

## ROLE OF ICT IN KNOWLEDGE MANAGEMENT IN ORGANISATIONS

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### ABSTRACT

*Knowledge has been lately recognized as one of the most important assets of organisations. The past two decades have seen growing interest in knowledge management and the use of information technologies. However, it is not clear how the relation between IT competency and knowledge management works. This study provides a better understanding of that relation. IT competency has a direct effect on the processes of knowledge management: knowledge generation, knowledge transfer, and knowledge codification and storage. At the same time, IT competency also has an indirect effect on knowledge management by facilitating the development of organisational structures that favour the development and expansion of knowledge.*

**Key Words:** *Information, Knowledge, Knowledge Management, Information Technology, Organisation.*

### INTRODUCTION

Organisations are facing a competitive environment characterized by the globalization of markets, increasingly complex business problems, and the acceleration of change phenomena. Consequently, the traditional sources of competitive advantage, such as protected markets, and physical and financial assets, have lost importance compared to knowledge assets (Foray and Lundvall, 1996, pp.11-32). This has contributed to the growing interest in the concept of Knowledge Management (KM) in the past two decades. Knowledge management has emerged as a discrete area in the study of organisations and is frequently cited as an antecedent of organisational performance. If organisations implement knowledge management practices successfully, they are able to perform intelligently to sustain their competitive advantage by developing their knowledge assets (Wigg, 1999). Thus, it is essential to know how to generate knowledge, how to disseminate it in the organisation

and what factors facilitate these processes (Stewart, 1997).

The emergence of the knowledge management concept is motivating, particularly in organisations with a certain complexity, some concern to invest in initiatives that help the firm to share and develop its organisational knowledge. This explains the growing recent interest among both academics and company managers in analysing Information Technology (IT). In recent years a large number of studies have stressed the importance of IT for knowledge management. But it is not clear how the relation between knowledge management and IT competency works. This is due to a number of reasons. First, the literature generally recognizes that IT has a positive effect on knowledge management, but researchers do not empirically analyze how IT affects each of the individual processes (knowledge generation, knowledge transfer, and knowledge codification and storage). One of the main contributions of the current work

has been to analyze the impact of IT on these three knowledge management processes.

The knowledge movement has proposed to put knowledge on the balance sheet in the form of intangible assets that account for organisations' intellectual capital. Such intangibles include: employees' competence; the internal structure of organisations, given by their patents, their own models, concepts and processes, their administrative system and IT infrastructure; their external structure, given by the relationships they have developed with customers and suppliers, their brand names, trademarks, image and reputation (Sveiby 1997). Some companies, most famous Skandia, a Swedish financial services firm, have started to develop knowledge auditing methodologies and to publish an intellectual balance sheet. But there is more than this. With respect to earlier, more scientific approaches to knowledge, from western epistemology to artificial intelligence, the knowledge movement has brought the new awareness that organisational knowledge is something inherently fluid and elusive, so inextricably linked with humans that people very often take it away once they leave the place; something that defeats being captured by rules and formulas and that comes in many different shapes and forms, one form dynamically transmuting into another. In particular, we have learned to distinguish between explicit knowledge and tacit knowledge (Nonaka and Takeuchi 1995). Explicit knowledge is formal knowledge that can be packaged as information and can be found in the documents of an organisation: reports, articles, manuals, patents, pictures, images, video, sound, software etc. Tacit knowledge is personal knowledge embedded in individual experience and is shared and exchanged through direct, eye-to-eye contact. Clearly, tacit knowledge can be communicated in a most direct and effective way. By contrast, acquisition of explicit knowledge is indirect: it must be de-coded and re-coded into one's mental models, where it is then internalized as tacit knowledge. In reality, these two types of knowledge are like two sides of the same coin, and are equally relevant for the overall knowledge of an organisation. Tacit

