively using infrastructures such as office buildings to save on overhead costs. They should create a position of "grants compliance officer" for the network and/or the centres to assist with financial reporting and resource acquisition. This would free managers and project staff from burdensome financial responsibilities. They would then be able to focus on roles they are better equipped to fill and in the process costs could further be reduced.

5.7 Strengthen relationships between the various NGOs in the network

If the differences that occur between the various NGOs, particularly between those that operate in Europe and North America and those in other less developed countries are to be respected, a more open and transparent debate needs to take place among them. The purpose of such interaction would be to **strengthen relationships**, promote debate, improve practice, and to seek common grounds with others engaged in the same activities.

5.8 Review institutional and management structures

The OWI network should review all institutional and management structures to ensure that impediments to reinforce knowledge building are removed. Human resource management should be strengthened by encouraging staff members to assume ownership of knowledge sharing efforts, be involved with the development and quality control of the knowledge base; and to ensure that knowledge sharing enhances organizational objectives incentives should be put in place to encourage knowledge creation and sharing. The network should strengthen staff and board contributions through active and relevant recruitment. The learning processes should be strengthened by including alternative but interesting and non-bureaucratic methods of enhancing knowledge sharing in a more free, open and trustworthy environment. More face to face interaction should be encouraged among all OWI staff. This will enhance the transfer of tacit knowledge among employees and will therefore assist the centres to grow and better utilise organizational memory.

6. Concluding remarks

It is hoped that the preceding recommendations could serve as a guide to achieving more effective knowledge creation and sharing within the OWI network. It is suggested that by adopting a more rigorous and standardised knowledge management framework OWI would be empowered to implement better knowledge management practices and be equipped to participate as a knowledge-intensive member of the global economy. Networked NGO's and specifically OWI could operate more efficiently and incrementally enhance service provision if they are given the tools to more effectively leveraging knowledge (both at an individual and organisational level). It is in this light that knowledge management practices should be examined in NGOs, particularly networks with their complex structures and often reoccurring and unavoidable problems.

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The Emergence and Diffusion of the Concept of Knowledge Work

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Abstract: The past decades have witnessed the proliferation of research on knowledge work. Knowledge work has mostly been used as an antonym to manual work, to refer to specific occupations characterized by an emphasis on specialized skills and the use of theoretical knowledge. The efforts to encompass all the different contexts where knowledge plays a relevant role in work tasks has resulted in various and ambiguous definitions of what knowledge work actually is.

In order to shed light on the elusive concept of knowledge work, we studied how it has appeared in the scientific discussion, and diffused from one scientific community to another. As the circulation of new ideas and concepts in scientific discussion is apparent through academic literature, we examined the emergence and diffusion of the concept of knowledge work through a citation analysis on articles from the Social Sciences Citation Index. The data set consists of 273 articles with 7,057 cited references for the 1974 to 2003 period, and we used a dense sub-network grouping algorithm on the co-citation network to distinguish highly cited groups of references.

We distinguish three periods of diffusion of the concept of knowledge work. The results show that Drucker's *In the age of discontinuity* (1969) and Bell's *The coming of post-industrial society* (1968) were the main influencers when the concept emerged in the scientific discussion from 1974 to 1992. After this period, we can distinguish a slow diffusion period from 1993 to 2003, when the concept started to gain attention, and a fast diffusion period from 1999 to 2003, when the research proliferated.

The discussion dispersed outside the management domain already in the emergence period, but the management domain has stayed the main domain of discussion also later on. However, from 1992 to 2003 the discussion inside the management domain dispersed into different groups. One of the main influences to a new group of research that appeared at this time was Zuboff's *In the age of the smart machine* (1984). This group, drawing on research conducted on knowledge-intensive firms, has recently produced highly cited articles such as Blackler's 'Knowledge, knowledge work and organizations' in *Organization Studies* (1995). As the current discussion on knowledge work is dispersed in different groups, there is a need to engage in a common conceptual discussion and define what is actually meant by knowledge work.

Keywords: scientific discourse, knowledge work, bibliometric analysis, citation analysis

1. Introduction

The past decades have witnessed proliferation of research on knowledge work, building on the belief that economic success of post-industrial societies increasingly depends on the ability to wisely use knowledge (Drucker 1994, Shariq 1997). A significant proportion of work in developed economies involves the activities of acquisition, processing, refining, packaging, and transfer of knowledge, activities that primarily constitute knowledge work (e.g. Davenport et al. 1996). Recently, knowledge workers have been referred to as the "most valuable asset" of modern organizations, and likened to the production equipment of modern organizations, given the difference that they own the means of production (Drucker 1999). With the perceived increasing importance of knowledge work, also knowledge-work productivity (Drucker 1969, 1999, Davenport et al. 2002) and managing knowledge work (Scarbrough 1999, Zack 2003, Pearce 2004) have gained substantial attention in academic journals.

Despite the clear significance of knowledge work to modern societies, there is consensus among academics that as even the concept of knowledge is ambiguous the same applies to knowledge work (Alvesson 2001, Pyöriä 2005). Knowledge work encompasses professions that have traditionally been referred to as professional work (accountancy, legal professions or scientific work) as well as the more contemporary types of work of consultancy, software development, or public relations (Newell et al. 2002). However, instead of classifying specific knowledge-work occupations, recent studies of knowledge work define it through different descriptive characteristics, such as processing of large amounts of information (Davenport et al. 1996), use of information and communication technologies (Blom et al. 2001), problem-solving capabilities (Tsoukas and Vladimirov 2001), non-routine work (Järvenpää and Eloranta 2001), increased autonomy over work (Robertson and Swan 2003), or collaboration (Kogan and Muller 2006). These characteristics often seem to

distinguish work that is “comparatively complex, analytic, and even abstract, because it makes use of tools that generate symbolic representations of physical phenomena” (Barley and Orr 1997: 5).

