

## Knowledge-base economic

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Received 23 October 2011; received in revised form 9 May 2011; accepted 22 June 2011

### Abstract

This paper explores the relationship between KM approaches and innovation performance through a preliminary study focusing on the manufacturing industry. The most significant implication that has emerged from the study is that managers in manufacturing firms should place more emphasis on human resource management (HRM) practices when developing innovation strategies for product and process innovations. The study shows that KM contributes to innovation performance when a simultaneous approach of "soft HRM practices" and "hard IT practices" are implemented.

### 1. Introduction

In its ideal form, innovation has the capacity to improve performance, solve problems, add value and create competitive advantage for organisations. Innovation can be broadly described as the implementation of both discoveries and inventions and the process by which new outcomes, whether products, systems or processes, come into being (Williams, 1999). The process of innovation depends heavily on knowledge, particularly since knowledge represents a realm far deeper than simply that of data, information and conventional logic; indeed, the power of knowledge lies in its subjectivity, underlying values and assumptions that underpin the learning process (Nonaka and Takeuchi, 1995). As old distinctions between manufactured objects, services and ideas are breaking down, knowledge assumes a more pivotal role within organisations (Davenport and Prusak, 1998). According to Stewart (1997), the management of knowledge and human capital should be an essential element of running any type of business, yet few individuals understand this challenging area; and, given the potential of knowledge management (KM) and intellectual capital as sources of innovation and renewal, business strategy should be focusing more on these issues.

The focus on issues of power and intellectual capital in the general business and management literature has implications for the study of KM. Where information management was viewed as a somewhat neutral and normative servicing system in the organisational literature in the 1970s (Handy, 1976; McRae, 1971), today KM has emerged as a discrete area in the study of organisations to the extent that it has become recognised as a significant source of competitive advantage (Nonaka, 1991; Nonaka and Takeuchi, 1995; Davis, 1998; Matusik and Hill, 1998; Miller, 1999; Moore and Birkinshaw, 1998; Stewart, 1997). Although having emerged as a field of study in its own right, KM has been criticized for being a misnomer and an oxymoron. The authors wish to thank Christopher J. Miller for making available his database and allowing them to utilise certain aspects of the data for this paper.

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(Coleman, 1999), or for being “fuzzy” and imprecise (McCune, 1999). While KM has a concrete and tangible side characterised by people, physical systems and processes, there is a great deal of scope for interpretation, as KM practices are highly subjective in nature and subject to various interpretations. There is no shortage of definitions of KM (Liebowitz, 1999); however, for the purposes of this paper we will highlight two broad definitions. For Beckman (1999), KM concerns the formalisation of and access to experience, knowledge, and expertise that create new capabilities, enable superior performance, encourage innovation, and enhance customer value. Coleman (1999) defines KM as an umbrella term for a wide variety of interdependent and interlocking functions consisting of: knowledge creation; knowledge valuation and metrics; knowledge mapping and indexing; knowledge transport, storage and distribution; and knowledge sharing.