knowledge is practical knowledge that is key to getting things done, but has been sadly neglected in the past, falling very often victim to the latest management fad. For instance, the recent spate of business process re-engineering initiatives, where cost reduction was generally identified with the laying off of people—the real and only repositories of tacit knowledge—has damaged the tacit knowledge of many organisations. Explicit knowledge defines the identity, the competencies and the intellectual assets of an organisation independently of its employees; thus, it is organisational knowledge par excellence, but it can grow and sustain itself only through a rich background of tacit knowledge. Indeed, the other great discovery of the knowledge movement lies in the following simple observation: knowledge that doesn't flow doesn't grow and eventually ages and becomes obsolete and useless—just as money which is saved without being invested eventually loses value until it becomes worthless. By contrast, knowledge that flows, by being shared, acquired and exchanged, generates new knowledge. Existing tacit knowledge can be expanded through its socialization in communities of interest and of practice, and new tacit knowledge can be generated through the internalization of explicit knowledge by learning and training. New explicit knowledge can be generated through the externalization of tacit knowledge, as happens, for instance, when new best practices are selected among the informal work practices of an organisation. Existing explicit knowledge can be combined to support problem-solving and decision-making, for instance through the application of data mining techniques to identify meaningful data relationships inside corporate databases. These four different phases of the knowledge life-cycle—socialization, internalization, externalization and combination—have been formalized by Nonaka and Takeuchi (1995) Under this view, “knowledge management” can be explained as the management of the environment that makes knowledge flow through all the different phases of its life-cycle.

## KNOWLEDGE MANAGEMENT

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Defining the concept of knowledge management is not straight forward, because this subject has been studied by several disciplines and from different approaches. For example, Davenport et al. (1998) defines knowledge management as a process of collection, distribution and efficient use of the knowledge resource. O'Dell and Grayson (1998) see knowledge management as a strategy to be developed in a firm to ensure that knowledge reaches the right people at the right time, and that those people share and use the information to improve the organisation's functioning. For Bhatt (2001, pp. 68-75), knowledge management is a process of knowledge creation, validation, presentation, distribution and application. And Bounfour (2003) defines knowledge management as a set of procedures, infrastructures, and technical and managerial tools, designed to create, share and Leverage information and knowledge within and around organisations. Although the above definitions vary in their description of knowledge management, there seems to be a consensus to treat knowledge management as a set of processes allowing the use of knowledge as a key factor to add and generate value (Bueno and Ordonez, 2004, pp. 531-533). In the conceptual framework of this work, knowledge management is composed of three main processes, which are namely: knowledge generation, knowledge transfer, and knowledge codification and storage. Knowledge generation can be defined as the process by which the firm obtains knowledge, either from outside the company or generated internally (Lee and Hong, 2002, pp. 17-25). The objective is to obtain new and better knowledge that helps the organisation improve its competitiveness (Wiig, 1997, pp. 399-405). Thus, knowledge generation is not just about generating new contents, but also about replacing, validating and updating the firm's existing knowledge (Bhatt, 2001, pp. 68-75). Organisations can acquire knowledge externally from different sources, for example talking to external agents, collaborators and partners, buying patents or taking on new

employees (McCann and Buckner, 2004, pp. 7-32). Internally, knowledge creation can involve developing new contents or replacing existing contents (Alavi and Leidner, 2001, pp. 107-136) by investing in R&D or training and development (McCann and Buckner, 2004). Knowledge transfer refers to the process by which an organisation shares knowledge among its units and members, promoting new understanding (Wiig, 1997, pp. 399-405). It is essential for the firm to develop an adequate design of informative interaction networks that allow individuals of diverse specialties, cultures, and geographic locations, not only to access the same information but also to come together through the network to undertake a particular project.

Moreover, for the transfer of tacit knowledge, this requires more interaction between the individuals, the firm must develop mechanisms that encourage dialogue and interaction (Lave and Wenger, 1991). Finally, knowledge codification and storage is a very important aspect in the effective management of knowledge. The existing knowledge must be captured, codified, presented and put in stores in a structured way, so it can be reused later. However, it is vital to remember that organisational knowledge is dispersed and scattered throughout the organisation.

It is found in different locations, in people's minds, in organisational processes, and in the corporate culture, embedded in different artifacts and procedures, and stored in different mediums such as print, Disk and optical media (Bhatt, 2001, pp. 68-75). Thus, some authors suggest that capturing, codifying and storing knowledge are the most challenging aspects of knowledge management.

