Where is the Border Between an Information System and a Knowledge Management System?

Imandra Galandere-Zile
Viktorija Vinogradova

Both information systems and knowledge management systems are important in an organisation and often fulfil the same task. The aim of this paper is to identify the border between these two systems. The approach of the research is to analyse both systems in order to identify their role in an organisation, determine the problems, advantages, and opportunities, and discover common and uncommon features between them to find out when an information system becomes a knowledge management system and when it is useful to implement the latter.

Key words: information system, knowledge management system, information, knowledge and knowledge management
JEL *Classification:* M1, L86, C88

1 Introduction

Nowadays information systems play a very important role in improving an organisation's performance and its increased competitive capacity. Therefore, it is essential for organisations to decide what are the most important business processes and core competencies that have to be supported by an information system, and what kind of information system has to be implemented and conforms to the organisation's requirements.

While the latest trends in organisational development have demonstrated the importance of knowledge management, there is no universal definition of knowledge management or a knowledge management system. Knowledge management systems are mostly built over existing information systems, thus it is difficult to determine when an information system becomes a knowledge management system or what kind of fea-

Imandra Galandere-Zile is Director of the Quality Management Department, The Treasury of the Republic of Latvia.

Viktorija Vinogradova is an Assistant at the Department of Systems Theory and Design, Riga Technical University, Latvia.

This paper is based on a presentation originally given at the 5th International Conference of the Faculty of Management Koper in Portorož, Slovenia, 18–20 November 2004.

Managing Global Transitions 3 (2): 179–196

tures are encompassed in a knowledge management system and not in an information system.

The goal of the paper is to identify the border between information systems and knowledge management systems, and discover common and uncommon features between them in order to find out when an information system becomes a knowledge management system and when it is useful to implement the latter.

The paper is organised as follows. In section 2 data, information and knowledge are analysed since they play an essential role in both systems. Considerations regarding information systems and their role in an organisation are discussed in section 3. Section 4 outlines the area of knowledge management and its role in an organisation. Section 5 focuses on the relationship between both systems, and discusses the contribution of information technology and systems to knowledge management. Common and uncommon features between these two systems are identified and analysed in section 6. Finally, some brief conclusions and directions for intended future work are provided.

2 Data, Information and Knowledge

Since data, information and knowledge play an essential role in both an information system and a knowledge management system, they were analysed first.

In practice, the terms data, information and knowledge are often used interchangeably. First of all, the differentiation is generally difficult because both data and information are located in an information management system. Secondly, users interpret data only when they use them. Users' contexts and the information manufacturing process make it difficult for users to determine precisely whether a piece is considered as data, information, or even knowledge. Although it might take a decade just to determine what these three words mean, we all agree that the transformation of data for clear and more meaningful information to users is important. Structuring and managing knowledge assets in an organisation are also critical for all organisations (Huang et al. 1999).

Data represent facts that are created when business processes are performed. They form a set of particular and objective facts about an event or simply the structured record of a transaction (Tiwana 2000). They are also the lowest level of known facts. Data can be stored in a structured relational database system or in an unstructured document management system, and includes non-text information, such as voice and image.

Data are collected, stored, grouped, analysed, and interpreted (Huang et al. 1999).

The terms data and information are often used synonymously (like information and knowledge). In practice, managers differentiate between information and data intuitively and describe information as data that has been processed. Information contains substance and purpose. There are different ways in which meaning can be added to data in order to transform it into information. Data becomes information through condensation, contextualisation, calculation, categorisation and/or correction processes (Tiwana 2000). What qualifies as useful information is a subjective judgment. Information moves around in both electronic and hard format, through electronic and social networks.

The key link between knowledge and information is probably best expressed in the commonly accepted idea that knowledge in the business context is nothing but actionable information. Knowledge is generated when information is combined with context and experience. Knowledge is a fluid mix of framed experience, values, contextual information, expert insight and grounded intuition that provides an environment and framework for evaluating and incorporating new experience and information. It originates and is applied in the minds of those in possession of the relevant knowledge. In organisations it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices and norms (Tiwana 2000). We strongly agree with Tiwana who states that data and information are essential, but it is the knowledge that can be applied, experience that comes into context, and skills that are used at that moment that make the difference between a good and a bad decision.