## 2.2 Approaches to KM

Definitions of the term “knowledge” vary considerably, and often such definitions are not clearly explicated in either the research literature or in the operational context. For the purposes of this paper, information can be characterised as “data endowed with relevance and purpose” (Drucker, 1998), while knowledge can be defined as “information combined with experience, context, interpretation, and reflection” (Davenport et al., 1998). Accordingly, all organisations deal in knowledge. However, organisations can choose between competing systems and processes to acquire, manage, and disseminate knowledge. These systems and processes are explicit as well as implicit and can be influenced by personal and organisational values and ideologies. In terms of an organisation’s internal systems, organisations actually filter acquired knowledge. For example, one organisational culture may support a devolved structure in KM while another’s culture may choose more centralised systems. In another organisation, information technology (IT) will drive KM while another organisation will favour a more human approach. At various points as knowledge moves through an organisation, choices are made about the most appropriate way to manage its flow. Research by Hansen et al. (1999) has indicated that organisations do not adopt a uniform approach to knowledge management. They outline two distinct strategies utilised when selecting a KM approach: a codification strategy, centred around IT resources; and a personalization strategy, centred around human resources (HR). Their research also suggests that in the rare cases when organisations attempt to adopt elements of both approaches, this leads to problems of a serious enough nature to undermine a business. Sveiby (1997) has also referred to two distinct approaches to knowledge management, one focusing more on people, the other more on technology. Indeed, contemporary knowledge management approaches appear to represent extensions of either organisational learning or business information systems, and these KM approaches tend to be driven predominantly within an IT or humanist framework or paradigm, with little if any overlap (Gloet, 2000). This divide between KM approaches has ramifications for both organisational learning and innovation processes. One body of literature on KM has its origins in approaches to IT, information systems and related issues. This canon supports an IT paradigm. In contrast, a competing body of literature supports a humanist paradigm in which the social relations of organisational knowledge are paramount. While this latter paradigm recognizes the technical side of KM, it also highlights the significant influence of people in the process of managing and interpreting knowledge. Whereas literature in the IT paradigm focuses more on tangible aspects of KM, such as collection and manipulation of information, the humanist paradigm concerns itself more with the nature of learning and the harnessing knowledge as an organisational resource. Compared to the “hard” IT paradigm, the “soft” humanist paradigm accords more attention to organisational slogans, metaphors, and symbols (Nonaka, 1991). Consequently, the analysis of KM in a humanist paradigm is open to more interpretive explanations. To confound the study of KM in general, the two paradigms necessitate two very different approaches. In the IT paradigm, researchers have accepted various extensions of information processing/business information systems management as springboards into KM. As a consequence, their research focuses on the collection, storage, and manipulation of essentially objective or explicit data, employing methodologies that implicitly construct an organisation as an information processing system. This diverts attention to how data are processed, collected, and stored (Lado and Zhang, 1998). Given this implicit focus in the IT paradigm, most KM tools revolve around information systems and software (Fusaro, 1998). Within the humanist paradigm, recent literature highlights the role of individuals and groups in the processes of knowledge sharing and manipulation, particularly with regard to highly interpretive

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forms of knowledge. Other themes in the paradigm include the distinctions between tangible and intangible knowledge, or explicit versus tacit knowledge (Nonaka and Takeuchi, 1995; Nonaka, 1991). In addition, other studies explore the role of knowledge and learning at the systems, organisational, and cultural level of an organisation (Nevis et al., 1995). Other literature in the area of KM suggest that a number of organisational or infrastructural elements have the power to influence the success or otherwise of KM within an organisation. These include: a healthy

organisational culture and support infrastructure (Beckman, 1999; Zand, 1997; Quinn et al., 1997); management support and proactive leadership (Davenport, 1996; Beckman, 1999), empowerment of employees (Davenport and Prusak, 1998; Liebowitz and Beckman, 1998); understanding KM as a business strategy (Ruggles and Holtshouse, 1999); strong communication channels (Koulopoulos and Frappaolo, 1999); and a commitment to developing and sustaining a climate for learning within the organisation (Starbuck, 1997; Liebowitz and Beckman, 1998).

### 2.3 Innovation

There are numerous definitions of innovation in the literature; however, most definitions share common themes relating to knowledge, which may be turned into new products, processes and services to improve competitive advantage and meet customers' changing needs (Nystrom, 1990). Carnegie and Butlin (1993) define innovation as "something that is new or improved done by an enterprise to create significantly added value either directly for the enterprise or directly for its customer." Livingstone et al. (1998) refer to innovation as "new products or processes that increase value, including anything from patents and newly developed products to creative uses of information and effective human resource management systems". Regarding the sources of innovation in management, De Toni et al. (1998) identify six sources of innovation, Drucker (1985) identifies seven sources and Edquist (1997) refers to nine. More recently, the Continuous Improvement and Innovation Management Project (CIMA) has identified four enabling mechanisms that contribute to continuous innovation and improvement, these being capabilities, behaviours, contingencies and levers (Gieski, 1999).

### 2.4 KM and innovation

From the literature, a number of elements of successful KM have been identified. HR can be seen as a strategic lever in creating competitive advantage through the value of the knowledge, skills and training (Becker and Gerhart, 1996). There is also reference to the need for a strong IT infrastructure within the organisation (Beckman, 1999; Libowitz and Beckman, 1999; Zand, 1997; Davenport and Prusak, 1998). In addition, in order to understand better the nature of innovation, management must ensure that innovation is woven into an organisational culture (Cottrill, 1998). Several researchers have emphasised the pivotal role of the management of knowledge, particularly in creating an internal working environment that supports creativity and fosters innovation (Amabile et al., 1996; Carnegie and Butlin, 1993; Soderquist et al., 1997). The literature indicates the need to formulate a method within a framework, to confront empirical data in the interest of pursuing further insights into the complex relationship between knowledge and innovation. The following research questions are articulated for analysis in this paper:

RQ1. Is a KM model based on IT and human resource management (HRM) a reliable and valid instrument for measuring and predicting the relationship between KM practice and innovation performance?