## ORGANIZATIONAL KNOWLEDGE CREATION THEORY

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Theory of organizational knowledge creation of Nonaka and Takeuchi' brings a description of knowledge creation process in an organisation. The authors claim that allowing constant changes of one

knowledge type into another is a basis for the creation of new knowledge in the organisation.

This process is defined as knowledge conversion. It distinguishes four modes of knowledge conversion:

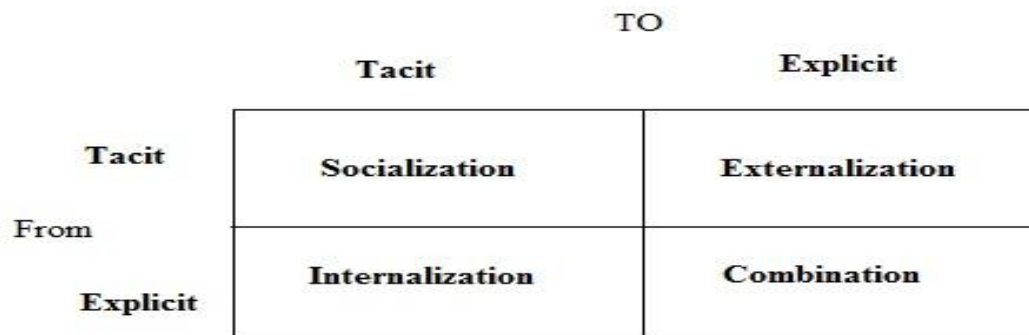


Figure 1 Knowledge Conversion model by Nonaka and Takeuchi(1995)

1. Conversion of tacit knowledge into tacit knowledge (socialization),
2. Conversion of tacit knowledge into explicit knowledge (externalization),
3. Conversion of explicit knowledge into explicit knowledge (combination),
4. Conversion of explicit knowledge into tacit knowledge (internalization).
5. Requisite variety, which allows adjusting the organisation to the variety of the environment.

## KNOWLEDGE MANAGEMENT MODELS

The theory of organisational knowledge creation was chosen for the construction of KMS model, due to its holistic description of knowledge creation process. Apart from this theory, three knowledge management models were selected:

Even though, according to I. Nonaka and H. Takeuchi, organisation does not create, it can provide suitable conditions for the creation of it. Authors distinguish five of these organisational conditions:

1. Empowerment in order to increase motivation level;
2. Organisational intentions – awareness of the strategic value of knowledge;
3. Creative chaos, state in which the organisation, under the influence of different signal coming from its environment, is able to adjust its knowledge system;
4. Redundancy – existence of information redundancy for the knowledge creation processes is desirable;

1. **SECI Nonaka model** – due to the holistic description of knowledge creation process in the organisation as well as distinguishing the “Ba” cyberspace–virtual space in the organisation, which on The basis of existing knowledge creates and regularizes new knowledge (Nonaka, Toyama, and Konno, 2000),
2. **Probst, Raub and Romhardt model** – due to its orientation towards practical aspects of knowledge management and a description of particular knowledge management processes (Probst, Raub and Romhardt, 2002),

- 3. **Carayannis model** – due to its possibility so support the knowledge management evaluation process through the determination of knowledge possession in particular areas of the enterprise’s activity (Carayannis model, 1999).

These models can be used to build a relation model for the knowledge management system in the organisation.

## KNOWLEDGE MANAGEMENT IN ORGANISATION

Figure 2 presents a modified knowledge pyramid that includes current proportions between: data, information, knowledge, understanding and wisdom as well as determines the possibility of using modern IT systems and organisational structures in order to process them.