3 Considerations on the Information System and its Role in an Organisation

This section presents a short overview of information systems and the benefits that can be acquired by implementing and applying such systems.

Information systems are widely used in organisations. They provide information and thus help improve an organization's operation and management. An information system can be defined as a group of components working together. These components include equipment (or hardware), instructions (or software), data stored in the system, the people to operate the system, and procedures for the people to follow (Nick-

erson 1998). Because information processing can be done using manual instructions, a wider view on information systems is also possible. Thus a computerised information system is just one of the information systems. In this paper we consider only computerised information systems.

An information system supports one or more work systems using information technology to capture, transmit, store, retrieve, manipulate or display information (Alter 1999).

A work system is a system in which human participants perform business processes using information, technology, and other resources to produce products for internal or external customers. The core of the work system (and thus the information system) is a business process consisting of steps related in time and place, having a beginning and an end, inputs and outputs.

There are a wide variety of different information systems that can be classified by:

- The number of users – individual, workgroup, organisational and inter-organisational.
- Ways users are connected to information technology – directly, through a network, through the Internet.
- Supported business functions – accounting, transaction, manufacturing etc.

Business processes are at the core of every information system. Information systems support business processes for one or more business functions. The simplest information system supports only one business function (for e. g. inventory systems, payroll systems etc.), in other cases information systems support a number of business functions. In these cases the information is transmitted automatically, thus saving time and work that would be necessary to maintain the integrity of these functions in an organisation. These information systems can thus be called *integrated.*

Information systems provide several benefits to the organisation (Nickerson 1998). One of the main benefits is *better information.* Information systems not only store and process data, they also produce information, which is the basis for good decision-making. Better information is available if data are properly managed in the information system, i. e. the data are available for processing, and are current, accurate, and secure (Alter 1999). Another benefit is *better information.* Information systems operate at any time of the day or night and process data faster than humans.

The third benefit is *increased productivity.* Information systems make the work more productive in a shorter period of time.

4 Knowledge Management and its Role in an Organisation

While recent trends in organisational development have demonstrated the importance of knowledge management, there is no universal definition of it. Besides, Wilson (2002) considers knowledge management (like Business Process Reengineering) as a utopian ideal that cannot be successfully implemented. Knowledge management addresses various fields related to the organisation, people, motivation, and technology. The goal of knowledge management is to increase the efficiency of activities related to knowledge as well as the benefits acquired from it. In order to transform knowledge into a valuable organisational asset, knowledge, experience, and expertise must be formalised, distributed, shared, and applied (Galandere-Zile 2002).

The knowledge management cycle reflects the life cycle of corporate knowledge. This dynamic process often starts with finding and collecting internal knowledge and best practices. The second step is sharing and understanding those practices so that they can be used. Finally, the process includes adapting and applying such knowledge and practices to new situations and bringing them up to the best practice performance level. Knowledge management is concerned with supporting and optimising these processes. Surrounding the process, and helping or hiding it, are what we call the enablers. These are: leadership, culture, technology and measurement. These aspects of an organisation's environment and infrastructure must be addressed in order to transfer a business process and develop knowledge management in an organisation (Zaharova and Galandere-Zile 2002).

Knowledge management has come to be regarded as the driving force behind some of the world's largest and most successful organisations. It is seen as the next evolutionary step that goes beyond the 'Learning Organisation' or 'Business Process Reengineering' and even beyond 'GroupWare' and the 'World Wide Web'. It is meant to integrate them all into an even higher level, enterprise-wide framework with its new work roles, responsibilities, reward systems, methods and tools, because an effective knowledge management depends not merely on information technology platforms but primarily on the social structure of an organization (Phillips et al. 2004). In other words, true knowledge management concerns radical and fundamentally new ways of creating, retaining, shar-

ing and leveraging knowledge about people and organisations; ways that were simply not possible before.