RQ2. Is there a significant and positive relationship between KM practices based on IT and HRM and innovation performance?

## 3. Theory and framework

Rigorous research involving the management of innovation is scarce (AECD, 1998). While a growing body of literature has attempted to understand innovation, the literature shows definite gaps in the investigation of KM processes and innovation. Therefore, this study will pose specific, relevant hypotheses in an attempt to gain a greater understanding of the relationship between innovation and KM practices relating to both human resources and IT resources. The following hypotheses are tested in this study:

H1. A KM model based on humanist/IT criteria is a reliable and valid instrument for measuring and predicting the relationship between KM practice and innovation performance.

H2. There is a significant and positive relationship between elements of HR/humanist approaches to KM and innovation performance.

H3. There is a significant and positive relationship between elements of IT focus on technological advancement (e-commerce) to KM and innovation performance.

## 8. Conclusions and implications for managers

Based on the results of this exploratory study we conclude by answering the two questions articulated at the beginning of this paper. Our first conclusion is that a KM model based on IT and HRM focus is a reliable and valid instrument for measuring and predicting the relationship between KM practices and innovation performance. Our second conclusion is that there is a significant and positive relationship between KM practices based on a combination of IT/HRM and innovation performance. From this point it can be argued that organisations should strive for an integrated approach to KM in order to maximise innovation performance leading to competitive advantage.

However, we found a significant and negative relationship between elements of IT focus on technological advancement (e-commerce) and innovation performance. This may be explained to a certain extent by the fact that e-commerce is still in its early stages, and therefore a sense of confidence in e-commerce as a major force in improving and sustaining innovation performance may not be shared by the managers surveyed. As the study was limited to the manufacturing sector, it may be argued that a multiple sector survey could yield different results. It may, for instance, be speculated that managers in the service sector may view e-commerce as having greater potential to influence innovation performance. Given the exploratory nature of the study, and the small sample size, it is clear that further investigation into the relationship between e-commerce and innovation performance is needed on a larger scale. The most significant implication that has emerged from the study is the conclusion that managers in manufacturing firms should place more emphasis on HRM practices when developing innovation strategies for product and process innovations. The study shows that KM contributes to innovation performance when a simultaneous approach of "soft HRM practices" and "hard IT practices" are implemented.

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**Abstract:** Purpose – The main objective of this paper is to develop a knowledge management (KM) approach in Iran aerospace industries based on the findings through the analysis of successful practices in KM area. Design/methodology/approach – A qualitative case study technique has been used in this paper for data collection and analysis. For that, “grounded theory” research approach has been selected by which the collected data from successful organizations in KM adoption are categorized and analyzed. The extracted concepts were deployed in Iran aerospace industries to present a KM approach through benchmarking.

## Introduction

Knowledge management (KM) is known as a systematic, goal-oriented application of measures to steer and control the tangible and intangible knowledge assets of organizations with the aim of using existing knowledge inside and outside of these organizations to enable the creation of new knowledge, and generate value, innovation and improvement out of it (Wunram, 2000). KM creates a new working environment where knowledge and experience can easily be shared and also enables information and knowledge to emerge and flow to the right people at the right time so they can act more efficiently and effectively (Smith, 2001). Meanwhile by the comparison of different definitions of “KM” the following aspects of high relevance are resulted during KM adoption (Wunram, 2000): “Exploitation of existing knowledge, Creation of new knowledge, Process orientation, Goal orientation, Value orientation, Improvement orientation, and Innovation orientation”.

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**Introduction:** on innovation as a means to create and maintain sustainable competitive advantages.

Innovation is considered a fundamental component of entrepreneurship (e.g. Covin and Miles, in press) and a key element of business success (e.g. Nonaka and Takeuchi, 1995). This is becoming even more evident as we move into a post-capitalist, knowledgebased society (Drucker, 1993). Jacobson (1992) argues that continuous changes in the state of knowledge produce new disequilibrium situations and, therefore, new profit opportunities or “gaps”. The rate of change is also increasing due in part to exponential advancements in technology, frequent shifts in the nature of customer demand, and increased global competition. D’Aveni (1994) categorizes the situation in its extreme form as “hyper-competition” and, as we move into a more knowledge-based society, an increasing number of industries and firms are likely to face such hypercompetitive conditions. Hence, the unending and increasing stream of knowledge that keeps marketplaces in perpetual motion will require companies to focus even harder on being innovative in order to create and sustain competitive advantages. what is innovation and how should it be operationalized? As a starting point, we note that nearly every definition of innovation focuses on the concept of newness. Slappendel (1996) argues that the perception of newness is essential to the concept of innovation as it serves to differentiate innovation from change. Thus, we suggest that, in order to isolate a useful definition and measure of innovation, we need to address three newness-related questions: what is new, how new, and new to whom? With these innovation concepts in mind, we developed a study that investigated six different types of innovative activity:

- (1) new products;
- (2) new services;
- (3) new methods of production;
- (4) opening new markets;
- (5) new sources of supply; and
- (6) new ways of organizing.