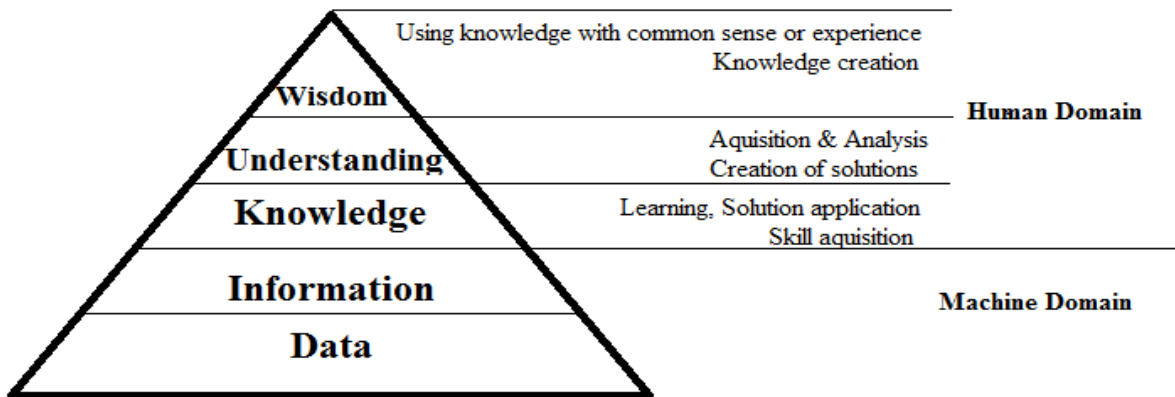


Figure 2 Knowledge Pyramid

Knowledge pyramids proposed by D. J. Skyrme (Skyrme, 1999) were used in creation of this pyramid. Knowledge definition, which was used in the elaboration of knowledge management system in the organisation, is as follows: “knowledge is a combination of experience, information and expert opinion, which assures basis for development and implementation of new experience and information. It is originated and is used in the minds of people who posses this knowledge. In organisations it usually is stored not only in documents or data banks but also in methods of activity and best practices, processes and norms”(Davenport and Prusak, 1998). Knowledge management system is also basing in the corporate knowledge creation theory and three knowledge management models, which will be described in the following part of the article.

## INFORMATION TECHNOLOGY (IT) COMPETENCY

Organisations need internal information about their financial situation, the effectiveness of their products, their production costs, and so on. And they need external information about the environment in which they operate– competitors, customers,

suppliers, etc. – that helps them to get to know their customers and satisfy them immediately and effectively, and so gain sustainable competitive advantages (Maier et al., 1997, pp.177-201). Getting information is no longer the problem. The difficulty lies in obtaining quality information, where quality is measured in terms of accuracy, reliability, precision, and timeliness, and the extent to which the information is relevant in the decision making

(Huber,1990, pp. 47-71). The IT revolution has facilitated the processes of searching for and recovering information, but at the same time it has led to an important growth in the database industry. Organisations must be able to use IT to obtain useful information for their decision-making. This study defines IT competency as how the organisations uses these technologies to manage its information effectively. While IT is a generic term fundamentally used to refer to programs, computers and telecommunications, the term IT competency is broader and refers to the use of these technologies to satisfy the organisation's information needs (Gunasekaran et al., 2001, pp. 349-364). This study differentiates between three dimensions of this concept: IT knowledge, IT operations, and IT infrastructure. These dimensions represent specialized resources that indicate the organisation's capacity to understand and use the tools necessary for managing information about markets and customers (Tippins and Sohi, 2003, pp. 745-761). Moreover, although they are independent, all three aspects must be present for the firm to achieve IT competency. For example, many organisations invest in technical tools but at the same time fail to achieve IT competency because they lack the knowledge required to use these tools efficiently. Brief definitions for these three dimensions follow-

**(i) IT knowledge:** Knowledge is information combined with experience, context, interpretation and reflection, so knowledge has a tacit component that is difficult to quantify (Davenport et al., 1998). Taylor (1971) defines technical knowledge as the set of principles and techniques that are useful to bring about change toward desired ends. Thus, the current study defines IT knowledge as the extent to which the firm possesses a body of technical knowledge about elements such as computer systems.

**(ii) IT operations:** This concept refers to the IT-related methods, processes and techniques that may be needed if these technologies are to create value (Maier et al., 1997, pp.177-201). In the context of the current study, an IT operation is defined as the extent to which the firm uses IT to improve its effectiveness and decision making.