5 State of the Art Concerning Knowledge Management Systems and Information Systems for Knowledge Management

This section focuses on the relationship between knowledge management systems and information systems and discusses the contribution of information technology and systems to knowledge management.

AN INFORMATION SYSTEM AND A KNOWLEDGE MANAGEMENT SYSTEM

Even though there is considerable disagreement in the literature and business practice about what exactly knowledge management is, some researchers and practitioners stress the importance and usefulness of information and communication technologies as enablers or vehicles for the implementation of these approaches. Knowledge management systems should particularly help to overcome the shortcomings of current practices of business engineering in regard to organisational performance (Maier 2002).

Technology by itself does not constitute a knowledge management program it rather facilitates one, especially in large, geographically dispersed organisations. Knowledge management represents an opportunity to derive additional benefits from an organisation's existing investment in computers, databases and networks by integrating them to support knowledge management in many ways (Zaharova and Galandere-Zile 2002). Technology's most valuable role in knowledge management is broadening the reach and enhancing the speed of knowledge transfer (Tiwana 2000).

Past management information systems basically used the computer as a means of providing information to solve recurring operational problems. Today, there is a need for new types of systems that would focus on discovering knowledge that responds to the changing environment. By increasing the capabilities of decision makers, information systems that support knowledge management initiatives help an organisation to achieve its goals. Information systems that support information flow are an essential component in a knowledge management system. Information systems create a good virtual environment for knowledge management (Galandere-Zile 2004).

Examples of information and communication technologies related to knowledge management are (Maier 2002):

- *Intranet infrastructures* that provide basic functionality for communication (e-mail, teleconferencing) as well as storage, exchange, search and retrieval of data and documents.
  Document and content management systems that handle electronic documents or Web content.
- *Workflow management systems* that support well-structured organisational processes and handle the execution of workflows.
- *Artificial intelligence technologies* that support, for example, search and retrieval, user profiling and matching of profiles, text and Web mining.
- *Business intelligence tools* that support the analytic process which transforms fragmented organisational and competitive data into goal-oriented 'knowledge' and require an integrated data base that is usually provided by a data warehouse.
- *Visualisation tools* that help to organise relationships between knowledge, people and processes.
- *Groupware* that supports, for example, time management, discussions, meetings or creative workshops of workgroups and teams.
- *E-learning systems* that offer specified learning content to employees in an interactive way and thus support the teaching and/or learning process.

Knowledge management systems promise to significantly enhance functionality through an integrated combination of the aforementioned information systems from the perspective of knowledge management. A knowledge management system should not be seen as a voluminous centralised database. It can rather be imagined as a large networked collection of contextualised data and documents linked to directories of people and skills and providing intelligence to analyse these documents, links, employees' interests and behaviour, as well as advanced functions for knowledge sharing and collaboration (Maier 2002).

The term knowledge management system has become a strong metaphor or vision for the development of a new breed of information and communication technology systems. In this vision, the knowledge management system creates a corporate information and communication technologies environment, a contextualised base, an infrastructure that

takes into account the complex nature of knowledge and thus supports the handling of knowledge in organisations. In order to achieve this, a number of heterogeneous information and communication technologies have to be integrated, improved, recombined, and repacked. The development of a knowledge management system is a complex undertaking (Maier 2002).

Knowledge management has to handle and improve complex relationships and networks rather than individual knowledge elements or just one location, for e. g. a knowledge base. In the implementation process of a knowledge management system the content to be managed is very important. Companies that put organisational knowledge at the centre of consideration implement knowledge management. Typically, the organisation's knowledge structure is determined in workshops or reflects sources that already exist in the organisation but are handled by a number of incompatible information and communication technology systems. In many cases, explicit knowledge is predominant. It is also a lot harder to describe implicit knowledge that is an equally important part of the organisational memory content (Maier 2002), though an important factor behind the implementation of knowledge management systems is the ability of organisational personnel to share knowledge through some type of online forum.