Based on the variety of existing definitions, it is clear that there is a lack of shared understanding on the essential nature of knowledge work. Going back in literature we often find that Peter F. Drucker has been referred to as the first who “coined the phrase” knowledge work (e.g., Kelloway and Barling 2000, Lindgren et al. 2003). After the concept was introduced in the late 1960’s, it was often used as synonym to white collar work and antonym to manual work (Mandt 1978), referring to specific occupations characterized by and emphasizing on specialized skills and the use of theoretical knowledge. However, as knowledge work denotes the changes in the nature of work which cut across existing occupational categories, it has later on been shown to be lacking in occupational identity (REF). As a result, knowledge work can not be defined based on occupational identity, and new bases of definition have to be found.

In this paper, we examine how the concept of knowledge work has come to be under increasing attention, as an attempt to narrow down the relevant body of knowledge. Finding the concept of knowledge work elusive and ambiguous, we aim to elaborate how it has appeared in scientific discussion, and diffused from one scientific community to another. the following we first describe our approach to the literature. Second we present the results of our analysis on the origins and the diffusion of the concept of knowledge work, discussed as presented. Finally we conclude our results and outline future research possibilities.

2. Methodology

The circulation of new ideas and concepts in scientific discussion is apparent through academic literature, in other words publications in scholarly books and journals. Based on this notion, we have used citation analysis, a major bibliometric approach (Osareh 1996), to study the discussion that has evolved around the concept of knowledge work.

Bibliometric analysis is based on the idea that citations can be used as indicators of present and past activities of scientific work (Small 1973). Citations play an important role in the social system of science, as researchers follow the academic habit of crediting sources by citing references they used related to their research (Summers 1984). This principle is crystallized in the normative theory of citation which maintains that bibliographies are lists of “influences that authors cite in order to give credit where credit is due” (MacRoberts and MacRoberts 1989). Authors have various reasons for using citations, from support and acknowledgement to illustration¹, but it is argued that only a relatively small percentage of citations are self-serving or frivolous (Summers 1984). So, citation analysis allows us to trace the path of ideas through the evidence and documentation left by the network of references and citations (Hoffman and Holbrook 1993).

Co-citation analysis, a particular form of citation analysis, uses these “paths of ideas” to represent the structure of scientific literature (Small and Griffith 1974). When two documents cite the same piece of literature, a document-to-document similarity measure called co-citation can be calculated to represent the association between these two documents. As every author could cite a vast number of sources from the totality of related literature, but includes only a small amount of crucial references², it can be assumed that co-citing works share a common view on the scientific literature in question. The groupings of co-citing works can be called invisible colleges or scientific communities, in which authors interact and draw on each others’ works (Crane 1972). The scientific structure of a number of disciplines has already been mapped with co-citation analysis, either as a snapshot at a given point in time, or as the development over a specified time period (see White and Griffith 1982). However, to our knowledge, co-citation analysis has not been used to analyze the emergence and diffusion of scientific concepts.

2.1 Data

Based on the bibliometric principle that knowledge of disciplines is concentrated in only a small proportion of important journals, we retrieved citation data from Social Sciences Citation Index (SSCI) of ISIWeb of Science. SSCI indexes 1750 journals over 50 social science disciplines, adding approximately 60,000 new cited references per week. We searched for all articles with the words “knowledge work*”, “knowledge-intensive work*”, “knowledge intensive work*”, and “knowledge worker*” published during the 1956 to 2003 period. The time-frame was chosen to start in 1956 to cover all early publications and to end in 2003 to allow

¹ The Encyclopedia of Library and Information Science lists 15 specific reasons why authors cite the work of others ranging from giving credit for related work to identifying an eponymic concept or term (Weinstock 1971).

² The amount of crucial references included is estimated around 11 items in average for social sciences (Price 1980).

sufficient time for article citing. By restricting the search in the title, abstract, and keywords we ensured that the resulting articles intentionally discuss the concept of knowledge work, not just use it in passing. The search resulted in a data set of 281 articles, of which 8 were discarded, as they did not discuss knowledge work³. The final data set consisted of 273 articles with references to over 7,000 sources.

2.2 Methodology

In typical bibliometric analysis, the relationship between two sources is based on the co-occurrence of references within articles. It is assumed that if two articles are cited in the same paper, they are closely related to each other either because they belong to the same topic area or because their topic areas are closely connected (Small 1973, Garfield 1983). Although many co-citations may be quite unrelated in each individual article, a sufficiently large sample of cited articles enables one to attenuate random “noise” created by articles focusing on diverse topics.

The network, extracted through linking similar references, is called a co-citation network. Given that the 273 selected articles for analysis had over 7,000 cited references, it was impossible to include all of them in the analysis. As literature does not give a concise view on how to select a particular threshold level, we selected the citation frequency threshold by investigating citer-cited networks with different thresholds. After testing a series of networks, we analyzed only articles with at least 3 references to disregard e.g. book reviews and editorial pieces with a limited scope.