The purpose of the study was to explore how perceptions of innovative activity in these six areas might contribute to a meaningful definition of innovation and inform us about effective ways to measure innovation. Two different mailed surveys were conducted among Norwegian firms ± a “general” study to which 696 CEOs from eight industry groups responded, and a “knowledge sector” study that yielded 200 CEO respondents from the information technology sector (IT-sector).

## Literature review

The innovation literature can be categorized into four different approaches or orientations:

- (1) individual-oriented;
- (2) structure-oriented;
- (3) interactive-oriented; and
- (4) systems of innovation-oriented.

The individual-oriented perspective emphasizes the role of individual factors such as age, educational level, gender, cognitive style and creativity (e.g. Scott and Bruce, 1994). Influential theoretical sources are mainly found in the notion of the rational actor and in limited rationality as a determinant of innovation (Pettigrew, 1985; Cyert and March, 1963). The structural perspective focuses on organizational characteristics. Influential theoretical sources here are structural functionalism and contingency theory, i.e. how organizational structure constrains or propels innovation. A strongly emphasized area in this perspective is the relationship between the organization and the environment (Slappendel, 1996). The interactive perspective has recently received increased attention (e.g. Van de Ven et al., 1989; Van de Ven and Rogers, 1988). The focus in this perspective is on how action influences structure, and vice versa in the innovation process (Van de Ven and Poole, 1988; Pettigrew, 1985; Walton, 1987), and some importance has been attached to the political context of innovation (Child and Smith, 1987). A fourth research school which has also received increased attention in

recent years is the study of how national and regional innovation systems influence innovation activity in companies (Nelson and Winter, 1982; Lundvall and Johnson, 1994; Edquist, 1997). The main focus is on the organization in the environment, interactive learning, knowledge creation, the practical use of knowledge and the distribution of knowledge. In particular, the knowledge infrastructure and the organization of networks between companies and knowledge institutions, suppliers, customers and other entities are emphasized in this perspective. Each of these orientations may be useful for addressing issues of the definition and measurement of innovation. But the picture that emerges from these diverse approaches underscores the point that a multitude of factors are interacting to induce innovation in economic life. The various perspectives are indicative of the lack of common definitions and measures of innovation. The resulting inconsistency makes it difficult to conduct comparative studies because it is often unclear whether researchers are studying the same phenomena. Thus, in the subsections below, we draw on important insights from each of these four schools to focus on the elements of innovation that are common across approaches.

**Innovation as newness** Most of the widely-used definitions of innovation focus on novelty and newness. For example, the European Commission Green paper on innovation defines innovation rather broadly as a synonym for "the successful production, assimilation and exploitation of novelty in the economic and social spheres" (European Commission, 1995, p. 9). Nohria and Gulati (1996) defined innovation to include any policy, structure, method or process, or any product or market opportunity that the manager of an innovating unit perceives to be new. Damanpour defined innovation as "the generation, development, and adaption of novel ideas on the part of the firm" (1991, p. 556), and Zaltman et al. defined it as "any idea, practice, or material artifact perceived to be new by the relevant unit of adoption" (1973, p. 10). Although newness is a theme in all of these definitions, they do not agree on three basic questions about the nature of newness: what is new, how new, and new to whom? Several of the definitions suggest a theme of "successful adoption", for example, but are vague in terms of what is adopted and what constitutes a success. Specifying what is new is important for distinguishing innovation from mere change (Slappendel, 1996) because all innovation presupposes change, but not all change presupposes innovation. Additionally, none of the above definitions addresses the issue "how new?", that is, the degree or extent of newness that constitutes an innovation. Finally, the issue of new to whom? is also unresolved in the above definitions. Nohria and Gulati's (1996) definition seems confusing because it is unclear whether the newness of an innovation applies to the manager of an innovating unit or to the innovating unit itself. Damanpour's (1991) emphasis on newness to the firm seems to exclude the kind of innovation that might be associated with individuals or emerge from systems of innovation outside the firm. As a starting point, this study embraces Zaltman et al.'s (1973) definition of innovation as "any idea, practice, or material artifact perceived to be new by the relevant unit of adoption" to guide our examination of what is new, how new, and new to whom? Next, we will discuss each of these subquestions in more detail.