Knowledge management systems organise and make available an important know-how wherever and whenever it is needed. This centres on 'best practices' or guiding principles, projected forecasts, reference sources, proven processes and procedures, patent information, established formulas, corrective fixes, and similar items. Data warehouses, computer networks, company intranets, extranets, groupware, bulletin boards, and video conferencing are the technological tools for storing and distributing appropriate knowledge. Major components of knowledge management systems are considered to be the best practices, communication enablers, and system road maps. The main purpose of these components is to provide users with the right information at the right time and place. Experience has shown that successful knowledge management system developers are those with a well-developed collaboration between all these tools (Maier 2002).

Knowledge management systems might also be viewed as important organisational assets that provide core competencies for the organisation. In particular, highly knowledge-intensive organisations might view the systematic handling of knowledge in general, and especially their in-

formation and communication technology systems supporting knowledge management, as their core competence and fear that they might lose a strategic advantage if they implement a standard software solution available on the market (Thierauf 1999).

FROM AN INFORMATION SYSTEM TOWARD A KNOWLEDGE MANAGEMENT SYSTEM

The task of implementing a successful knowledge management system may seem insurmountable. But in reality there are different views and approaches to implementation of a knowledge management system. Some experts have stated that up to 90 percent of the infrastructure required for knowledge management is already in place. In most organisations this refers to their existing structure of computer networks and servers. Hence, only a small shift in the total computer technology budget is required to make the change to a knowledge management system (Lasker and Norton 1996). The success of an organisation is more dependent on its capability to create an effective environment for knowledge generation and application, and on the knowledge and talent it can recruit, develop and retain in order to provide the innovation (Kim and Mauborgne 1999). Knowledge work processes drive a successful knowledge management system, not the technological issues. The rationale is that these newer systems are helping decision makers make better decisions in terms of their work activities. The technology is incidental to this critical issue.

Redesign may be necessary for changing knowledge work processes (Thierauf 1999):

- *The content of knowledge should be changed* by expanding or contracting what it encompasses in order to better meet desirable objectives.
- *The composition of work should be reordered* (so that company personnel may change the focus of their jobs from information to knowledge).
- *Change can be focused* on the employment of new networking technology that lends itself to groupware.

Thierauf (1999) proposes a summary of those critical factors that determine the appropriate software useful for providing knowledge for decision makers and managing the software. For example:

- Is the software easy to use and does it enable the development and use of knowledge?
- Does the software provide an in-depth analysis of patterns and trends?
- Does the software actually do what decision makers want here and now?
- Does the software allow decision makers to access and analyse a large amount of information in order to get at pertinent knowledge?
- Is the software generally a combination of packages designed for the organisation's size or will it be outgrown in a few years?
- Does the software provide flexibility in the development of pertinent knowledge to meet decision makers' needs?

Knowledge management systems of today often integrate a variety of off-the-shelf software products such as groupware, document management systems, e-mail, relational databases, and workflow, with knowledge extraction tools, knowledge management intranet search engines, and knowledge discovery or the data mining software. In addition, a knowledge management system can employ OLAP software, the statistical analysis software to assist decision makers in getting the knowledge at hand. Depending on the nature and purpose of a knowledge management system, there can be still other software products and hardware needed to form a complete knowledge management system package to gather, organise, collaborate, refine, and distribute knowledge (Thierauf 1999). Most organisations that had actually implemented knowledge management system solutions have combined several tools and implemented additional functions on their own rather than simply buying specialised knowledge management system software on the market.

A classification of knowledge management systems can only be considered as preliminary due to the considerable dynamics of the market for knowledge management. At this stage, the analysis of a knowledge management system is a great challenge. This is already visible in the difficulties of defining the term and continues in the trial to present a typical architecture of such systems or to give a comprehensive list of functions. The same is true for a classification of knowledge management systems. The pragmatic perspective that knowledge management systems are just document management systems with some added functionality which seems to dominate the market is unsatisfying. The information and com-

munication technologies support for knowledge management is not restricted to the handling of documented knowledge (Maier 2002).