**(iii) IT infrastructure:** The IT infrastructure acts as an enabler, and to a large extent is responsible for the growing interest in the production and dissemination of information (Reardon et al., 1996, pp.125-155). IT infrastructure refers to the artifacts, tools and resources that contribute to the acquisition, processing, storage, dissemination and use of information. According to this definition, the IT infrastructure includes elements such as hardware, software and support staff.

The influence of IT competency on knowledge management can be considered with two fold: direct and indirect. Information systems can directly influence the knowledge management processes. They can also indirectly influence knowledge management by affecting contextual factors such as structure, which, in turn, influence knowledge management. This section develops the hypotheses about the relations between IT competency and knowledge management.

## INFORMATION TECHNOLOGY COMPETENCY AND KNOWLEDGE MANAGEMENT PROCESSES

IT improves the efficiency of organisational management processes and provides new ways of improving the capacity of response to environmental requirements. According to Oliver (2000, pp.811-832), those technology systems serve a variety of functions such as storing large amounts of information, making information accessible to individuals, providing means of communication, generating records of interactions and transactions, and automating processes. On the basis of the above reasoning, the influence of IT on the previously identified knowledge management processes (knowledge generation, knowledge transfer, and knowledge codification and storage) is now analysed. Strategic applications of information systems for knowledge generation can take two forms (Mason, 1993, pp.840-849): capabilities for assimilating knowledge from outside (such as competitive intelligence systems acquiring

information about other companies in the same industry); and capabilities for creating new knowledge from the reinterpretation and reformulation of existing and newly acquired information (such as executive information systems or decision-support systems). Likewise, IT facilitates the process of knowledge transfer. Technology enables individuals to coordinate the logistics of face to face meetings. It can also be used to catalogue expertise of organisational members and a result facilitating access to the right people and enhancing knowledge sharing (Al-Hawamdeh, 2002, p.143). Certain systems (e.g., groupware or collaborative systems) provide a virtual space where the participants can process the information and knowledge in real time, giving them more chance to interact (Marwick, 2001, pp. 814-830). Exchange spaces become the ideal place to develop innovative and creative behaviours around problems and situations. One of the most important characteristics of these exchange spaces and virtual communities is that they are founded on the democratization of knowledge, so they enable the appearance of natural flows of transference and collaboration and consequently favour creativity and innovation (Narayanan, 2001).

Finally, IT supports the process of knowledge codification and storage. IT facilitates the standardisation and automation of certain tasks, supporting the transformation of tacit knowledge into explicit knowledge (Anand et al., 1998, pp. 796-809). Similarly, IT also provides the necessary mechanisms to codify and store knowledge. In order to be useful, however, knowledge stores must be accessible to firm members and must be in a form that will enable each member to interpret in a similar manner, thereby becoming a part of the whole firm's knowledge base. IT, with its protocols and platform standards, provides an ideal mechanism for connecting widely dispersed individuals via a common system and enabling firm members to access more easily the knowledge that is stored in memory bins, so that new information can be interpreted and synthesized with existing knowledge (Tippins and Sohi, 2003, pp.745-761).

## INFORMATION TECHNOLOGY COMPETENCY, STRUCTURE, AND KNOWLEDGE MANAGEMENT

The development of IT is having a considerable effect on organisations, and researchers argue that these technologies have a critical role in the appearance of new organisational forms, which go under a large number of names. Clearly, a relation exists between the appearance of new organisational forms and technological development, and these technologies are considered the causes of the structural changes and of the emergence of new, more flexible organisational forms capable of rapidly and effectively adapting to the growing changes in the environment (Barley, 1990, pp.61-103).

IT moderates vertical differentiation and allows fewer levels in the hierarchy to handle as much or more problem solving and decision making, resulting in a flatter organisation (Dewett and Jones, 2001, pp.313-346).

IT systems, by increasing the level of formalization or allowing "controlled" decentralization, can substitute for the control typically provided by the hierarchy (Keen, 1990). In addition, since IT provides low-level employees with more freedom to coordinate their actions, employees can experiment and find better ways to perform their tasks (Huber, 1990, pp.47-71). Consequently, the link between IT, organisational structure and knowledge management is evident. To the extent that IT has led to a reduction in the traditional boundaries between hierarchical levels (vertical boundaries) and between functions (horizontal boundaries), these technologies favour the development of organic structures where information, ideas and knowledge can flow rapidly through the organisation and hence improve the chances of processing and generating knowledge effectively.