**What is new?** Evidence of vagueness in specifying what about innovation is new can be found by analyzing how innovation has been operationalized in prior studies. A European example illustrates this well. In 1991, the European Commission stated the following: "economic performance depends upon the progressive introduction over time of innovations in products and processes . . ." (European Commission, 1991, p. 8). This notion was elaborated in the European Commission Green Paper on innovation which emphasized "the successful production, assimilation and exploitation of novelty in the economic and social spheres" (1995, p. 10). When it came to operationalizing the construct, however, the Green Paper used proxy's as measures of innovative activity rather than explicitly addressing what is new. These proxy's include, among other measures, total expenditure on R&D, proportion of R&D scientists and engineers, and number of patents. Similar measures can be found in other innovation research: Daft and Becker (1978) analyzed the number of innovations adopted within a given period of time, Blau and McKinley (1979) investigated the number of patents, Miller (1987) measured the relative amount spent on R&D, and Miller and Friesen (1978) used the number of new product and service introductions. The measures in these earlier studies often had limited face validity and tended to foster a narrow view of innovation.

Such operationalizations are rather weak indicators of what is new and they generate several levels of problems for research. First, these measures indicate a general lack of consistency between definition and measurement. Second, a heavy focus on R&D suggests a linear approach to the innovation process, although most contemporary research emphasizes circular processes (e.g. Nelson and Winter, 1982; Edquist, 1997). Third, by focusing on the proportion of scientists and engineers, they leave out other members of the organization who may be equally important to the innovative activity within a firm (Johannessen and Hauan, 1994). Fourth, by using patents as measures of innovative activity, they ignore those who argue that patents are often not commercialized (Manu and Sriram, 1996), and that innovations may take other forms than only those that it is possible to patent. It may also be argued that all innovations are not patented. Hence, the operationalizations and measurement of innovation in prior research provide little guidance to the question "What is new?" Exceptions, however, do exist. Some researchers have used methods that are consistent with Zaltman et al.'s (1973) notion of perceptions of newness. McGrath et al. (1996) operationalized innovation by

having participants address to what extent 15 different project characteristics were new to the firm at the moment. The characteristics ranged from new products to the skill of the project team. Damanpour (1996) operationalized innovation broadly to encompass a range of types, including new products or services, new organizational structures or administrative systems, new process technologies or new plans or programs pertaining to organizational members. We follow in the footsteps of McGrath et al. (1996) and Damanpour (1996), who themselves relied on important work by Schumpeter (1934; 1939; 1942) and Kirzner (1976; 1985), to operationalize what is new in a fashion that addresses a range of innovative activities across broadly-defined "relevant units of adoption". How new? A review of the four orientations in the innovation literature reveals that several different approaches have been used to address the issue of how new, that is, the degree of newness that constitutes an innovation. The literature has devoted considerable attention to debating the issue of revolutionary innovations (Gersick, 1991). Revolutionary innovations, often reflected in punctuated equilibrium models (Tushman and Romanelli, 1985), describe situations where discontinuities totally redefine the meaning of an industry by creating new technological regimes or paradigms. The invention of the combustion engine and IBM's introduction of the DOS operating system are examples of such revolutionary innovations. Lawless and Anderson (1996) argued that most punctuated equilibrium models are explaining broad patterns of change on a historical time scale. However, within these paradigms, considerable innovative activity may take place. Henderson and Clark (1990), for example, argued for the importance of architectural innovations, i.e. the reconfiguration of existing products. Drazin and Schoonhoven (1996) noted that the emergence of a dominant design leads to additional innovation, bringing new approaches and technologies in its wake. For instance, in the IT-sector, the pace of innovation has been extremely rapid within existing technological regimes. The distinction between radical and incremental innovations is also often highlighted in studies of innovativeness. Hage (1980) argued that innovations vary along a continuum from incremental to radical. The term "radical" has been associated with revolutionary innovations, whereas "incremental" is associated with innovations within a paradigm (Dosi, 1982; Dewar and Dutton, 1986). However, the distinctions noted above suggest that the terms radical and incremental could also be used in a within-paradigm context. Damanpour (1996), for example, used the term radical innovations to characterize innovations that produce fundamental changes in the activities of an organization and large departures from existing practices, whereas the term incremental innovations was used to depict innovations that represent a lesser degree of departure from existing practices. In both cases, the terms apply to within-organization innovations. From this very brief review of the literature, we observed that the issue of "how new" is closely linked to the question, "new to whom?" That is, in order to operationalize the distinction between incremental and radical innovations, we must also determine the relevant unit of analysis. It is that issue that we turn to next. New to whom? Prior innovation research suggests that the extent of newness of an innovation may be related to the domain into which the innovation is adopted. In other words, to assess the nature of an innovation, we need simultaneously to consider the "relevant unit of adoption". Both Cooper (1993) and Kotabe and Swan (1995) argued that innovation can be investigated in terms of both newness to the company (the firm-based framework), and newness to the market (the newness to the market framework). Although the firm-based framework is unlikely to reflect a product's impact on either competitors or customers (Kotabe and Swan, 1995), from a broader perspective, the measure does capture the ability of a firm to service and continue to update the innovative technology which are key consumer concerns. Thus, even innovations that are primarily new within a firm may have an impact outside the firm. Booz, Allen & Hamilton (1982) combined the two approaches in a framework that identifies six levels of product innovativeness. However, since innovations can materialize both as new products and new processes (Utterback and Abernathy, 1975; Damanpour, 1996), we argue that newness to a market framework represents a view that is too narrowly focused on product innovations. To encompass both product and process innovations, we suggest that newness to the industry, rather than newness to the market, represents a more broadly-construed and inclusive framework. Thus, by ascribing to Zaltman et al.'s (1973) notion of "relevant units of adoption", we envision a continuum of units of adoption that is roughly parallel to the degree of radicalness continuum. That is, as the economic unit that adopts an innovation becomes more broadly-defined or encompassing, the impact of the innovation is more likely to be radical, that is, organizationchanging or paradigm-shifting. In operationalizing this distinction, therefore, it is important to inquire about both within-firm and industry-level innovations to address the question, "new to whom?"