In our analysis, we constructed a co-citation network using the so called Jaccard index as a normalized co-citation strength measure (S) in order to emphasize proximate relations between similar references that are not cited as often as the most common references (Gmur 2003).

$$S = N_{AB} / (N_A + N_B - N_{AB}),$$

where N_{AB} = the number of common citations to articles A and B,

N_A = the number of citations to A, and

N_B = the number of citations to B.

A dense sub-network grouping algorithm, yielding a number of independent densely connected groups and a list of disconnected nodes (Schildt and Mattsson 2006), was used to distinguish highly cited groups of references. It is assumed that these groups represent the different intellectual bases that participate in the discussion evolving around the concept of knowledge work. The dense sub-network grouping analysis is implemented in the bibliometric software tool Sitkis (Schildt 2002) that was used to produce the co-citation network data. Other network analyses were conducted using Ucinet (Borgatti et al. 2002).

3. Results

We found a total of 273 articles on knowledge work with 7,057 references for the time period 1974-2003. In the following the 273 articles discussing knowledge work are called ‘citing articles’ and their references are called ‘cited articles’. These groups are partly overlapping.

3.1 Periods of evolution

Figure 1 shows the distribution of the citing articles over the considered period. The 1974 to 2003 period can be divided into three main periods: the emergence period and two diffusion periods.

³ The 8 articles had the words “knowledge” and “work” in a row, but did not use them as an individual concept “knowledge work”. For example, one article discussed “job knowledge, work sample performance, and supervisory ratings” (Schmidt et al. 1986).

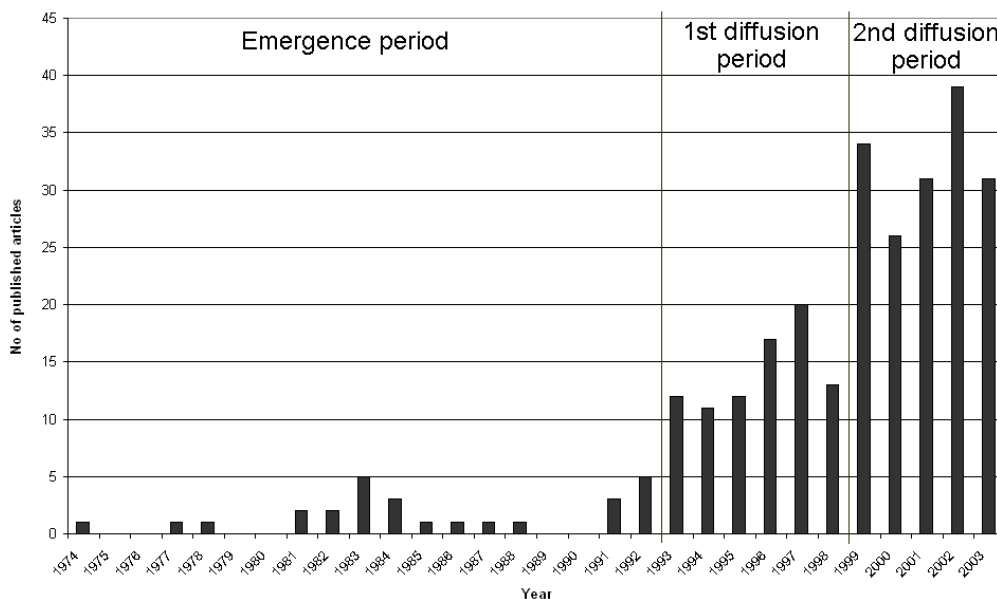


Figure 1: The yearly distribution of the citing articles over the 1974 to 2003 period.

At first, the appearance of citing articles is sporadic. Until 1992, no more than 5 articles were published per year, so we consider the concept of knowledge work entered the scientific discussion during the ‘Emergence period’ from 1974 to 1992. After the Emergence period, the concept of knowledge work started to gain more attention in various scientific communities. The 1993 to 2003 period can roughly be divided in the early diffusion period from 1993 to 1998 (‘1st diffusion period’), when no more than 20 articles on the concept of knowledge work were published annually, and the proliferation period from 1999 to 2003 (‘2nd diffusion period’).

3.2 Influential articles

The citing articles and how much they are cited reveal us what articles are the most influential in the discourse evolving around knowledge work. Of the 273 citing articles, only 133 have received 3 or more citations in SSCI. The articles received 8.6 citations in average, the median being only 2.0. We can therefore assume that only a limited number of citing articles have considerably affected the scientific discourse on knowledge work.

Table 1 presents the 20 most cited citing articles. The most influential article by far has been Blackler’s 1995 article on knowledge and knowledge work, one of the few articles to date that truly discusses the definition and meaning of knowledge work. Blackler is also the most influential author currently writing on knowledge work, with a total of 199 citations on his 2 articles (Blackler 1993, 1995). Another influential author is Alvesson, who has a total of 103 citations on his 3 articles on knowledge work (Alvesson 1993, 2000, 2001).

Table 1: The 20 most cited citing articles published during the 1974 to 2003 period.