Information and communication technologies infrastructure needs a strategy to define knowledge goals and subsequently implement organisational instruments, roles and processes, and an organisational culture supportive of knowledge sharing in order to create benefits for the organisation. There has been a shift in the perspective of knowledge management system vendors as well as organisations applying those systems. The focus is now placed on the explicit side of knowledge management rather than on a combination and integration of its implicit side.

6 Common and Uncommon Features of Information Systems and Knowledge Management Systems

During the analysis of information systems and knowledge management systems, common and uncommon features of both areas were ascertained.

Overview of common and uncommon features of both systems

Knowledge management systems are operated on the basis of an (organisation-wide) information and communication infrastructure, and in most cases an Intranet platform of Lotus Notes environment on which information sharing between (virtual) teams both within the organisation and across the organisational boundaries, and allies, suppliers and customer is possible. Most organisations have installed a large number of application systems and information and communication technology platforms that provide functionality for knowledge management. The basic functionality of such an information and communication technologies platform designed 'with knowledge management in mind' would comprise an integrated set of the following functions:

- *Communication:* as well as coordination and cooperation, e. g. e-mail, workflow management, newsgroup or list server.
- *Document management:* handling documents throughout their life cycle.
- *Access:* to various data sources, e. g. relational data bases, document bases, file servers or Web servers.
- *Search:* basic search functionality.
- *Visualisation.*

In a somewhat narrower sense, knowledge management systems provide functionality that goes well beyond these basic functions. Nevertheless there is no single hardware or software product or a combination of the two that can provide a comprehensive approach to knowledge work. Building a corporate-wide knowledge management infrastructure requires the integration of many different technologies. It is necessary not only to implement an integrated hardware or software technology but also to integrate the company's personnel and their related business processes with this knowledge management technology. If the company's personnel are not working in a collaborative environment or if no procedures and processes are in place to share the *knowledge,* no amount of knowledge management system technology can change that (Thierauf 1999). In other words, a knowledge management system requires a systemic knowledge management initiative in order to be used effectively and efficiently. This includes a knowledge management system strategy and the development of knowledge management system goals, an appropriate organisational design describing roles responsible for knowledge-related tasks and processes that use the knowledge management system, a supportive organisational culture and a corresponding knowledge management system supervision that evaluates whether the goals of using these systems have been achieved (Maier 2002).

The main differences between a knowledge management system and more traditional information and communication technology systems, such as document management systems, Intranet solutions or Groupware can be characterised as follows (Maier 2002):

- A contextualised combination and integration of functionality.
- An organisation-wide focus.
- An integration of intelligent functions.
- Matching with knowledge management initiatives.
- Dynamics of organisational learning.

ANALYSIS OF COMMON AND UNCOMMON FEATURES OF BOTH SYSTEMS

The aim of this section is to provide a detailed analysis of an information system and a knowledge management system.

As described in previous sections, information systems and knowledge management systems have many common features. However, the differences between them cannot be declared only by the system's name

or goals. We applied the Enterprise Knowledge Development (EKD) methodology in order to analyse the features in which knowledge management systems differ from information systems.

Figure 1 describes the concepts that are essential for information and knowledge management systems. Boxes that are in white colour denote concepts that are related to both systems, boxes tinted in light grey represent concepts that are unique for knowledge management systems, while dark grey boxes refer only to information systems.

Figure 1 shows that most of the concepts are common to both systems. Although there are information systems that are implemented and maintained to support only one business process, knowledge management systems support many integrated business processes as well as specific knowledge related processes. Besides, the concept of knowledge is clearly defined in knowledge management systems. It denotes that in the implementation process of a knowledge management system the content to be managed is very important. Moreover, an efficient knowledge management system requires knowledge management initiatives, namely, leadership, measurement, and organisation culture.

Figure 2 describes the business processes of both systems. Boxes with rounded corners that are shadowed denote external processes that are performed by users themselves; other boxes are system processes accomplished by a computerised system, whether it is an information system or a knowledge management system.