#### Issues of definition

Innovation as a descriptor is so widely used that its reference has become somewhat generic. Organizations use innovation as a term to describe many things and definitions of innovation found in the literature vary depending on the context and scope of the analysis. Some definitions are quite general – for example, to have creative employees or be market leading, and others quite specific – referring to the types of behaviors and specific roles – in the form of culture, to be engaged by employees. In their article, they propose and define organizational innovativeness as:

an organization's overall innovative capability of introducing new products to the market, or opening up new markets, through combining strategic orientation with innovative behavior and process (Wang and Ahmed, 2004).

Their definition of innovativeness was multi-dimensional, as was their construct which included the dimensions of product, market, process, behavior and strategic innovation. It is probably safe to say that that innovation is associated with creativity and change (Drucker, 1991; Hellriegel et al., 1998; Robbins, 1996), or is regarded as something new which leads to change (West and Farr, 1990). Thus, it would appear that the standard for innovativeness is multi-dimensional, and grounded in product/service, process, behavioral (cultural), and infrastructure aspects.

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#### Abstract

Purpose – To provide important empirical evidence to support the role of knowledge management within firms.

Design/methodology/approach – Data were collected using a mail survey sent to CEOs representing firms with 50 or more employees from a cross-section of industries. A total of 1,743 surveys were mailed out and 443 were returned and usable (27.8 percent response rate). The sample was checked for response and non-response bias. Hypotheses were tested using structural equation modelling.

Findings – This paper presents knowledge management as a coordinating mechanism. Empirical evidence supports the view that a firm with a knowledge management capability will use resources more efficiently and so will be more innovative and perform better.

management. However, there are a number of studies that consider antecedents of innovation and performance. Many of these antecedents may be applicable within a definition of knowledge management. For example, Capon et al. (1992) profiled innovative firms in the USA and found that acquiring other firms, as a way of accessing new knowledge, did not significantly affect the ability of a firm to innovate. However, Capon et al. (1992) did find that hiring scientists, spending money on applied R&D to develop new products and encouraging scientific discussions enhances the ability of a firm to innovate.