## INFORMATION TECHNOLOGY FOR KNOWLEDGE MANAGEMENT

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Concepts of knowledge and science were subjects of many analyses, starting from Plato and his student Aristotle who started rationalism and empiricism. In modern ages both these trends have found followers among the greatest thinkers and philosophers and evolved thus creating new trends being their modification or synthesis.

Alfred Marshall, one of the first economists who recognized the value of knowledge, claimed that capital is mostly made of knowledge and organisation (Marshall, 1890; F. A. Hayek, 1996 and J.A. Schumpeter, 1983) were the next researchers of issues connected with the economic aspect of knowledge. They claimed that organisation not only has access to common determined knowledge, but also can use its own, subjective knowledge. Hayek divided knowledge into open and tacit – different for different circumstances, which can be specific for given organisation as well as he emphasized the importance of tacit knowledge.

There is an on-going lively debate about the role that information technology can play for knowledge management. On the one hand, information technology is used pervasively in organisations, and thus qualifies as a natural medium for the flow of knowledge. A recent study from the American Productivity and Quality Centre shows that organisations embarking in knowledge management efforts generally rely, for accomplishing their goals, on the setting up of a suitable IT infrastructure (AP&QC 1997). At the other end of the spectrum, leading knowledge management theorists have warned about the attitude that drives management towards strong investments in IT, possibly at the expense of investments in human capital; see for instance. The danger that this viewpoint sees is that IT-driven knowledge management strategies may end up objectifying and calcifying knowledge into static, inert information, thus disregarding altogether the role of tacit knowledge. Knowledge management strategies of this type would bring back

the ghost of the infamous, and none too far in time, re-engineering days, when the corporate motto was “More IT, less people!”; they conjure grim scenarios of organisations with enough memory to remember everything and not enough intelligence to do anything with it. Part of the problem here derives from a linguistic ambiguity: now-a-days information technologies are as much about creating direct connections among people through such applications as electronic mail, chat-rooms, video-conferencing and other types of groupware as they are about storing information in databases and other types of repositories. As for information databases, they can also be fruitfully re-thought, in a knowledge management perspective, as resources for the sharing of best practices and for preserving the intellectual capital of organisations. Generally speaking, investments in IT seem to be unavoidable in order to scale up knowledge management projects. The best way of applying information technology to knowledge management is probably a combination of two factors: on the one hand, the awareness of the limits of information technology, and of the fact that any IT deployment will not achieve much, if it is not accompanied by a global cultural change toward knowledge values; on the other hand, the availability of information technologies that have been expressly designed with knowledge management in view.

## CONCLUSION

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To summarize, this study contributes the predominantly theoretical literature on knowledge management and IT competency. It is, to a certain extent, common sense that IT has a positive impact on knowledge management. However, this paper takes an important step forward by detailing how IT competency influences knowledge management directly, favouring its processes, and indirectly, favouring the development of an organisational structure that in turn favours knowledge transmission. Moreover, the findings of the research also have important implications for managers. Managers should not only focus on allocating sufficient resources for IT investments. Organisations



must focus their attention on intervening processes such as knowledge management in order to determine what benefits are being derived from IT-based information systems. In order to meet this challenge, the authors recommend developing an information and knowledge strategy before developing an IT strategy. Organisations lacking such a strategic foundation could fail to understand the complementarities between IT and information and knowledge resources in the organisation and consequently miss out on successful innovations and improved performance. Organisations need to: develop a clear policy of knowledge generation, identifying what knowledge is important for the organisation and under what circumstances it should be disseminated; foster the transfer and integration of knowledge between workers, exploiting the interrelations between workgroups; and elaborate a knowledge map that determines in which people and systems the firm's accumulated knowledge base should reside. Organisations should also be aware of the potential that ICT has for favouring the development of more decentralized and flexible structures that ultimately facilitate the processes of knowledge generation and transformation.

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