	1st author	Year	Journal	Article title	Times cited
1	Blackler	1995	Organization Studies	Knowledge, knowledge work and organizations: An overview and interpretation	162
2	Thompson	1991	MIS Quarterly	Personal computing: Toward a conceptual-model of utilization	128
3	Gefen	1997	MIS Quarterly	Gender differences in the perception and use of e-mail: An extension to the technology acceptance model	116
4	Zmud	1984	Management Science	An examination of push-pull theory applied to process innovation in knowledge work	108
5	Cook	1999	Organization Science	Bridging epistemologies: The generative dance between organizational knowledge and organizational knowing	100
6	Orlikowski	1994	Administrative Science Quarterly	Genre repertoire: The structuring of communicative practices in organizations	90

	1st author	Year	Journal	Article title	Times cited
7	Campion	1996	Personnel Psychology	Relations between work team characteristics and effectiveness: A replication and extension	88
8	Star	1996	Information Systems Research	Steps toward an ecology of infrastructure: Design and access for large information spaces	69
9	Straub	1994	Information Systems Research	The effect of culture on IT diffusion: E-mail and fax in Japan and the U.S.	66
10	Alvesson	1993	Journal of Management Studies	Organizations as rhetoric: Knowledge-intensive firms and the struggle with ambiguity	64
11	Warkentin	1997	Decision Sciences	Virtual teams versus face-to-face teams: An exploratory study of a Web-based conference system	55
12	Janz	1997	Personnel Psychology	Knowledge worker team effectiveness: The role of autonomy, interdependence, team development, and contextual support variables	46
13	Snell	1994	Academy of Management Journal	Strategic compensation for integrated manufacturing: The moderating effects of jobs and organizational inertia	45
14	Davenport	1996	Sloan Management Review	Improving knowledge work processes	44
15	Blackler	1993	Journal of Management Studies	Knowledge and the theory of organizations: Organizations as activity systems and the reframing of management	37
16	Knights	1993	Journal of Management Studies	Networking as knowledge work: A study of strategic interorganizational development in the financial services industry	34
17	Bernhardt	1995	Applied linguistics	Interpreting relationships between L1 and L2 reading: Consolidating the linguistic threshold and the linguistic interdependence hypotheses	34
18	Perlow	1998	Administrative Science Quarterly	Boundary control: The social ordering of work and family time in a high-tech corporation	34
19	Thelwall	2002	Journal of Documentation	Evidence for the existence of geographic trends in university Web site interlinking	29
20	Drucker	1999	California Management Review	Knowledge-worker productivity: The biggest challenge	25

The most highly cited citing articles are mainly published in recent years. Only 2 articles have been published before 1993 (Table 1): Thompson and Higgins (1991) on personal computing and Zmud (1984) on process innovations in knowledge work. Most of the highly cited citing articles have also been published in management journals. There are, however, some articles from other domains such as IS (8, 9), psychology (7, 12), linguistics (17), and information sciences (19). The discussion evolving around the concept of knowledge work has thus diffused outside the management community.

3.3 Origins of the concept of knowledge work

The concept of knowledge work emerged in the scientific community during the Emergence period of 1974 to 1992. Only 27 citing articles appeared during these years. The first citing article is Powers (1974) on paraprofessionals as knowledge workers. He draws on the earlier work of Drucker (1969) and Bell (1968), two books on the new post-modern society that seem to have laid the foundation for the development and further diffusion of the knowledge work concept. Powers's work was followed by more articles in the beginning of the 1980's that saw knowledge work as a new class, and studied e.g. structural and ideological convergence among various knowledge workers (Wuthnow and Shrum 1983). This group of articles is one of the 4 highly cited groups found using the dense sub-network grouping algorithm for this period, called the 'Knowledge work as a new class' (Figure 2).

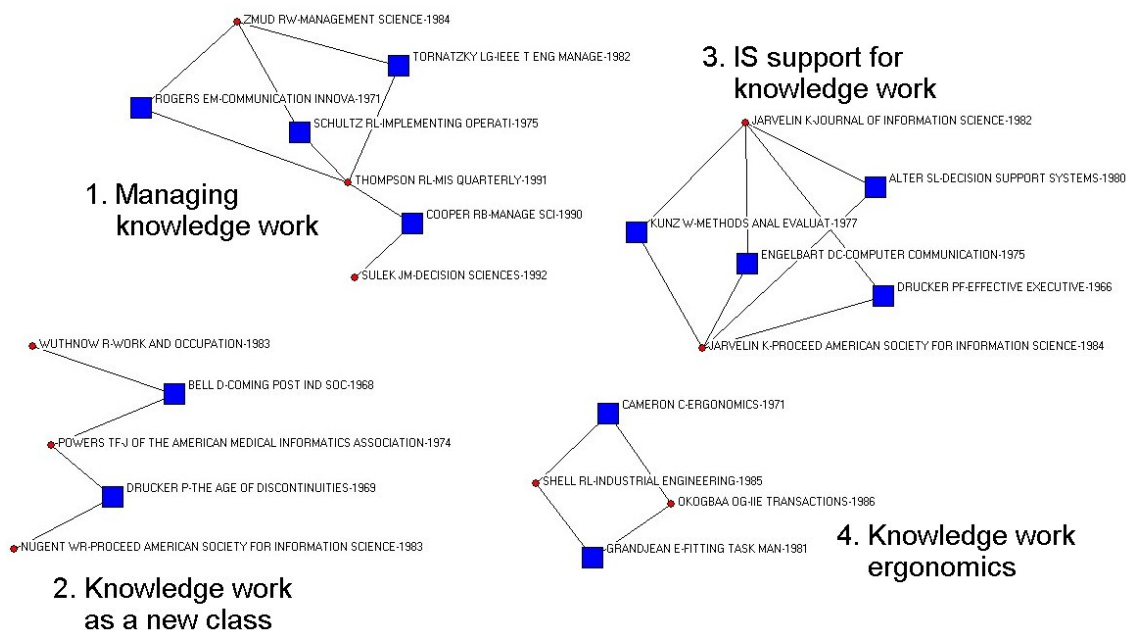


Figure 2: The four highly cited groups over the 1974 to 1992 period with the corresponding citing articles. The cited references are marked with blue squares, and the citing articles with red dots.