Probably the most frequent area of research linking knowledge management and innovation relates to the role of inter-functional co-ordination, teamwork and the use of networks to facilitate innovation. There are many good review articles in this area. Perhaps one of the more extensive reviews is that of Griffin and Hauser (1996) who examined the integration between R&D and marketing, citing such integration as an important antecedent of new product success. In this article, Griffin and Hauser (1996, p. 202) make recommendations based on a summary of a large number of empirical studies, that integration is achieved by the design and location of physical facilities, personnel movement, informal social systems, organizational structures, incentives and rewards, and formal integrative management processes (e.g. the use of the stage-gate new product development process or quality functional deployment process). Henard and Szymanski (2001) provide another comprehensive review article. The authors undertook a meta-analysis of the antecedents of new product performance. Of the 24 antecedents reported frequently (i.e.  $n \geq 10$ ), two related to aspects of knowledge management: cross-functional integration and cross-functional communication. However, the results of the meta-analysis found that neither could be generalized across research studies. Several studies provide mixed evidence of the effect of organizational climate on innovation (e.g. Amabile et al., 1996; Anderson and West, 1998; Capon et al., 1992; Tang, 1999). In this paper, it is argued that organizational climate is an antecedent of knowledge management since few items included in climate studies can be considered knowledge management behaviours and practices. To place climate as an antecedent of knowledge management is consistent with work by researchers such as Jaworski and Kohli (1993), who positioned organizational climate as an antecedent of a market orientation or Homburg and Pflesser (2000) who included a market oriented culture as an antecedent of market orientation behaviours and practices.

Thus, it is difficult to draw conclusions from the extant literature about the relationship between effective knowledge management and innovation. This is not because empirical evidence refutes the existence of such a relationship, but simply because research examining this link is developing. Thus, based on mixed but scant empirical results, it is proposed that each component of the knowledge management construct will positively affect innovation. In order for innovation to occur, managers first need to have knowledge about the internal and external forces that affect the firm – the more knowledge, and the greater the variety of knowledge, the better. Second, knowledge must flow freely around the firm – the better the dissemination of knowledge the greater the likelihood of innovation as more people within levels and departments of the organization are exposed to new knowledge that interacts with the knowledge already held. Lastly, an innovative organization is, by definition, responsive. In fact, innovation is a response in itself. Therefore, the more responsive and agile an organization is the more likely it is to be innovative. Thus, the relevant hypotheses are:

#### Definition of variables

Knowledge management orientation. Darroch (2003) developed three scales to measure behaviours and practices for each of component of knowledge management: knowledge acquisition, knowledge dissemination and responsiveness to knowledge. Knowledge acquisition is captured by six factors: valuing employees attitudes and opinions and encouraging employees to up-skill; having a well-developed financial reporting system; being market focused by actively obtaining customer and industry information; being sensitive to information about changes in the marketplace; employing and retaining a large number of people trained in science, engineering or math; working in partnership with international customers; and getting information from market surveys. Five factors describe the knowledge dissemination construct: readily disseminating market information around the organization; disseminating knowledge on-the-job; using techniques such as quality circles, case notes, mentoring and coaching to disseminate knowledge; using technology (such as teleconferencing, videoconferencing and Groupware) to facilitate communication; and preferring written communication to disseminate knowledge. Lastly, responsiveness to knowledge was described by five factors: responding to

knowledge about customers, competitors and technology; being flexible and opportunistic by readily changing products, processes and strategies; and having a well-developed marketing function. Innovation. The original Booz Allen Hamilton (1982) typology of innovation is used in this paper. Here, innovations are categorized as new to the world, new products to the firm, additions to existing product lines, improvements or revisions to existing product lines, cost reductions to existing products, or repositioning of existing products. New to the world innovations are typically characterized as radical innovations while the other categories are incremental innovations. In spite of recent attempts to revisit innovation typologies (for a recent discussion of this see Avlonitis and Gounaris, 1999 or Garcia and Calantone, 2002), the Booz Allen Hamilton (1982) scale still maintains reasonable face validity.

**Conclusions:** The role of effective knowledge management as a coordinating mechanism was established by providing evidence that firms with a propensity toward developing incremental innovations were more likely to have well-developed knowledge management behaviours and practices. One can assume that these firms not only have a knowledge management capability but also effectively use other available resources. This result provides early empirical support for the ideas of Penrose (1959) and Nelson and Winter (1982) by showing the role of knowledge management as a coordinating mechanism when developing incremental innovations. However, there was limited support for the view that a firm developing new to the world innovations had well-developed knowledge management behaviours and practices, nor was there conclusive evidence for the proposition that superior financial performance and knowledge management co-existed. One interpretation of this result is that new to the world innovations require those within the firm to move beyond their comfort zone, to take on board new knowledge and to develop new capabilities. It may be that a reliance on existing knowledge and existing processes to disseminate and respond to that knowledge may inhibit the development of new to the world innovations. For performance, it may be that there is perhaps too large a gap between the supporting role of knowledge management and performance as an outcome. All three knowledge management components were found to have a direct effect on innovation, but only responsiveness to knowledge directly contributed to financial performance. This result is particularly important because seminal works on knowledge management, for example Nonaka and Takeuchi's (1995) book, *The Knowledge-creating Company*, present knowledge management as imperative for innovation.