Specific processes of knowledge management are only concerned with knowledge (creation, identification, sharing, formalisation, collection, organisation, transfer, and, finally, application of knowledge). However, it is essential to stress that internal processes of a knowledge management system (processes 4, 5 and 6) use general information system processes (1, 2 and 3). Thereby, during the performance of the knowledge management system's processes, explicit knowledge is transformed in some kind of data or information that can be stored and processed by the information system. That confirms that a knowledge management system is always supported by an information system.

During the analysis of information and knowledge management systems, the goals, opportunities (or benefits) and problems characteristic of both systems were identified. One of the main goals of both systems is to support one business process, i. e. decision making. In this process the information system provides just better information, while the knowledge management system provides intelligent decision making based on

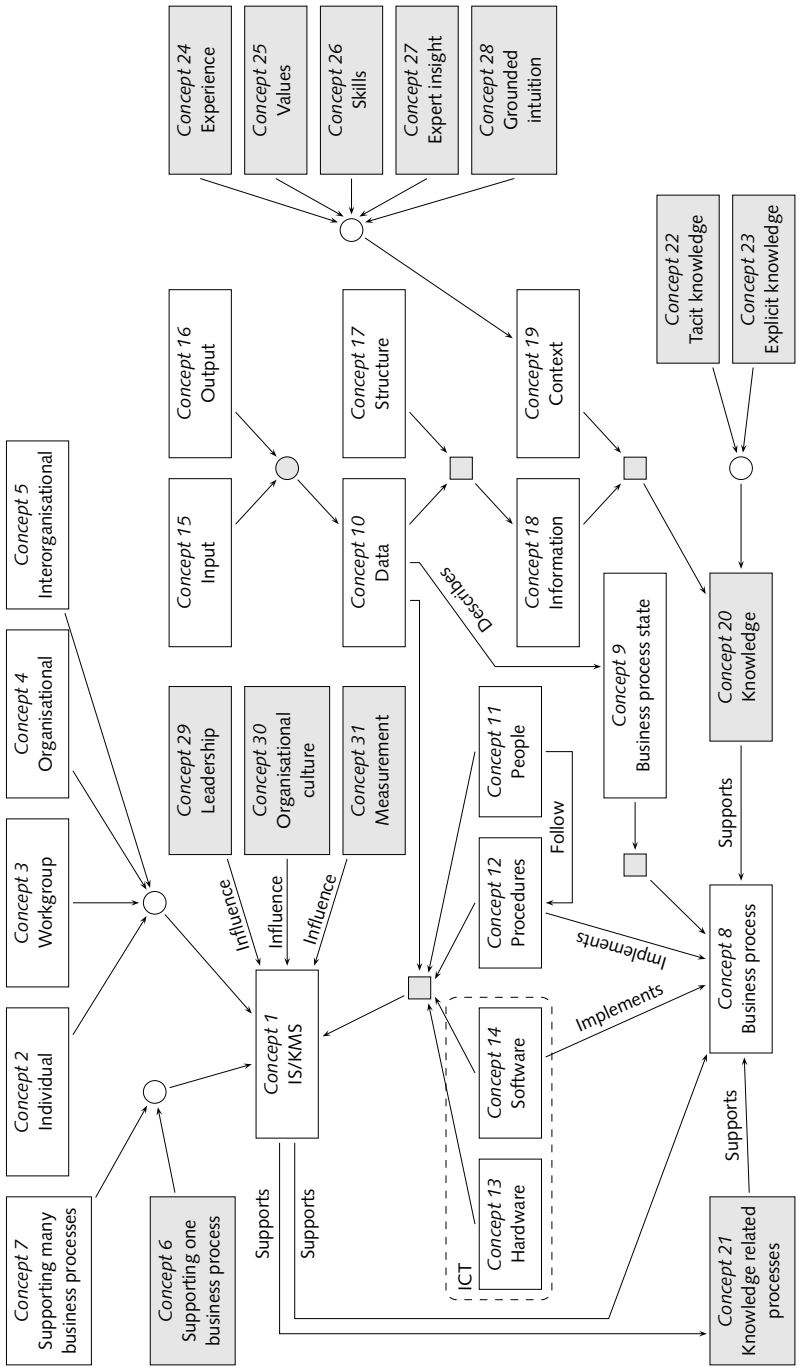

FIGURE 1 A concept model of an information system and a knowledge management system