After this early work, the most influential work on knowledge work was conducted by the highly cited ‘Managing knowledge work’ group in Figure 2. Researchers in this group were not that interested about the concept of knowledge work, but debated how to *improve* knowledge work. The citing articles of the late 1970’s dealt with the quality of working life, productivity of knowledge workers, and the management challenges of white collar workers. Later citing articles discussed various organizational, management, and educational issues.

Nevertheless, measured in numbers of publications, the discussion around knowledge work at this time was not the playground of management researchers, but that of computer scientists and human-computer interface researchers: almost half (13) of the citing articles in this period were published in IS journals. These researchers participated either in the ‘IS support for knowledge work’ group studying IT tools, or the ‘Knowledge work ergonomics’ group that studied knowledge work ergonomics. Except for a few references to Drucker, these groups were influenced by previous research in the IS domain.

It seems that Drucker was indeed one of the main influencers in bringing the concept of knowledge work in the scientific discussion, even if different groups draw their inspiration on different articles (Drucker 1966, 1969). We should, however, also acknowledge the influence of Bell (1968). Measured by the amount of citations in this period, he was as influential as Drucker in opening the discussion. Still, neither Drucker nor Bell really defined the concept of knowledge work. It seems that Drucker used the term knowledge worker to “embrace all whose work requires a high degree of specialized training and education and a mental, rather than physical effort” (Mandt 1978), but a clear definition of the phrase was still lacking.

3.4 Diffusion of the concept of knowledge work

Even if the early discussion was dispersed in different domains, the management domain was clearly the originating domain of discussion on knowledge work. Therefore, it is no surprise that by 1993 it was the management domain that started a serious discourse and actually defined what was meant by knowledge work through a special issue on knowledge work published by the *Journal of Management Studies* in 1993 (see Blackler et al. 1993).

This research built mainly on the work of ‘Managing knowledge work’ group of the Emergence period (Figure 2). This group was much influenced by research on cooperation and group behavior from e.g. the psychology domain (Campion et al. 1993). This group, called ‘Managing groups and teams’, is one of the 14 highly cited groups found using the dense sub-network grouping algorithm for the whole 1974 to 2003 period. Due to severe space limitations, we present here only 4 of the 14 groups, outlined in the co-citation network in Figure 3, and presented in more detail in Figure 4. The 4 groups are from the management domain (groups 1 and 2) and in the IS domain (groups 3 and 4). The other 10 groups do show that the

concept of knowledge work has also sporadically diffused in other research domains such as nursing, library research, linguistics, operations research, sociology, economy, or even urban and regional studies, but that the research in these groups has not influenced other groups of research later on.