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#### Abstract

**Purpose –** This research proposes to study the connection between knowledge management practices and firm performance.

**Design/methodology/approach –** Theoretical relations are tested through an empirical study carried out on 222 Spanish firms in the biotechnology and telecommunications industries.

#### Literature review

The study of the possible effects of introducing KM in the firm has centered on determining whether it is able to carry out quantifiable improvements. As Davenport (1999) points out, although the relationship between KM and performance indicators has been discussed at length (exchange value, market value, balance sheet, etc.), few firms have been able to establish a causal relationship between KM activities and firm performance.

Firestone (2001) proposes an intuitive approach to clarify the relation between KM, corporate objectives and benefits. He suggests an abstract model called "benefit global estimation". To estimate the benefit of a KM program, a conceptual perspective is required, as well as the use of tools and methods, rather than the ad hoc use of analytical approaches. To relate KM programs and firm performance, the previous analysis of corporate objectives and business processes is required. In this sense, KM is a business process that can help firms reach their goals. Firestone (2001) argues that a KM program is made up of tasks ( $T_1, T_2, \dots, T_n$ ). These tasks have an impact on business processes ( $P_1, P_2, \dots, P_n$ ) and are compounded by different attributes which determine their present state. The difference between the present state and the objective state aids the understanding of how the introduction of a KM program influences firm performance.

One of the main problems of this model is the excessive simplicity of the effects deriving from the introduction of KM in the firm. There are variables related to human capital that the model does not include, such as the improvement of its capabilities or skills. Davenport (1999) relates KM activities with some intermediate activities that affect financial results. Progress in KM activities affects intermediate variables such as project performance measurements, indicators of the capacity of employees to carry out tasks related to knowledge, and finally, the generation of ideas and innovations. The generation of new ideas and innovations in the firm, due to a better use of knowledge, could have an effect on the improvement of processes. In the same way, an improvement in processes perfects employees' capabilities. Wiig (1999) creates a cause and effect diagram depicting the effects of introducing a KM program. The added value of the model lies in introducing all the effects deriving from a program that encourages the creation and sharing of knowledge.

Decarolis and Deeds (1999) study the impact of organizational knowledge on firm performance. Organizational knowledge is conceptualized through stocks and flows of knowledge (Dierickx and Cool, 1989). Knowledge stocks accumulate knowledge assets that are internal to the firm. Flows refer to all the elements able to modify the stock of knowledge. A suitable context for examining stocks and flows of organizational knowledge and its relationship with firm performance is a dynamic industry in terms of knowledge generation, so the authors are using the biotechnology sector for the empirical study.

H1. The degree to which an organization takes on the introduction of KM practices is positively related to firm performance. The acceptance of these practices or techniques creates an appropriate environment for the development of some distinctive competences (Lei et al., 1996; Beckman, 1997). This hypothesis can be formulated by distinguishing every dimension of the KM practices.



- H1a. There is a positive relationship between the orientation towards the development, transfer and protection of knowledge and firm performance.
- H1b. There is a positive relationship between continuous learning in the organization and firm performance.
- H1c. There is a positive relationship between an understanding of the organization as a global system and firm performance.
- H1d. There is a positive relationship between the development of an innovative culture that encourages R&D projects and firm performance.
- H1e. There is a positive relationship between an approach based on individuals and firm performance.
- H1f. There is a positive relationship between competence development and management based on competences and firm performance.

Dibella and Nevis (1998) state that the introduction of KM programs facilitates the acquisition of new knowledge, which will have a bearing on the creation of new routines and mental models. Ranft and Lord (2002, p. 420) hold that knowledge transfer occurs when knowledge-based assets are acquired and used. So, an organization directed towards knowledge development and transfer allows its human capital fast and unimpeded access to the knowledge (Szulanski, 1996). Besides, the importance of knowledge as basic factor to create competitive advantages is reinforced in industries that are constantly innovating (Decarolis and Deeds, 1999).

**Causal relationships:** All the structural models fit properly, so the first hypothesis and the six sub-hypothesis that can be derived from it have been verified.

From the results it could be concluded there is a strong and positive relationship between the adoption of KM practices and firm performance.