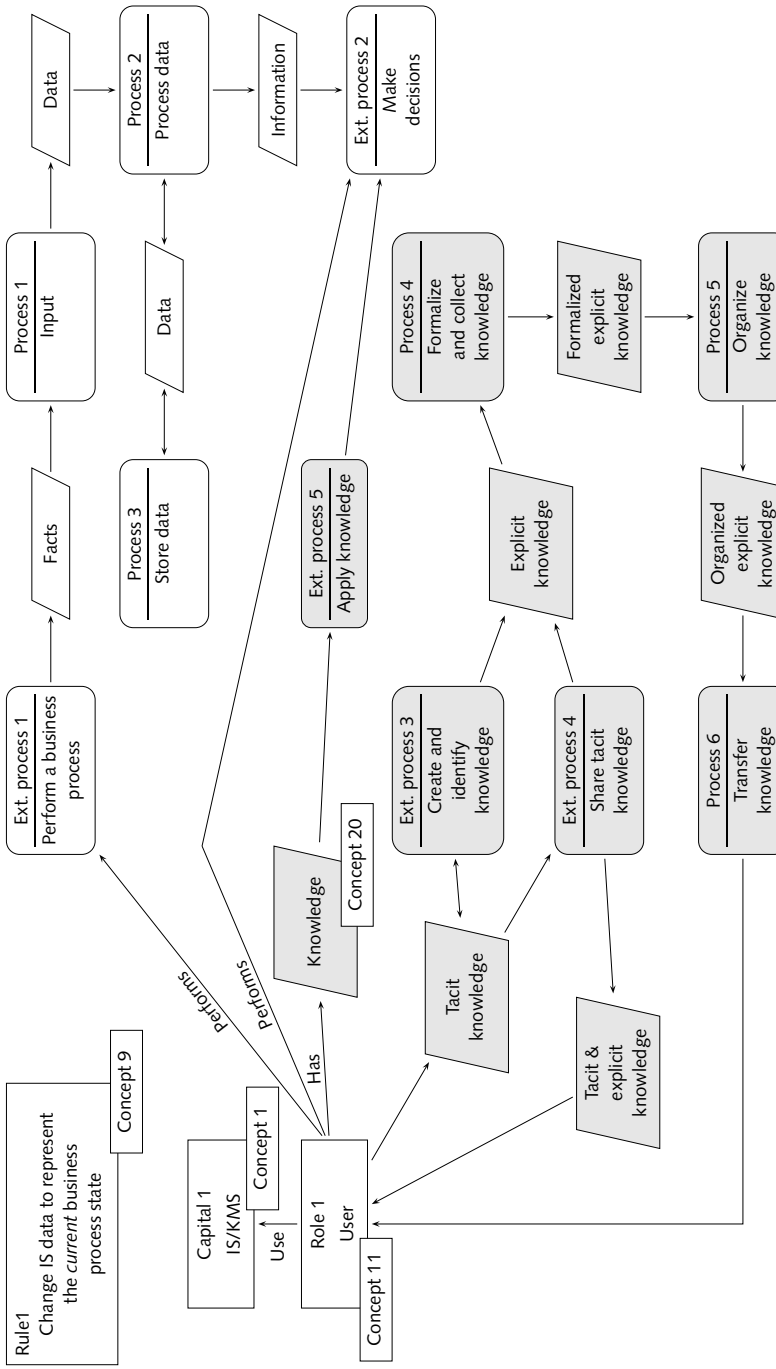

FIGURE 2 A business process model of an information system and a knowledge management system

best practices, organisational knowledge and experience that nowadays are very crucial for organisations that are confronted with increased environmental complexity and dynamics.

7 Conclusions and Further Research

The paper deals with issues concerning information systems and knowledge management systems, and tries to identify the border between both systems. The main conclusions derived from the analysis of both systems are summarized below.