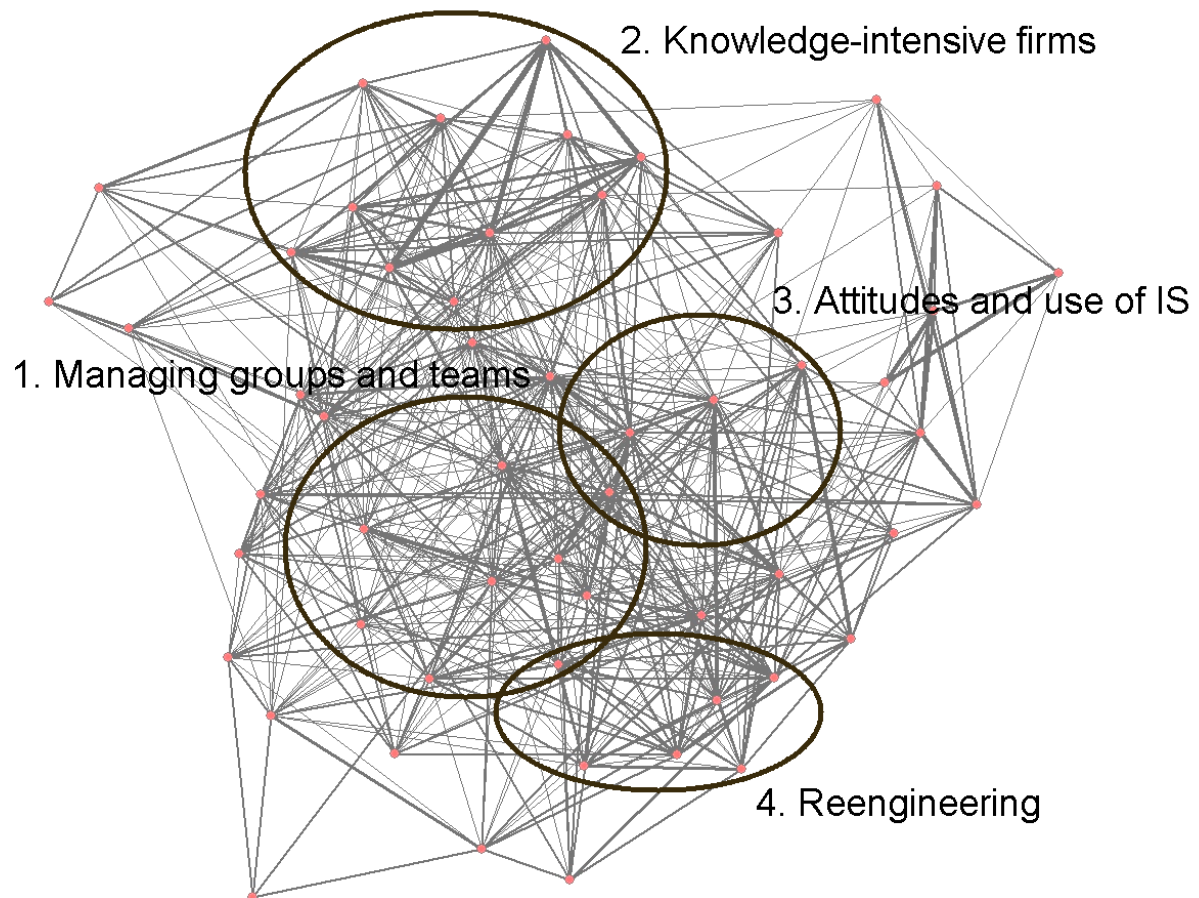
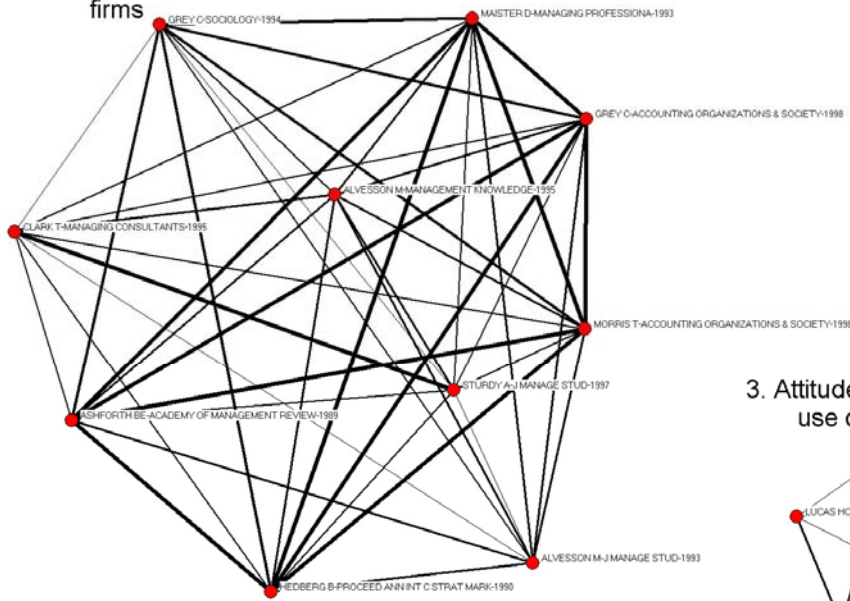
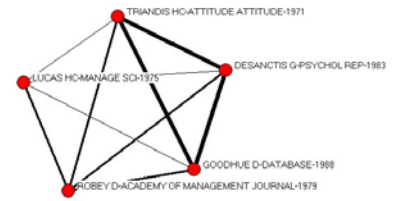


Figure 3: The four highly cited groups over the 1974 to 2003 period outlined in the co-citation network.

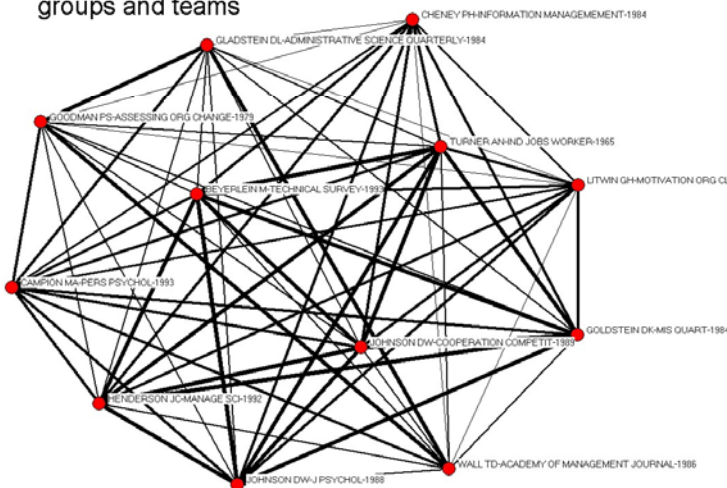
2. Knowledge-intensive firms



3. Attitudes and use of IS



1. Managing groups and teams



4. Reengineering



Figure 4: The four highly cited groups over the 1974 to 2003 period.

Like the 'Managing groups and teams' group, also the 'Attitudes and use of IS' group built mainly on previous work, continuing the work of 'IS support for knowledge work' group of the Emergence period. Besides research on user attitudes, the group was influenced by psychological theories explaining learning and use of IS. However, the 'Attitudes and use of IS' group started to decline after the outburst of research in the beginning of the Diffusion period as can be seen in Figure 5. The citing articles in this group (Figure 4) consist of cited articles that have been written in the 1970's and 1980's, suggesting that the outstanding research later on was done somewhere else.

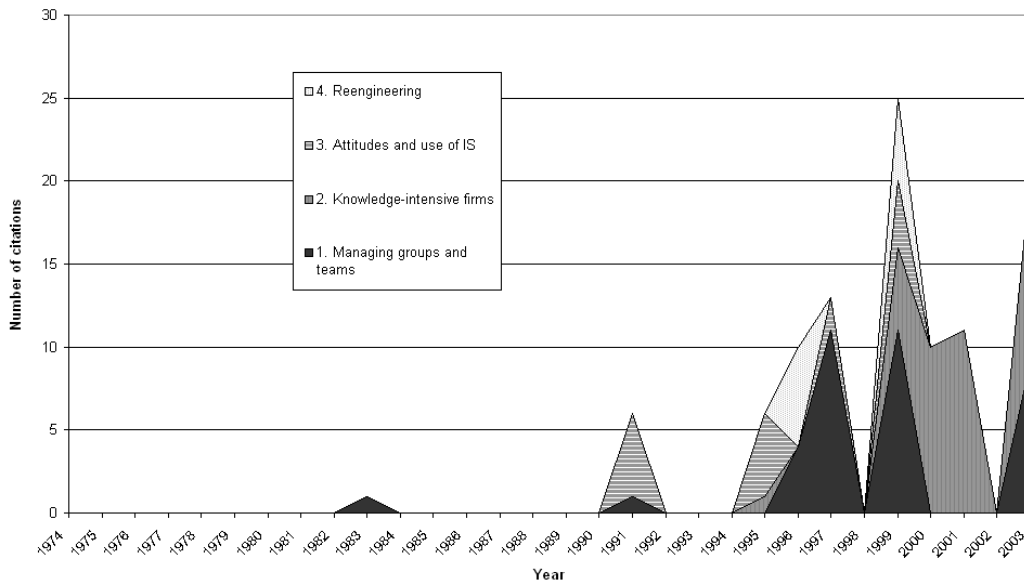


Figure 5: The yearly citations of the 4 most cited groups over the 1974 to 2003 period.

In the 1st diffusion period of 1993 to 1998, also another group emerged in the IS domain: the ‘Reengineering’ group. This group was interested in improving the processes of knowledge work, and drew on the business process engineering approach (Hammer and Champy 1993, Davenport 1995). This group was highly influenced by research of the ‘Managing groups and teams’ group: the existing strong links between the different groups can be seen in Figure 6. The main influence on the concept of knowledge work for this group seems to be Drucker (1969).

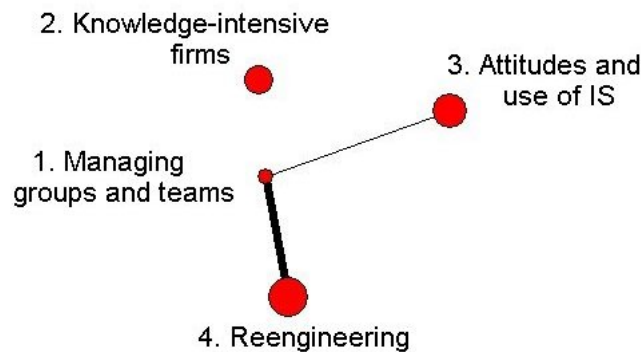


Figure 6: Relationships between the 4 most cited groups over the 1974 to 2003 period. The size of the dot represents the amount of received citations by the group.

The ‘Reengineering’ group was quite influential during the 1st diffusion period, and received huge attention in the form of citations (Figure 6). However, the peak of the group was quite short-lived (Figure 5). In fact, the 2 groups in the IS domain have not received any citations since the beginning of the 21st century. According to our analysis, the original work on the concept of knowledge work, is conducted in the management domain, influencing later on other domains like IS and nursing.

At this period, the ‘Managing groups and teams’ group in the management domain started to decline as well. Even if the group still receives citations in recent years (Figure 5), it has not produced any new articles since 1993. However, the 1st diffusion period saw the emergence of a new group in the management domain, the ‘Knowledge-intensive firms’ group. In the 2nd diffusion period, this group is already the most influential group writing about knowledge work, and is the source of the proliferation of the research in recent years. Also the most influential citing articles like Blackler (1995) (Table 1) and authors such as Blackler and Alvesson are from this group. The influence of the ‘Knowledge-intensive firms’ group is evident when regarding the list of most cited articles (Table 2), as the only recent citing articles to have made the top 20 are from this group.

Table 2: The 20 most cited articles (excluding methodological sources). Articles that are also citing articles are highlighted.

	1 st author	Year	Journal	Book or article title	Times cited
1	Nonaka	1995		The knowledge-creating company: How Japanese companies create the dynamics of innovation	21
2	Nonaka	1994	Organization Science	A dynamic theory of organizational knowledge creation	16
3	Senge	1990		Fifth discipline: The art and practice of the learning organization	15
4	Zuboff	1984		In the age of the smart machine: The future of work and power	15
5	Bell	1968		The coming of post-industrial society: A venture in social forecasting	13
6	Lave	1991		Situated learning: Legitimate peripheral participation	12
7	Drucker	1969		The age of discontinuities: Guidelines to our changing society	12
8	Nonaka	1991	Harvard Business Review	The knowledge-creating company	11
9	Davenport	1998		Working knowledge: How organizations manage what they know	14
10	Brown	1991	Organization Science	Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovating	10
11	Stewart	1997		Intellectual capital: The new wealth of organizations	9
12	Kunda	1992		Engineering culture: Control and commitment a high-tech corporation	9
13	Mintzberg	1973		Nature of managerial work	9
14	Kogut	1992	Organization Science	Knowledge of the firm, combinative capabilities, and the replication of technology	8
15	Blackler	1995	Organization Studies	Knowledge, knowledge work and organizations: An overview and interpretation	8
16	Alvesson	1993	Journal of Management Studies	Organizations as rhetoric: Knowledge-intensive firms and the struggle with ambiguity	8
17	Prahalad	1990	Harvard Business Review	The core competence of the corporation	8
18	Levitt	1988	Annual Review of Sociology	Organizational learning	8
19	Drucker	1988	Harvard Business Review	Management and the world's work	8
20	Davenport	1998	Sloan Management Review	Two cheers for the virtual office	7