Data, information, and knowledge are essentially different and play different roles in both information systems and knowledge management systems, while in practice these terms are often used interchangeably and knowledge is used as a synonym for information. As a result, knowledge management systems are often considered as information systems under another name (Wilson 2002).

Typically, the organisation's knowledge already exists within the organisation. Most of the explicit knowledge is handled by a number of incompatible information systems that can serve as a platform that provides functionality for a knowledge management system. However, there has been a shift in the perspective of organisations applying knowledge management systems. The focus is now placed on the explicit side of knowledge management rather than on a combination and integration of its implicit side.

Knowledge management is a systematic and articulated approach to managing knowledge related processes. It represents an opportunity to derive additional benefits from the organisation's existing investment in computers, databases and networks by integrating them to support knowledge management. Knowledge management has been implemented by companies that put organisational knowledge at the centre of consideration.

Knowledge management systems:

- Have become a strong metaphor or vision for the development of a new breed of information systems.
- Organise and make available an important know-how wherever and whenever it is needed.
- Require a systemic knowledge management initiative in order to be used effectively and efficiently.
- Are operated on the basis of an (organisation-wide) information

and communication infrastructure. Technologies by themselves do not constitute a knowledge management system, they rather facilitate one, and they are very important and useful as enablers for the implementation of knowledge management approaches.

Due to the considerable dynamics of the market for knowledge management there are difficulties in presenting a typical architecture of knowledge management systems or providing a comprehensive list of functions.

The border between an information system and a knowledge management system is diffused and depends on the existence of factors such as an organisation's strategy and goals concerning business and knowledge processes, culture, initiatives, information and communication technologies etc. An effective knowledge management depends not merely on information technology platforms but primarily on the social structure of an organization. The knowledge management system focuses on discovering knowledge that responds to the changing environment and takes into account an implicit knowledge that plays an essential role in an organisation's competitive advantage.

Future research is aimed at refining the architecture of knowledge management systems and organisational information systems, and providing a deeper analysis of dependency relationships between both systems.

References

Alter, S. 1999. *Information systems: A management perspective.* 3rd edition. Reading, MA: Addison-Wesley.

Galandere-Zile, I. 2002. Application of knowledge management elements for quality management systems. In *11th International Conference on Information Systems Development, Riga,* eds. J. Stirna and K. Steins, 15–25. Riga: Riga Technical University.

Galandere-Zile, I. 2004. Applicability of ERP systems for knowledge management in the context of quality management. In *The 16th International Conference on Advanced Information Systems Engineering, Riga,* eds. A. Persson and J. Stirna, 276–89. Riga: Springer.

Huang, K.-T., Y. W. Lee, and R. Y. Wang. 1999. *Quality information and knowledge.* Upper Saddle River, NJ: Prentice Hall.

Kim, W. C., and R. Mauborgne. 1999. Strategy, value innovation, and the knowledge economy. *Sloan Management Review* 40 (3): 41–54.

Lasker, H. H., and D. P. Norton. 1996. The new CIO/CEO partnership. *Computerworld,* 22 January.

Maier, R. 2002. *Knowledge management systems: Information and communication technologies for knowledge management.* Berlin: Springer.

Nickerson, R. C. 1998. *Business and information systems.* Upper Saddle River, NJ: Prentice Hall.

Phillips, F., L. Delcambre, and M. Weaver. 2004. Knowledge management: A re-assessment and case. *Knowledge Technology & Policy* 17 (3/4): 65.

Tiwana, A. 2000. *The knowledge management toolkit: Practical techniques for building a knowledge management system.* Upper Saddle River, NJ: Prentice Hall.

Thierauf, R. J. 1999. *Knowledge management systems for business.* London: Quorum Books.

Wilson, T. D. 2002. The nonsense of 'knowledge management.' *Information Research: An international Electronic Journal* 8 (1), paper no. 144. Http://InformationR.net/ir/8-1/paper144.html.

Zaharova, S., and I. Galandere-Zile. 2002. The impact of the knowledge management to business processes. In *International Conference: Traditional and Innovative in the Lasting Development of Society, Rezekne, Latvia,* 298–304. Rezekne: Rezekne Higher Education Institution.