The 'Knowledge-intensive firms' group was not influenced by the work done by the group 'Managing groups and teams', but has drawn mainly on the early work of Bell (1968) and especially Zuboff's *In the age of the smart machine* (1984). Bell (1968) and Zuboff (1984) are also quite high on the most cited list, higher than Drucker (1969). So, while Drucker and Bell are early influencers on the discussion evolving around knowledge work, we should not underestimate the work of Zuboff who was an inspiration to later new streams of thought. If we look at Figure 7, we see that Zuboff (1984) was not 'discovered' in the scientific discussion before 1993, when the 'Knowledge-intensive firms' group started using his work. Nonaka, who is the most cited individual author (48 citations in total), was clearly not noticed at this time. He was recognized in the scientific discussion only after his *The knowledge-creating company* (1995), even if he had written on the topic in *Harvard Business Review* already in 1991. It seems that sources such as Nonaka and Takeuchi (1995) and Senge (1990) might be cited more as general sources.

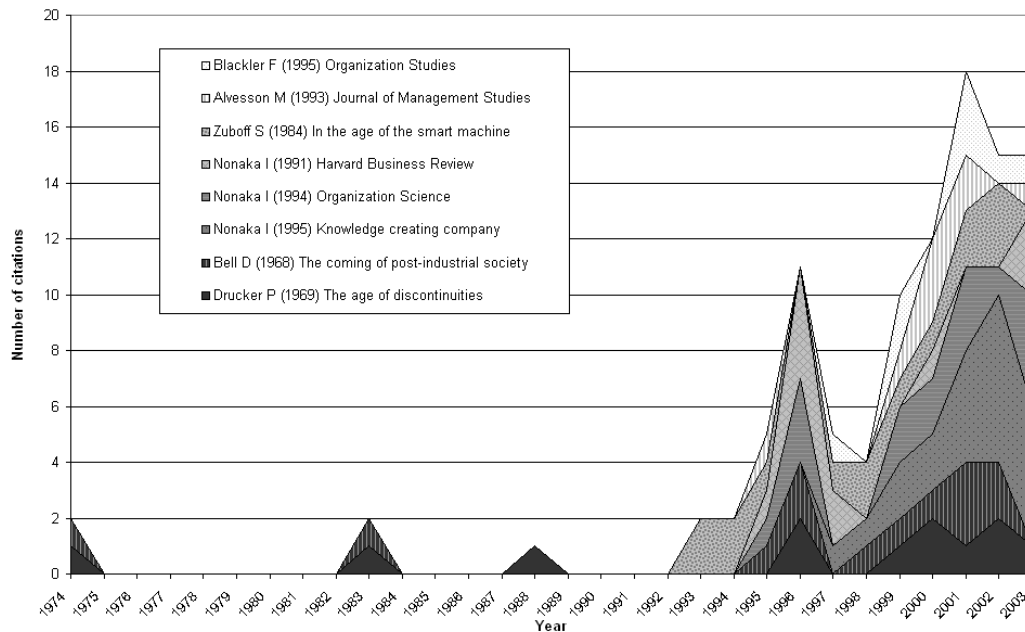


Figure 7: The yearly citations of the most cited references that are discussed in the text.

4. Discussion and conclusions

It is evident that the current discussion around the concept of knowledge work is somewhat dispersed in different scientific domains. However, the main discussion takes place inside the management domain. This discussion is also divided into at least two main groups that focus more either on ways that knowledge work is performed and managed as teams and project groups, or on the actual implications and meaning of knowledge work in organizations. These groups do have some common cited articles like Nonaka and Takeuchi (1995), but they draw on somewhat different articles in their ideas on knowledge work *per se*. We feel that as the research area has matured in recent years and has witnessed proliferation of publications on the topic, there should be enough empirical material and insights to engage in a conceptual discourse.

This paper has contributed to current literature in two ways. First, we have narrowed down the relevant body of research on knowledge work in order to make the structure of the scientific discussion visible. We feel that there is a need to open a discussion between the different groups that have been identified in the analysis. This should be done in order to adopt a common definition of knowledge work and to gain a more profound understanding about the nature and meaning of knowledge work by combining the insights and results of different groups. As the scope of this paper has limited the discussion of the particular viewpoints on knowledge work adopted by different groups, future work should engage in more analytical work to show the similarities and differences between them. It is clear that the discussion on knowledge work is very much linked to the knowledge management domain, and we feel that the knowledge management community should be the starting point of this discussion. We hope that this paper could serve as a starting point to more conceptually-oriented discussions and more detailed research, e.g. content analysis, aiming toward a common definition of knowledge work.

Second, our analysis on the emergence and diffusion of the concept of knowledge work is a new way to use co-citation analysis to investigate how individual concepts are found and used in scientific discussion. We have shown that there are indeed various invisible colleges that influence how concepts emerge and diffuse in the scientific literature. Future work is needed to test the usability of this approach in different settings, and to combine this analysis with an analysis of the informal influences not shown in bibliographic analyses but affecting the adoption and diffusion of scientific concepts.

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